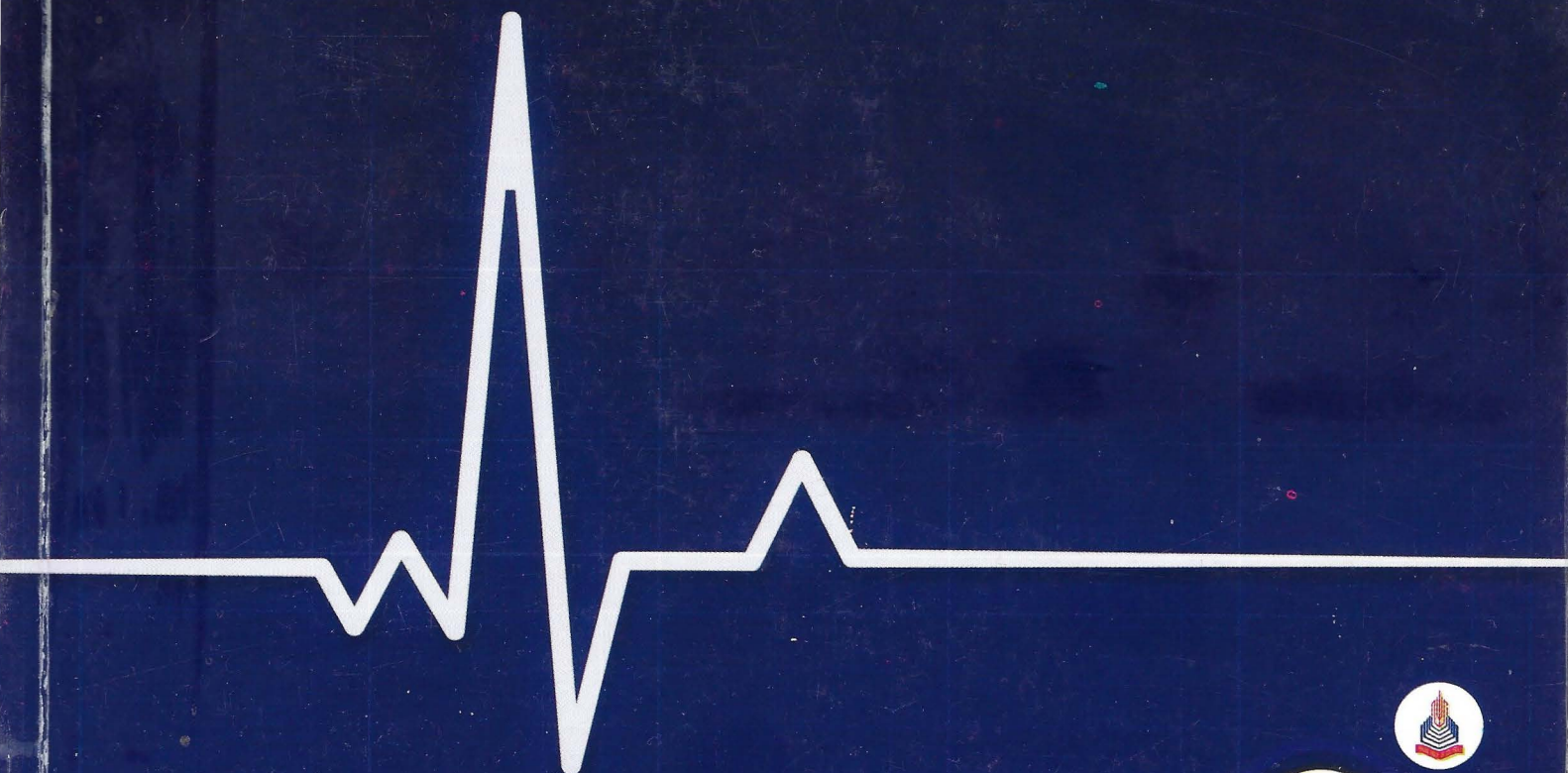


# STEP PRACTICE BOOK

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2<sup>nd</sup>  
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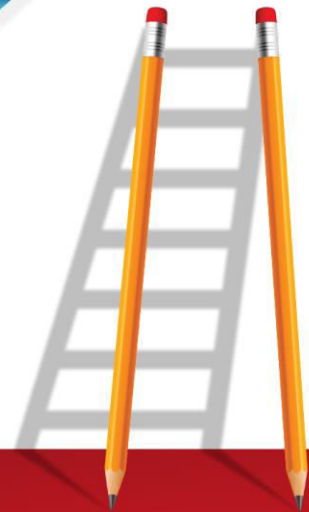
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# BIOLOGY



## Worksheets (1-18)



**STOP**

A PROJECT BY PUNJAB GROUP

**Worksheet-1**  
**(Homeostasis)**

**Q.1 Animals cope with the temperature extremes by a homeostatic mechanism called:**

- A) Evaporative cooling
- B) Shivering thermogenesis
- C) Non-shivering thermogenesis
- D) Thermoregulation

**Q.2 Each organism of a species has assumed, in evolutionary history a specific set up of \_\_\_\_\_ at various levels of organization suitable to its surrounding.**

- A) Internal environment
- B) External environment
- C) Intracellular environment
- D) Intercellular environment

**Q.3 Weight of kidneys accounts for less than \_\_\_\_\_ % of the total body weight.**

- A) 10
- B) 20
- C) 1
- D) 0.1

**Q.4 Kidneys receive \_\_\_\_\_ % of blood supplied with each cardiac beat.**

- A) 1
- B) 10
- C) 5
- D) 20

**Q.5 Nephrons, in human kidneys are arranged along two distinct regions, i.e.:**

- A) An inner cortex and outer medulla
- B) An outer cortex and an inner medulla
- C) An inner cortex and an inner medulla
- D) An outer cortex and a middle medulla

**Q.6 The structure which is specifically instrumental in the production of concentrated urine is:**

- A) Cortical nephron
- B) Juxtamedullary nephron
- C) Counter current multiplier
- D) Restricted supply of water

**Q.7 The nephrons arranged along the cortex are called as:**

- A) Cortical
- B) Juxtamedullary
- C) Juxtacortical nephron
- D) Medullary

**Q.8 In each nephron inner end forms a cup shaped swelling, called:**

- A) Glomerulus
- B) Bowman's capsule
- C) Renal pyramid
- D) Renal hilus

**Q.9 In each nephron inner end forms a cup shaped swelling around a ball of capillaries called:**

- A) Bowman's capsule
- B) Glomerulus
- C) Loop of Henle
- D) Renal pelvis

**Q.10 It circulates blood through a capsule in a nephron:**

- A) Afferent arteriole
- B) Peritubular capillaries
- C) Efferent arteriole
- D) Glomerulus

**Q.11 Blood is specially filtered in glomerulus, because glomerular walls are porous, and the fraction of the \_\_\_\_\_ reaching here provides the filtration pressure.**

- A) Osmotic pressure
- B) Blood pressure
- C) Interstitial pressure
- D) Diffusion pressure

**Q.12** After coming out of the capsule as efferent arteriole, the blood vessel subdivides again into another network of capillaries called:

- A) Vasa recta
- B) Afferent arteriole
- C) Peritubular capillaries
- D) Renal vein

**Q.13** Bowman's capsule continues as:

- A) Proximal tubule
- B) Distal tubule
- C) Loop of Henle
- D) Urine collecting duct

**Q.14** The collecting tubule receives wastes from:

- A) Renal pelvis
- B) Distal tubule
- C) Proximal tubule
- D) Loop of Henle

**Q.15** Blood passing through \_\_\_\_\_ is filtered into Bowman's capsule.

- A) Peritubular network
- B) Glomerulus
- C) Afferent arteriole
- D) Efferent arteriole

**Q.16** Blood is specially filtered in glomerulus, because glomerulus walls are porous and the fraction of the pressure reaching here provides the:

- A) Osmotic pressure
- B) Filtration pressure
- C) Diffusion pressure
- D) Osmotic pressure

**Q.17** Glomerular filtrate contains numerous useful substances such as:

- A) Glucose, amino acids, urea
- B) Glucose, uric acid, salts
- C) Glucose, amino acids, salts
- D) Urea, uric acid, ammonia

**Q.18** All useful constituents of the glomerular filtrate are reabsorbed in:

- A) Distal tubule
- B) Loop of Henle
- C) Proximal tubule
- D) Collecting tubule

**Q.19** The tubular epithelium also secretes substances into the lumen, which is mainly of:

- A) Hydrogen ions
- B) Hydroxyl ions
- C) Potassium ions
- D) Sodium ions

**Q.20** Conservation of water is the principal function of the body in:

- A) Surplus supply of water
- B) Restricted supply of water
- C) Sufficient supply of water
- D) Excess supply of water

**Q.21** In restricted supply of water concentration of the filtrate is done by the following except:

- A) Counter current
- B) Hormonal mechanism
- C) Antidiuretic Hormone
- D) Aldosterone

**Q.22** In sufficient or excess supply of water, reabsorption of water from filtrate is:

- A) Increased
- B) Maintained
- C) Reduced
- D) Stopped

**Q.23** Reabsorption of water from filtrate is reduced in:

- A) Surplus supply of water
- B) Sufficient supply of water
- C) Excess supply of water
- D) Restricted supply of water



**Q.24** Mammalian kidney including human is adapted to conserve water by \_\_\_\_\_ reabsorption of glomerular filtrate.

- A) 99.0%                      C) 99.5%  
B) 99.1%                      D) Over 99.5%

**Q.25** The \_\_\_\_\_ of the kidney are gradually concentrated from cortical to medullary part of kidney.

- A) Interstitial fluid  
B) Glomerular filtrate  
C) Blood  
D) Interstitial fluid as well as filtrate

**Q.26** Counter current multiplier causes gradual osmotic outflow of water from the filtrate back to kidney as it passes downward in the:

- A) Proximal tubule  
B) Collecting tubule  
C) Descending loop of Henle  
D) Distal tubule

**Q.27** Ascending limb of loop of Henle does not allow \_\_\_\_\_ from its filtrate.

- A) Outflow of sodium  
B) Outflow of water  
C) Outflow of salts  
D) Outflow of any material

**Q.28** Ascending loop of Henle actively transport \_\_\_\_\_ into kidney interstitium to sustain its high concentration.

- A) Water                      C) Urea  
B) Na<sup>+</sup> ions                      D) H<sup>+</sup> ions

**Q.29** Various factors of pathological and chemical nature may progressively destroy the nephron which results in:

- A) Increase in the plasma level of urea  
B) Decrease in other nitrogenous wastes  
C) Decrease in the plasma level of urea  
D) Decrease in the blood pressure

**Q.30** The function of the kidney is completely lost and it is unable to remove nitrogenous wastes, in:

- A) Acute renal failure  
B) Chronic renal failure  
C) Partial renal failure  
D) Kidney stones

**Q.31** In case of uremia, to remove nitrogenous wastes, particularly the urea, the blood of the patient is treated through:

- A) Centrifugation                      C) Transfusion  
B) Lithotripsy                      D) Dialysis

**Q.32** There are two types of dialysis i.e.:

- A) Blood dialysis and peritoneal dialysis  
B) Plasma dialysis and peritoneal dialysis  
C) Hemodialysis and peritoneal dialysis  
D) Hemodialysis and permanent dialysis

**Q.33** Hemodialysis means:

- A) Cleaning the blood  
B) Replacing the blood  
C) Washing the blood  
D) Centrifugation of the blood

**Q.34** The wastes and excess water pass during dialysis from blood through the membrane:

- A) Into the body  
B) Out of the body  
C) Into the dialysis fluid  
D) Out of the dialysis fluid

**Q.35** Peritoneal cavity is filled with dialysis fluid that enters the body through a/an:

- A) Artery                      C) Capillary  
B) Vein                      D) Catheter

**Q.36 It is the kidney machine that works on the same principle as the kidney for removal of wastes and excess water from the blood:**

- A) Catheter                      C) Dialyzer  
B) Peritoneum                D) Epithelium

**Q.37 The surgical transplantation of a matching donor's kidney is the only option left for the permanent treatment of:**

- A) Kidney stones            C) Uremia  
B) Hypercalcemia        D) Hyperoxaluria

**Q.38 Homeostasis is the central requirement in the maintenance of an organism, which compels the \_\_\_\_\_ in constant changing conditions and contribute in evolutionary process.**

- A) Thermoregulation    C) Excretion  
B) Osmoregulation      D) Adaptations

**Q.39 Pick up the matching one:**

- A) Conservation of water-concentration of filtrate  
B) Conservation of water-diluted urine  
C) Restricted supply of water-diluted urine  
D) Sufficient supply of water-concentration of filtrate

**Q.40 Pick up the incorrect one:**

- A) Conservation of water results in concentration of filtrate  
B) Restricted supply of water cause conservation of water  
C) Release of ADH is inhibited in the presence of hypo-osmotic body fluids  
D) Reduction in reabsorption results in production of small volume of conc. urine

**Q.41 It is adapted to conserve water by over 99.5% reabsorption of glomerular filtrate:**

- A) Mammalian body including human  
B) Mammalian kidney including human  
C) Mammalian skin including human  
D) Mammalian liver including human

**Q.42 The active uptake of sodium from the ascending limb or thick loop of Henle is promoted by the action of:**

- A) ADH  
B) Aldosterone  
C) Concentration of filtrate  
D) Vasopressin

**Q.43 The production of varied concentration of urine depends upon the:**

- A) Availability of water  
B) Availability of sodium  
C) Production of aldosterone  
D) Counter current multiplier

**Q.44 Kidney stones are formed in:**

- A) Infectious diseases  
B) Metabolic diseases  
C) Genetic disease  
D) Congenital diseases

**Q.45 Calcium oxalate type stone is caused by:**

- A) Hyperoxaluria        C) Hyperuricemia  
B) Hypercalcaemia      D) Metabolic disease

**Q.46 The kidney stones caused by hypercalcaemia are \_\_\_\_\_ percent of the total kidney stones.**

- A) 10%                              C) 70%  
B) 15%                              D) 5%

**Q.47** The kidney stones caused by hyperoxaluria are \_\_\_\_\_ percent of the all kidney stones.

- A) 10%                      C) 70%  
B) 15%                      D) 5%

**Q.48** The kidney stones caused by hyperuricemia are \_\_\_\_\_ percent of the all kidney stones.

- A) 10%                      C) 70%  
B) 15%                      D) 5%

**Q.49** Hypercalcaemia i.e. high level of circulating calcium in blood is because of:

- A) Stone of calcium phosphate  
B) Stone of calcium oxalate  
C) Stone of uric acid  
D) Other diseases

**Q.50** The salts are precipitated out during \_\_\_\_\_ and accumulate later to form stone.

- A) Urea formation      C) Urine formation  
B) Urination              D) Defecation

**Q.51** Lithotripsy is a technique used to break up stones formed in the:

- A) Kidney  
B) Gall bladder  
C) Ureter  
D) Kidney, Ureter and gall bladder

**Q.52** Extracorporeal, shock wave lithotripsy is:

- A) The only way to carry out lithotripsy  
B) One of the several ways to carry out lithotripsy  
C) The most common way to carry out lithotripsy  
D) A way likely to be used in future

**Q.53** Various factors of pathological and chemical nature may progressively destroy the nephron, particularly its:

- A) Glomerulus part  
B) Convoluted tubule  
C) Loop of Henle  
D) Bowman's capsule

**Q.54** A pair of Kidneys consists of \_\_\_\_\_ of functional units.

- A) Million                      C) Millions  
B) Billion                      D) Billions

**Q.55** Detection of change and signalling for effector's response to control system is a:

- A) Homeostasis  
B) Thermoregulation  
C) Excretion  
D) Feedback mechanism

**Q.56** Animals maintain their internal osmotic state through:

- A) Homeostasis              C) Osmoregulation  
B) Thermoregulation      D) Excretion

**Q.57** A specified set up of internal environment at various levels of organization suitable to its surroundings, have been assumed by each organism of a species in:

- A) Life history  
B) Life cycle  
C) Evolutionary history  
D) Homeostatic history



ANSWER KEY (Worksheet-1)							
1	D	18	C	35	D	52	B
2	A	19	A	36	C	53	A
3	C	20	B	37	C	54	C
4	D	21	D	38	D	55	D
5	B	22	C	39	A	56	C
6	B	23	C	40	D	57	C
7	A	24	D	41	B	58	
8	B	25	D	42	B	59	
9	B	26	C	43	A	60	
10	D	27	B	44	B	61	
11	B	28	B	45	A	62	
12	C	29	A	46	B	63	
13	A	30	B	47	C	64	
14	B	31	D	48	A	65	
15	B	32	C	49	D		
16	B	33	A	50	C		
17	C	34	C	51	D		

### EXPLANATION

**Q.1** Answer is "Thermoregulation"

**Explanation:** The process mentioned in 'A', 'B' and 'C' are partially supportive in temperature maintenance, however thermoregulation is the homeostatic process used in this regard.

**Q.2** Answer is "Internal environment"

**Explanation:** Homeostatic arrangements in each organism have acquired perfection through evolution and now each species have its own arrangement.

**Q.3** Answer is "01"

**Explanation:** Kidneys contribute less than 1% of the total body weight but they receive 20% of the total blood of the body by each cardiac beat. This indicates their physiological importance.

**Q.4** Answer is "20"

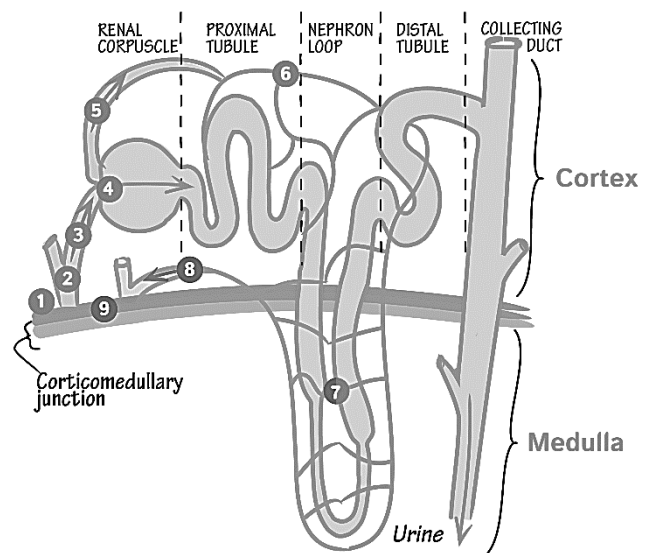
**Explanation:** Kidney contribute less than 1% of the total body weight but they receive 20% of the total blood of the body by each cardiac beat. This indicates their physiological importance.

**Q.5** Answer is "An outer cortex and an inner medulla"

**Explanation:** Cortex literally means outer layer and medulla literally means inner part. The outer and peripheral part is called renal cortex and inner or central part is called renal medulla.

**Q.6** Answer is "Juxtamedullary nephron"

**Explanation:** Though counter current multiplier and restricted supply of water are also associated with production of concentrated urine but they are not structures.



**Q.7** Answer is "Cortical"

**Explanation:** Cortex is the outer and peripheral part of kidneys whereas medulla is the inner or central part of kidney. The nephrons of cortical part are called cortical nephrons.

**Q.8** Answer is "Bowman's capsule"

**Explanation:** Bowman's capsule or the Bowman capsule or capsule glomeruli or glomerular capsule is a cup like sac at the beginning of the tubular component of a nephron in the mammalian kidneys.

**Q.9** Answer is "Glomerulus"

**Explanation:** The ball of capillaries is called glomerulus which is surrounded by a cup shaped structure called Bowman's

capsule. Glomerulus circulates the blood in the cup shaped Bowman's capsule.

**Q.10 Answer is "Glomerulus"**

**Explanation:** The ball of capillaries is called glomerulus which is surrounded by a cup shaped structure called Bowman's capsule.

**Q.11 Answer is "Blood pressure"**

**Explanation:** The net filtration pressure (NFP) at the glomerulus is the difference between the net hydrostatic pressure and the blood colloid osmotic pressure acting across the glomerular capillaries. This is the average pressure forcing water and dissolved materials out of the glomerular capillaries into the capsular space.

**Q.12 Answer is "Peritubular capillaries"**

**Explanation:** Peritubular capillaries constitute a network of tiny blood vessels that travel alongside nephrons, allowing reabsorption and secretion between blood and the inner lumen of the nephron. Peritubular capillaries surround the proximal and distal tubules, as well as the loop of Henle where they are known as Vasa recta.

**Q.13 Answer is "Proximal tubules"**

**Explanation:** Proximal tubule receive filtrate from Bowman's capsule.

**Q.14 Answer is "Distal tubules"**

**Explanation:** Distal tube opens into collecting tubule.

**Q.15 Answer is "Glomerulus"**

**Explanation:** Glomerular membrane is used as initial filtering membrane.

**Q.16 Answer is "Filtration pressure"**

**Explanation:** Blood pressure provides the pressure required for pressure filtration.

**Q.17 Answer is "Glucose, amino acids, salts"**

**Explanation:** These useful substances are filtered out in aqueous solution along with

waste substances from glomerulus into the Bowman's capsule.

**Q.18 Answer is "Proximal tubule"**

**Explanation:** All useful constituents of the glomerular filtrate are reabsorbed in the proximal tubules and when filtrate leaves proximal tubules, it mostly contains nitrogenous wastes.

**Q.19 Answer is "Hydrogen ions"**

**Explanation:** Hydrogen ions make pH acidic to give the urine an antiseptic effect.

**Q.20 Answer is "Restricted supply of water"**

**Explanation:** When supply of water to the body is restricted the water inside the body is conserved to compensate it and vice versa. Thus volume of the urine is reduced and it becomes concentrated.

**Q.21 Answer is "Aldosterone"**

**Explanation:** Aldosterone is associated with active reabsorption of salts not of water. Whereas, rest of the choices are associated with concentration of urine and conservation of water.

**Q.22 Answer is "Reduced"**

**Explanation:** When sufficient or excess supply of water is available to our body, reabsorption from the glomerular filtrate will be reduced and more and more water will be allowed to leave the body in the form of urine.

**Q.23 Answer is "Excess supply of water"**

**Explanation:** When supply of water to the body is restricted the water inside the body is conserved to compensate it and vice versa.

**Q.24 Answer is "Over 99.5%"**

**Explanation:** More than 99.5% water from filtrate is reabsorbed in human and mammalian kidney.

**Q.25 Answer is "Interstitial fluid as well as filtrate"**

**Explanation:** The interstitial fluid of kidney becomes more and more concentrated from cortex to inner medulla which exerts osmotic pressure on the filtrate moving inside

the nephron thus making it more and more concentrated as well.

**Q.26 Answer is “Descending loop of Henle”**

**Explanation:** Water is passively reabsorbed from the filtrate back into blood stream while passing through the descending limb of loop of Henle.

**Q.27 Answer is “Outflow of water”**

**Explanation:** Sodium is actively reabsorbed from filtrate under the influence of aldosterone hormone while passing through the ascending limb of loop of Henle, not water.

**Q.28 Answer is “Na<sup>+</sup> ions”**

**Explanation:** Sodium is actively reabsorbed from filtrate under the influence of aldosterone hormone while passing through the ascending limb of loop of Henle.

**Q.29 Answer is “Increase in the plasma level of urea”**

**Explanation:** When nephrons suffers from any disorder, they remain unable to filter the urea from blood and as a result of plasma level of urea increases.

**Q.30 Answer is “Chronic renal failure”**

**Explanation:** In chronic renal failure the kidneys will not remove the nitrogenous wastes from the blood.

**Q.31 Answer is “Dialysis”**

**Explanation:** Dialysis is a temporary measure to clean the blood off nitrogenous wastes until the kidney transplant is managed.

**Q.32 Answer is “Hemodialysis and peritoneal dialysis”**

**Explanation:** Hemodialysis is a pure mechanical dialysis whereas in peritoneal dialysis a human membrane called peritoneum is used as filtering membrane to isolate the nitrogenous wastes from blood.

**Q.33 Answer is “Cleaning the blood”**

**Explanation:** Hemodialysis literally means cleaning the blood.

**Q.34 Answer is “Into the dialysis fluid”**

**Explanation:** Wastes are collected in dialysis fluid during dialysis.

**Q.35 Answer is “Catheter”**

**Explanation:** A catheter is a thin tube made from medical grade materials, serving a broad range of functions along with filling and draining the dialysis fluid from peritoneal cavity.

**Q.36 Answer is “Dialyzer”**

**Explanation:** As the name indicates, it is a dialysis machine.

**Q.37 Answer is “Uremia”**

**Explanation:** Uremia is an end stage kidney failure and it can be treated with kidney transplant only.

**Q.38 Answer is “Adaptations”**

**Explanation:** Adaptations gradually accumulate and become a result of evolution in longtime.

**Q.39 Answer is “Conservation of water – concentration of filtrate”**

**Explanation:** When water is taken back from the filtrate it becomes concentrated.

**Q.40 Answer is “Reduction in reabsorption results in production of small volume of conc. urine”**

**Explanation:** When reabsorption from filtrate is reduced it results in production of massive volume of diluted urine.

**Q.41 Answer is “Mammalian kidney including humans”**

**Explanation:** More than 99.5% water from filtrate is reabsorbed in human and mammalian kidney.

**Q.42 Answer is “Aldosterone”**

**Explanation:** Aldosterone hormone is secreted from adrenal cortex and acts upon



ascending limb of loop of Henle to promote reabsorption of sodium by active uptake. It is mineralocorticoid hormone.

**Q.43 Answer is “Availability of water”**

*Explanation:* When sufficient water is available diluted urine is produced and when water is deficient urine is concentrated.

**Q.44 Answer is “Metabolic diseases”**

*Explanation:* Metabolic diseases result in formation of kidney stones.

**Q.45 Answer is “Hyperoxaluria”**

*Explanation:* It is high level of oxalates in blood which cause calcium oxalate type stones.

**Q.46 Answer is “15%”**

*Explanation:* As per statistical data given in textbook.

**Q.47 Answer is “70%”**

*Explanation:* As per statistical data given in textbook.

**Q.48 Answer is “10%”**

*Explanation:* As per statistical data given in textbook.

**Q.49 Answer is “Other diseases”**

*Explanation:* Hypercalcemia is caused by some metabolic, dietary or hormonal disorder.

**Q.50 Answer is “Urine formation”**

*Explanation:* Stone formation occur during urine formation.

**Q.51 Answer is “Kidney, ureter and gall bladder”**

*Explanation:* Stones formed in kidney, ureter and gall bladder can be broken down by radiations.

**Q.52 Answer is “One of the several ways to carry out lithotripsy”**

*Explanation:* Others are intracorporeal shockwave lithotripsy, laser lithotripsy electrohydraulic lithotripsy, mechanical lithotripsy and ultrasonic lithotripsy.

**Q.53 Answer is “Glomerulus part”**

*Explanation:* As glomerulus plays a vital role in filtration of wastes (particularly nitrogenous wastes).

**Q.54 Answer is “Millions”**

*Explanation:* Means many millions.

**Q.55 Answer is “Feedback mechanism”**

*Explanation:* In these processes there is an inverse effector’s response to control the change.

**Q.56 Answer is “Osmoregulation”**

*Explanation:* Maintenance of inner osmotic state is the basic responsibility of osmoregulatory homeostasis, however excretory homeostasis also plays a role in it as a secondary function.

**Q.57 Answer is “Evolutionary history”**

*Explanation:* Homeostasis is the central requirement in the maintenance of an organism, which compels the adaptations in the constant changing conditions and contribute in evolutionary process. Thus homeostatic arrangements have been evolved along with the evolution of animal world. Highly evolved animals like mammals (including humans) have perfectly evolved homeostasis. Evolution of excretory homeostasis in animal world proceeded in following sequence.

Protonephridial system →  
metanephridial system → true  
nephridial system.

**Worksheet-2**

**(Muscles and Movement)**

- Q.1** The muscles that are attached to the skeleton are:  
A) Smooth muscles  
B) Skeletal muscles  
C) Cardiac muscles  
D) Involuntary muscles
- Q.2** Generally, each end of the entire muscle is attached to bone by a bundle of collagen, non-elastic fibres known as:  
A) Ligament  
B) Capsule  
C) Tendon  
D) Connective tissue
- Q.3** It is a long cylindrical cell with multiple oval nuclei arranged just beneath its sarcolemma:  
A) Muscle fibre  
B) Muscle bundle  
C) Myofibril  
D) Myofilament
- Q.4** Sarcoplasm of muscle fibres differs from the cytoplasm of the other cells as it contains usually:  
A) Large amount of stored starch  
B) A unique oxygen binding protein, myoglobin  
C) Hemoglobin that stores oxygen  
D) Large amount of stored lipids
- Q.5** Myofibrils run in parallel fashion and extend entire length of the:  
A) Muscle bundle  
B) Muscle  
C) Muscle fibre or muscle cell  
D) Myofilament
- Q.6** Bundles of myofibrils are enclosed by the:  
A) Muscle cell membrane  
B) Nuclear membrane  
C) Sarcolemma  
D) Muscle cell membrane or sarcolemma

- Q.7** The light band of sarcomere is called:  
A) H band  
B) A band  
C) I band  
D) M band
- Q.8** Light and dark bands of muscles give the muscle cell as a whole its:  
A) Strength  
B) Nourishment  
C) Striped appearance  
D) Protection
- Q.9** A sarcomere is the region of a myofibril between two successive:  
A) A-lines  
B) H-lines  
C) Z-lines  
D) M-lines
- Q.10** Myofibrils contain:  
A) Myofilaments  
B) Thick filaments  
C) Thin filaments  
D) Muscle fibres
- Q.11** It is made up of thick and thin filament:  
A) Myofibril  
B) Muscle fibre  
C) Muscle bundle  
D) Myofilament
- Q.12** The diameter of thick filament is:  
A) 16  $\mu\text{m}$   
B) 7-8 nm  
C) 1-2  $\mu\text{m}$   
D) 16 nm
- Q.13** Each myosin molecule has a tail terminating in:  
A) Two globular heads  
B) Two linear heads  
C) A globular head  
D) A linear head
- Q.14** Globular heads of myosin filaments link the thick and the thin myofilaments together during contraction, that is why they are sometimes called:  
A) Cross links  
B) Cross bridges  
C) Cross connection  
D) Cross heads
- Q.15** Thin filaments have a diameter of:  
A) 1-2  $\mu\text{m}$   
B) 10-60  $\mu\text{m}$   
C) 7-8 nm  
D) 16 nm

**Q.16 Thin filaments are composed chiefly of:**

- A) Actin
- B) Troponin
- C) Tropomyosin
- D) Actin, tropomyosin and troponin

**Q.17 Out of three polypeptides of troponin one binds to actin chain, another binds to tropomyosin while third binds:**

- A) Myosin
- B) Collagen
- C) Sodium ions
- D) Calcium ions

**Q.18 The hypothesis to explain all events involved in muscle contraction was suggested by:**

- A) H. Huxley
- B) H. Huxley and A.F Huxley
- C) A.F. Huxley
- D) H. Huxley and A.F Huxley and their colleagues

**Q.19 During muscle contraction the cross bridges of thick filaments become attached to:**

- A) Myosin filament
- B) Binding sites of myosin filament
- C) Binding sites on actin filament
- D) Actin filament

**Q.20 Calcium ions bind with the troponin molecule and cause them to:**

- A) Extend
- B) Move slightly
- C) Contract
- D) Remain in the same position

**Q.21 Once the myosin head has become attached to the actin filament:**

- A) ATP is synthesized and the bridge goes to its cycle
- B) ATP is hydrolyzed and the bridge goes to its cycle
- C) ATP is synthesized and the bridge becomes fixed
- D) ATP is hydrolyzed and the bridge becomes fixed

**Q.22 All the fibres innervated by a single motor neuron contract:**

- A) One after other
- B) Simultaneously
- C) Separately
- D) Now or then simultaneously

**Q.23 T-system extends and encircles the myofibril at the level of:**

- A) Z-line
- B) A and I junction
- C) Z-line or A and I Junctions
- D) M-line or A and I Junctions

**Q.24 It causes muscle pH to drop when the muscle suffers from:**

- A) Accumulation of ATPs
- B) Aerobic breakdown of glucose
- C) Overactive metabolism
- D) Lactic acid accumulation

**Q.25 It increases the excitability of neurons and result in loss of sensation:**

- A) Cramp
- B) Muscle fatigue
- C) Tetany
- D) Tetanus

**Q.26 The vertebrates possess \_\_\_\_\_ kinds of muscles:**

- A) Two
- B) Four
- C) Three
- D) Six

**Q.27 It has regular stripes:**

- A) Cardiac muscles
- B) Skeletal muscles
- C) Voluntary muscles
- D) Involuntary muscles

**Q.28 It has many nuclei per cell:**

- A) Smooth muscles
- B) Cardiac muscles
- C) Skeletal muscles
- D) Involuntary muscles



- Q.29** Contraction of smooth muscles is caused by following causes:  
 A) Spontaneous stimuli  
 B) Nervous system & hormonal stimuli  
 C) Stretch stimuli  
 D) Spontaneous, stretch, nervous & hormones
- Q.30** The contraction of cardiac muscles is caused by:  
 A) Spontaneous stimuli  
 B) Nervous stimuli  
 C) Stretch stimuli  
 D) Hormonal stimuli
- Q.31** The function of cardiac muscles is to:  
 A) To pump blood  
 B) To move the skeleton  
 C) To control movement of substances through hollow organs  
 D) To pump the lymph
- Q.32** The function of skeletal muscles is to:  
 A) To pump blood  
 B) To move the skeleton  
 C) To control movement of substances through hollow organs  
 D) To pump the lymph
- Q.33** A smallest contractile unit of muscle contraction called sarcomere is the area between two:  
 A) H- zone                      C) Z- Line  
 B) M- Line                      D) A band
- Q.34** The thousands of T-tubules of each muscle cell are collectively called:  
 A) Triad  
 B) Sarco-tubules  
 C) T-system  
 D) Neuromuscular junction
- Q.35** If a cross section of a sarcomere is seen, each myosin is surrounded by how many actin molecules:  
 A) 9                                  C) 6  
 B) 5                                  D) 7

- Q.36** The protein filament which binds to the calcium:  
 A) Actin                                  C) Troponin  
 B) Myosin                              D) Tropomyosin
- Q.37** Muscle fatigue is caused by:  
 A) CO<sub>2</sub>  
 B) Accumulation lactic acid  
 C) Fumaric acid  
 D) Ethyl alcohol
- Q.38** Twisting around the actin chains there are two strands of another protein:  
 A) Myosin                              C) Troponin  
 B) Tropomyosin                      D) Creatine
- Q.39** It remains fixed during muscle contraction:  
 A) Origin                                  C) Belly  
 B) Insertion                              D) Bone
- Q.40** \_\_\_\_\_ can polarize visible light:  
 A) M-line of sarcomere  
 B) I-band of sarcomere  
 C) H-band of sarcomere  
 D) A-band of sarcomere
- Q.41** It length of myofibril from one Z-line to the next:  
 A) Plasma membrane              C) Sarcoplasm  
 B) Sarcomere                              D) Sarcolemma
- Q.42** Muscle cell is considered as:  
 A) Muscle fiber  
 B) Sarcomere  
 C) Muscle bundle  
 D) Myofibril
- Q.43** Smooth reticulum are similar in structure to:  
 A) RER  
 C) Golgi bodies  
 B) Microfilaments  
 D) Sarcoplasmic reticulum
- Q.44** Pickup the ranges of muscle fibre:  
 A) 5 – 10  $\mu$ m                          C) 10 – 100  $\mu$ m  
 B) 1 – 2  $\mu$ m                              D) 50 – 100 nm

- Q.45** The thin filaments extends across the I-band and partly in to:  
A) Z-line                      C) A-band  
B) H-zone                      D) M-line
- Q.46** The \_\_\_\_\_ have mid-section called H zone:  
A) H-zone                      C) Z-zone  
B) M-zone                      D) A-zone
- Q.47** Pick up a complex of three polypeptide chains protein:  
A) Tropomyosin              C) Myosin  
B) Actin                      D) Troponin
- Q.48** Each myosin filament is surrounded by \_\_\_\_\_ actin filaments on both ends:  
A) 5                              C) 10  
B) 6                              D) 12
- Q.49** After death, the amount \_\_\_\_\_ in the body falls:  
A) Water                      C) Oxygen  
B) Calcium                      D) ATP
- Q.50** Majority of muscles tissue in human body are \_\_\_\_\_ type:  
A) Smooth                      C) Cardiac  
B) Circular                      D) Skeletal

**ANSWER KEY (Worksheet-2)**

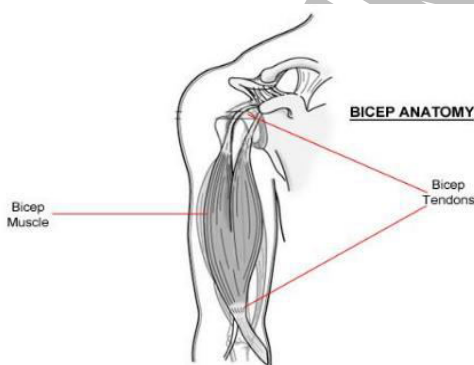
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2	C	22	B	42	A
3	A	23	C	43	D
4	B	24	D	44	C
5	C	25	C	45	C
6	D	26	C	46	A
7	C	27	B	47	D
8	C	28	C	48	D
9	C	29	D	49	D
10	A	30	B	50	D
11	D	31	A		
12	D	32	B		
13	A	33	C		
14	B	34	C		
15	C	35	C		
16	A	36	C		
17	D	37	B		
18	D	38	B		
19	C	39	A		
20	B	40	D		

**EXPLANATION**

**Q.1** Answer is "Skeletal muscles"

*Explanation:* Skeletal muscles are called so because of their association on with skeleton.

**Q.2** Answer is "Tendon"



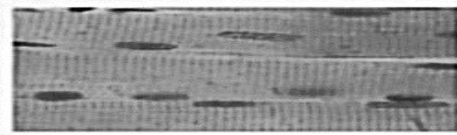
**Explanation:**

Tendon makes the ends of origin and ends of insertion of a skeletal muscles.

**Q.3** Answer is "Muscle fibre"

*Explanation:* A muscle cell or muscle fibre of skeletal muscle have such features.

**SKELETAL MUSCLE**



**LEG**

**Q.4** Answer is "A unique oxygen binding protein myoglobin"

*Explanation:* It is called muscle hemoglobin.

**Q.5** Answer is "Muscle fibre or muscle cell"

*Explanation:* Myofibrils have same length as held by muscle cell.

**Q.6** Answer is "Muscle cell membrane or sarcolemma"

*Explanation:* The plasma membrane of muscle cell is called sarcolemma.

**Q.7** Answer is "I-band"

*Explanation:* It consists of thin (actin) filaments only.

**Q.8** Answer is "Striped appearance"

*Explanation:* That is why they are called striped or striated muscles.

**Q.9** Answer is "Z-line"

*Explanation:* An area between two Z-lines or Z disc is called sarcomere.

**Q.10** Answer is "Myofilaments"

*Explanation:* Actin and myosin filaments.



**Q.11 Answer is “Myofilament”**

**Explanation:** Actin filament is thin while myosin filament is thick. They collectively (six thin myofilaments and one thick myofilament) give rise to a myofibril.

**Q.12 Answer is “16nm”**

**Explanation:** As per measurement.

**Q.13 Answer is “Two globular heads”**

**Explanation:** These are looping ends which make cross bridges with thin myofilament.

**Q.14 Answer is “Cross bridges”**

**Explanation:** Bond between myosin head and thin filament is called cross bridge.

**Q.15 Answer is “7-8 nm”**

**Explanation:** As per measurement.

**Q.16 Answer is “Actin”**

**Explanation:** Thin myofilaments consist of actin, tropomyosin and troponin, however the chief protein is actin. So thin myofilament is chiefly made up of actin.

**Q.17 Answer is “Calcium ions”**

**Explanation:** Calcium ions after making bond with troponin drag the tropomyosin away from the slot where myosin head makes bond.

**Q.18 Answer is “H. Huxley and A-F Huxley and their colleagues”**

**Explanation:** As per historical fact.

**Q.19 Answer is “Binding sites on actin filament”**

**Explanation:** Myosin heads bind to the binding sites on actin filaments to make cross bridges. These myosin heads bring the actin filaments towards the centre of the sarcomere by contracting.

**Q.20 Answer is “Move slightly”**

**Explanation:** When the muscle is required to contract, calcium ions bind with the troponin molecule and cause them to move

slightly. This has the effect of displacing the tropomyosin and exposing the binding sites for the myosin head.

**Q.21 Answer is “ATP is hydrolyzed and bridge goes to its cycle”**

**Explanation:** Muscle contraction is highly active process and ATPs are consumed at each step i.e. making bond with actin filament, moving or bending and detaching from actin filament.

**Q.22 Answer is “Simultaneously”**

**Explanation:** the contraction of each muscle fibre is based on “All or none” principle i.e. all of its fibrils participate in contraction. The degree of contraction depends at once upon the number of fibres that participate in the contraction.

**Q.23 Answer is “Z-line or A and I junctions”**

**Explanation:** It is to ensure the transmission of impulse.

**Q.24 Answer is “Lactic acid accumulation”**

**Explanation:** It accumulates as a result of anaerobic respiration and accumulation of acid lowers the pH.

**Q.25 Answer is “Tetany”**

**Explanation:** As per symptoms of tetany.

**Q.26 Answer is “Three”**

**Explanation:** Skeletal, smooth and cardiac.

**Q.27 Answer is “Skeletal muscles”**

**Explanation:** Skeletal muscles have regular striations or strips converting the surface into alternating light and dark bands.

**Q.28 Answer is “Skeletal muscle”**

**Explanation:** Skeletal muscle cells are multinucleate.

**Q.29** Answer is “Spontaneous, stretch, nervous and hormones”

**Explanation:** Causes of contraction of smooth muscles are diverse.

**Q.30** Answer is “Nervous stimuli”

**Explanation:** It is autonomic nervous system, which send rythonic stimuli.

**Q.31** Answer is “To pump blood”

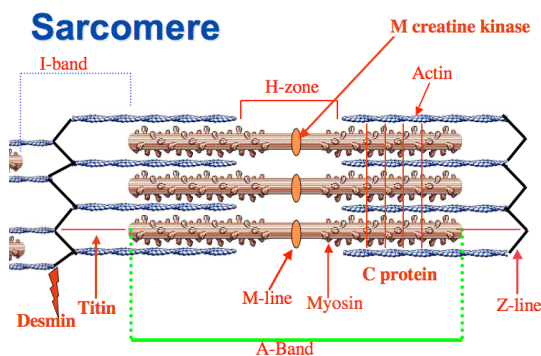
**Explanation:** As per function of the heart.

**Q.32** Answer is “To move the skeleton”

**Explanation:** As per function of the skeletal muscles.

**Q.33** Answer is “Z- Line”

**Explanation:**

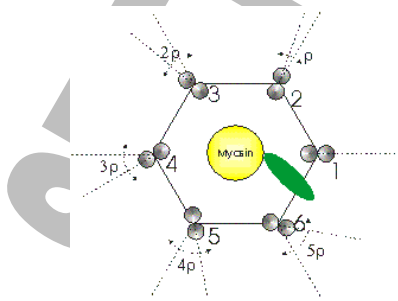


**Q.34** Answer is “T-system”

**Explanation:** The thousands of T-tubules of each muscle cell are collectively called T-system.

**Q.35** Answer is “6”

**Explanation:**



Each myosin filament is surrounded by 6 actin filaments on each end.

**Q.36** Answer is “Troponin”

**Explanation:** The protein filament which binds to the calcium troponin.

**Q.37** Answer is “Accumulation lactic acid”

**Explanation:** Muscle fatigue is caused by accumulation lactic acid.

**Q.38** Answer is “Tropomyosin”

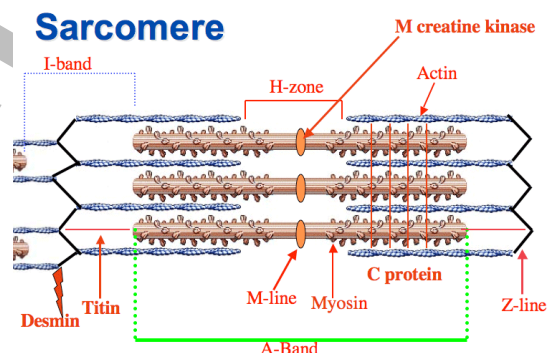
**Explanation:** Twisting around the actin chains there are two strands of another protein tropomyosin.

**Q.39** Answer is “Origin”

**Explanation:** It remains fixed during muscle contraction origin.

**Q.40** Answer is “A-band of sarcomere”

**Explanation:** I-band of sarcomere cannot polarize visible light.



**Q.41** Answer is “Sarcomere”

**Explanation:** The length of myofibril from one Z-line to the next is known as sarcomere.

**Q.42** Answer is “Muscle fiber”

**Explanation:** Each muscle consists of muscle bundles, which are further composed of muscle fibers of cells.

A diagram of a myofibril, a cylindrical structure composed of repeating sarcomeres. The sarcomere is the basic contractile unit, bounded by Z lines. Within each sarcomere, thin filaments (actin) are attached to the Z lines, and thick filaments (myosin) are in the center. The M line is the center of the sarcomere. The diagram labels the Z line, Sarcomere, M line, Thin filament, Thick filament, and Myofibril.

**Worksheet-3**  
**(Communication)**

**Q.1** Nervous coordination involves specialized cells or neurons linked together directly or via the central nervous system, to form network that connects the:

- A) Receptor and neurons
- B) Receptors and Effectors
- C) Receptors and CNS
- D) CNS and effectors

**Q.2** The neurons has capacity to generate and conduct impulses which travel across the:

- A) Synapse and pass from the receptors to effectors
- B) Effectors and pass from the synapse to receptors
- C) Synapse and pass from the effectors to receptor
- D) Receptors and pass from the synapse to effectors

**Q.3** The elements of nervous system which help in coordination are:

- A) Receptors, neurons and effectors
- B) CNS and PNS
- C) Motor, sensory and associative neurons
- D) Brian and spinal cord

**Q.4** The receptors for smell, taste and blood composition are:

- A) Mechanoreceptors C) Nociceptors
- B) Chemoreceptors D) Thermoreceptor

**Q.5** The example of chemoreceptors is:

- A) Eyes C) Stray ending
- B) Nose D) Rods and cones

**Q.6** All are the examples of mechanoreceptors EXCEPT:

- A) Free nerve endings
- B) Stray endings
- C) Expanded tip endings
- D) Rods and cones

**Q.7** It is an example of mechanoreceptors:

- A) Hypothalamus
- B) Expanded tip endings
- C) Tongue
- D) Rods and cones

**Q.8** These respond to stimuli of light:

- A) Mechanoreceptors
- B) Chemoreceptors
- C) Photoreceptors
- D) Undifferentiated ending

**Q.9** The receptors that receive stimuli of light are:

- A) Free nerve ending
- B) Rods and cones
- C) Expanded tip endings
- D) Stray nerve ending

**Q.10** All of the principal types of sensations that we can experience are called:

- A) Visceral sensations
- B) Sensation of pain
- C) Modalities of sensation
- D) Sensation of body position

**Q.11** Despite the fact that we experience different modalities of sensation, nerve fibres transmit only:

- A) Responses C) Stimuli
- B) Impulses D) Few



**Q.12** The \_\_\_\_\_ is determined by the point in the CNS to which the nerve fibre leads.

- A) Type of sensation
- B) Strength of sensation
- C) Intensity of sensation
- D) Frequency of sensation

**Q.13** Touch stimulus is carried by nerve impulse in the:

- A) Visual cortex of brain
- B) Auditory centre of brain
- C) Taste centre of brain
- D) Touch area of brain

**Q.14** Each receptor organ is specialized to receive a particular type of stimulus and this is carried to the:

- A) Particular area of the PNS
- B) Particular area of the muscles
- C) Particular area of the glands
- D) Particular area of the brain

**Q.15** In skin the receptors are concerned with at least how many different senses:

- A) Two
- B) Three
- C) Four
- D) Five

**Q.16** Receptors found in the skin are associated with:

- A) Touch, pressure, hearing, cold & pain
- B) Touch, pressure, heat, cold & pain
- C) Touch, pressure, heat, cold & visual
- D) Touch, taste, heat, cold & pain

**Q.17** The detection of vibration of the ground by terrestrial vertebrates is probably achieved by receptors in the:

- A) Joints
- B) Eyes
- C) Ears
- D) Base of hairs

**Q.18** The relative abundance of various types of receptors:

- A) Remains same
- B) Differ rarely
- C) Differs greatly
- D) Remains uniform

**Q.19** Cold receptors are nearly \_\_\_\_\_ less abundant than pain receptors.

- A) 27 percent
- B) 10 percent
- C) 27 times
- D) 10 times

**Q.20** \_\_\_\_\_ receptors are nearly 27 times more abundant than cold receptors.

- A) Temperature
- B) Heat
- C) Pain
- D) Touch

**Q.21** \_\_\_\_\_ receptors are nearly 27 times less abundant than pain receptors.

- A) Touch
- B) Heat
- C) Temperature
- D) Cold

**Q.22** The receptors are \_\_\_\_\_ over the entire surface of the body.

- A) Distributed evenly
- B) Not distributed evenly
- C) Not distributed unevenly
- D) Not distributed

**Q.23** \_\_\_\_\_ receptors are much more numerous in the finger tips than in the skin of the back.

- A) Touch
- B) Pain
- C) Cold
- D) Heat

**Q.24** The unequal distribution of touch receptor in finger tips as compared to the backside skin indicates the:

- A) Normal functions of those two parts of the body
- B) Location of those parts of the body
- C) Surface area of these parts of the body
- D) Size of those parts of the body

**Q.25** The stimulus received by the receptors in the skin which are the endings of sensory neurons is passed to the \_\_\_\_\_ via inter neurons:

- A) Interneurons                      C) Motor neurons
- B) Relay neurons                    D) Somatic neurons

**Q.26** Example of mechanoreceptors is/are:

- A) Eyes                                  C) Rods and cones
- B) Stretch receptors                D) Hypothalamus

**Q.27** The stimulus received by the receptors in the skin is passed to the motor neurons via associative neurons which are present in the:

- A) Brain                                  C) Brain and spinal
- B) Spinal cord                        D) Fingertips

**Q.28** Impulse is sent by the motor neurons to the:

- A) Receptors                          C) Muscles
- B) Effectors                            D) Glands

**Q.29** The sensations of \_\_\_\_\_ are detected by modified sensory neurons having naked nerve endings.

- A) Heat and cold                    C) Touch and pain
- B) Pain and cold                    D) Pain and heat

**Q.30** The sensations of \_\_\_\_\_ are detected by modified sensory neurons.

- A) Touch, pressure, heat, cold and pain
- B) Hearing, taste, body position and smell
- C) Touch, pressure, hearing, taste and pain
- D) Pressure, pain, taste, touch and smell

**Q.31** Specialized cellular corpuscles detect the sensation of:

- A) Pressure, touch and pain
- B) Pressure, vision and hearing
- C) Pressure, heat and cold
- D) Pressure, taste and touch

**Q.32** The chief structural and functional units of nervous system are:

- A) Cell bodies
- B) Neurons
- C) Axons
- D) Receptors & Effectors

**Q.33** \_\_\_\_\_ play a vital role in the nutrition of neurons and their protection by myelin sheath.

- A) Soma                                  C) Neuroglia
- B) Cell body                            D) Dendrites

**Q.34** There are \_\_\_\_\_ functional types of neurons.

- A) Two                                    C) Four
- B) Three                                 D) Five

**Q.35** The \_\_\_\_\_ of certain brain cells branch profusely, giving cell a tree like appearance.

- A) Axons                                 C) Dendrites
- B) Cell bodies                          D) Soma

**Q.36** Many granules are present in the \_\_\_\_\_ of neuron:

- A) Axon ending
- B) Axons
- C) Dendrites
- D) Cell bodies or soma

**Q.37** Many sensory neurons have only one fiber, which branch:

- A) A long distance from the cell body
- B) A short distance from the cell body
- C) A long distance from the CNS
- D) A short distance from the PNS

**Q.38** The neuron has \_\_\_\_\_ arising from its cell body.

- A) Dendrites
- B) Axons
- C) Dendron
- D) Protoplasmic processes

**Q.39** There are \_\_\_\_\_ main types of cytoplasmic processes or fibres in neurons.

- A) Two
- B) Three
- C) Four
- D) Five

**Q.40** It may be more than a meter long in some neurons:

- A) Axon ending
- B) Axon
- C) Dendrite
- D) Dendron

**Q.41** Nissl's granules which are groups of ribosomes associated with endoplasmic reticulum and Golgi apparatus are present in the:

- A) Dendrites
- B) Axon
- C) Cell body
- D) Axoplasm

**Q.42** Microtubules, neurofibrils, rough endoplasmic reticulum and mitochondria are present throughout the \_\_\_\_\_ of the neuron.

- A) Axon
- B) Dendron
- C) Cytoplasm of axon
- D) Dendrites

**Q.43** The \_\_\_\_\_ is the main nutritional part of the nerve cell and is concerned with the biosynthesis of materials necessary for the growth and maintenance of the neuron.

- A) Cell body or soma
- B) Dendrites
- C) Dendron
- D) Axon

**Q.44** If the \_\_\_\_\_ of the neuron remains intact, it can regenerate axonal and dendrite fibres, but neuron once mature, do not divide any further.

- A) Axon
- B) Dendron
- C) Cell body
- D) Dendrites

**Q.45** The structures which respond to the impulse coming via motor neurons are:

- A) Receptors
- B) Effectors
- C) Sense organs
- D) Pacinian corpuscles

**Q.46** The nervous pathways utilized for an immediate and involuntary action performed by our body is called:

- A) Spinal cord
- B) Brain
- C) Reflex arc
- D) CNS

**Q.47** Flow of impulse through the nervous system involving \_\_\_\_\_ will be clear if we study an example of reflex arc.

- A) Receptors, neurons & effectors
- B) Forebrain, Mid brain & Hind Brain
- C) Sensory, motor and associative neurons
- D) Brain, Spinal cord & PNS

**Q.48** Reflex arc is the pathway of passage of impulse during a:

- A) Voluntary action
- B) Nervous action
- C) Unconscious action
- D) Reflex action

**Q.49** The simple reflex circuit includes of the four elements of a neural pathway in following sequence:

- A) Sensory neuron, associative neuron, motor neuron and muscles
- B) Sensory neuron, motor neuron, associative neuron and glands
- C) Sensory neuron, motor neuron, associative neuron and muscles
- D) Associative neurons, sensory neurons, motor neurons and muscles

**Q.50** The sensory neurons have pain sensitive endings in the:

- A) Joints
- B) Ears
- C) Skin
- D) Nose

**Q.51** The sensory neurons have pain sensitive ending in the skin and \_\_\_\_\_ leading to the spinal cord:

- A) Short fibre
- B) Long fibre
- C) Thick fibre
- D) Thin fibre

**Q.52** The sensory neurons also make a synapse on associative neurons not involved in the reflex, that carry signals to the brain:

- A) Informing it of the danger
- B) Informing it of the situation
- C) Informing it of the tranquil position
- D) Informing it of the confusion

**Q.53** Nerve impulse is a wave of electrochemical change, which travels along the length of the neuron involving \_\_\_\_\_ across the cell.

- A) Chemical reactions and movement of elements
- B) Chemical reactions and movement of molecules
- C) Physical actions and movement of ions
- D) Chemical reactions and movement of ions

**Q.54** Human nervous system is a type of:

- A) Diffused nervous system
- B) Centralized nervous system
- C) Primitive nervous system
- D) Peripheral nervous system

**Q.55** It conducts signals to and from the brain and controls reflex activities:

- A) Brain
- B) Spinal cord
- C) CNS
- D) PNS

**Q.56** It carries signals from the CNS that control the activities of muscles and glands:

- A) Sensory neurons
- B) Brain
- C) Associative neurons
- D) Motor neurons

**Q.57** It controls involuntary responses by influencing organs, glands and smooth muscles:

- A) Somatic nervous system
- B) Central nervous system
- C) Autonomic nervous system
- D) Peripheral nervous system

**Q.58** The CNS consists of brain and spinal cord, which are both protected in:

- A) Two ways
- B) Three ways
- C) Four ways
- D) Five ways

**Q.59** \_\_\_\_\_ which is a part of skull, protects the brain.

- A) Meninges
- B) CSF
- C) Cranium
- D) Vertebral columns



**Q.60** The brain and spinal cord are also protected by \_\_\_\_\_ layers of meninges.

- A) Single                      C) Triple
- B) Double                    D) Tetra

**Q.61** \_\_\_\_\_ bathes the neurons of brain and spinal cord and cushions against the bumps and jolts.

- A) Meninges
- B) Saliva
- C) Cerebrospinal fluid
- D) Amniotic fluid

**Q.62** The spinal cord has:

- A) Many cavities            C) Central canal
- B) Many ventricles        D) Many canals

**Q.63** Thalamus, limbic system and cerebrum are three functional parts of:

- A) Fore brain                C) Hind brain
- B) Mid brain                D) Limbic system

**Q.64** The information that includes sensory input from auditory and visual pathways, from the skin and from within the body is carried by \_\_\_\_\_ to limbic system and cerebrum.

- A) Thalamus                C) Cerebrum
- B) Hypothalamus          D) Limbic system

**Q.65** \_\_\_\_\_ works together to produce our most basic and primitive emotions, drives and behaviors.

- A) Cerebrum                C) Corpus callosum
- B) Thalamus                D) Limbic system

**Q.66** Fear, rage, tranquility, hunger, thirst, pleasure and sexual responses are the most \_\_\_\_\_ emotions.

- A) Basic and primitive
- B) Exceptional
- C) Developed and advanced
- D) Extraordinary

**Q.67** Limbic system consists of:

- A) Hypothalamus, amygdala & hippocampus
- B) Thalamus, Hypothalamus & Amygdala
- C) Hypothalamus, Pons & Hippocampus
- D) Amygdala, Hippocampus & thalamus

**Q.68** It acts as a major coordinating center controlling body temperature, hunger, the menstrual cycle, water balance, the sleep wake cycle etc.:

- A) Hypothalamus            C) Thalamus
- B) Hippocampus            D) Amygdala

**Q.69** It plays an important role in formation of long term memories:

- A) Hippocampus            C) Hypothalamus
- B) Amygdala                D) Cerebrum

**Q.70** It is the largest part of the brain:

- A) Cerebellum                C) Cerebrum
- B) Amygdala                D) Thalamus

**Q.71** Cerebrum consists of \_\_\_\_\_ of neurons.

- A) Ten billion                C) Tens of billions
- B) Ten million                D) Tens of millions

**Q.72** It directs the voluntary movements:

- A) Cerebral cortex
- B) Cerebral medulla
- C) Cerebral hemispheres
- D) Cerebellum

**Q.73** It contains primary sensory areas:

- A) Cerebral medulla
- B) Cerebral hemispheres
- C) Corpus callosum
- D) Cerebral cortex

**Q.74 This area is involved in speech and also receives and interprets sensation of touch from all parts of the body:**

- A) Cerebral hemispheres
- B) Cerebral cortex
- C) Corpus callosum
- D) Cerebral medulla

**Q.75 The left cerebral hemisphere controls the:**

- A) Right side of the body
- B) Upper side of the body
- C) Left side of the body
- D) Lower side of the body

**Q.76 It is very important in screening the input information, before they reach higher brain center:**

- A) Corpus callosum
- B) Mid brain
- C) Reticular formation
- D) Cerebrum

**Q.77 Certain neurons in \_\_\_\_\_ located above the medulla, appear to influence transition between sleep and wakefulness, and the rate and pattern of breathing.**

- A) Medulla oblongata
- B) Cerebellum
- C) Pons
- D) Mid brain

**Q.78 It is also involved in learning and memory storage for behaviors:**

- A) Pons
- B) Cerebellum
- C) Limbic system
- D) Hippocampus

**Q.79 Medulla oblongata narrows down into an oval shaped hollow cylinder called:**

- A) Cerebellum
- B) Pons
- C) Spinal cord
- D) Vertebral column

**Q.80 It runs through the vertebral column:**

- A) Spinal cord
- B) Meninges
- C) Cerebrospinal fluid
- D) CSF

**Q.81 An inner butterfly shaped grey matter is found in:**

- A) Cerebrum
- B) Cerebellum
- C) Spinal cord
- D) Medulla oblongata

**Q.82 White matter of spinal cord is made up of:**

- A) Myelinated nerve fibres
- B) Non-myelinated nerve fibres
- C) Myelinated nerve tracts
- D) Myelinated nerve fibres or tracts

**Q.83 It is centre of great many reflexes and it serves as a pathway for conduction of impulses to and from different parts of the body and brain:**

- A) Spinal cord
- B) Medulla oblongata
- C) Cerebellum
- D) Brain

**Q.84 It acts as relay centre in brain:**

- A) Thalamus
- B) Mid brain
- C) Pons
- D) Thalamus and mid brain

**Q.85 PNS comprises of \_\_\_\_\_ and \_\_\_\_\_ which may form ganglia and the nerves.**

- A) Sensory neurons, associative neurons
- B) Associative neurons, sensory neurons
- C) Sensory neurons, motor neurons
- D) Somatic neurons, autonomic neurons

**Q.86** These are bundles of axons or dendrites bound by connective tissue:

- A) The nerves                      C) Grey matters
- B) The ganglia                  D) Spinal cord

**Q.87** It may be sensory, motor or mixed, depending upon the direction of impulse they conduct:

- A) Neuron                        C) Nerve
- B) Nerve cell                  D) Ganglia

**Q.88** The stimulus received by the receptors in the skin (which are the endings of sensory neurons) is passed to the motor neurons via \_\_\_\_\_ neurons.

- A) Inter or somatic
- B) Sympathetic & Parasympathetic
- C) Somatic or autonomic
- D) Inter or associative

**Q.89** Biochemical reactions are regulated by:

- A) Enzymes                      C) Hormones
- B) Coenzymes                  D) Cofactors

**Q.90** Long term changes in our body are regulated by:

- A) Enzyme                      C) CNS
- B) Neurons                      D) Hormone

**Q.91** Endocrine system provides for:

- A) Nervous coordination
- B) Chemical coordination
- C) Immediate coordination
- D) Skeletal coordination

**Q.92** Endocrine glands/tissues are lying in:

- A) Abdominal cavity
- B) CNS
- C) Thoracic cavity
- D) Different parts of the body

**Q.93** Hormones are:

- A) Poured into specific ducts
- B) Transported by specific ducts
- C) Poured directly into blood
- D) Poured directly into blood which carry them to respective target tissues.

**Q.94** Hormones control some long-term changes, such as:

- A) Rate of growth
- B) Rate of metabolic activities
- C) Sexual maturity
- D) Rate of growth and metabolic activities and Sexual maturity

**Q.95** Increased levels of vasopressin cause increased water reabsorption in:

- A) Distal parts of nephron
- B) Cortical part of kidney
- C) Proximal parts of nephron
- D) Medullary part of kidney

**Q.96** Diabetes insipidus is a consequence of deficiency of:

- A) ADH                              C) STH
- B) MSH                              D) TSH

**Q.97** The islets of Langerhans contain:

- A) A large number of  $\beta$ -cells associated with insulin production
- B) A small number of  $\beta$ -cells associated with insulin production
- C) A large number of  $\alpha$  cells associated with insulin production
- D) A small number of  $\alpha$  cells associated with insulin production

**Q.98** Following are different growth promoting hormones of plants, **EXCEPT:**

- A) Absciscic acid      C) Auxins
- B) Kinetin              D) Gibberellins

**Q.99** Higher concentration of auxins inhibits:

- A) Root elongation      C) Cell division
- B) Cell elongation      D) Stem elongation

**Q.100** When auxins are used along with cytokinins on shoots they:

- A) Promote bud initiation
- B) Promote bud dormancy
- C) Inhibit bud dormancy
- D) Inhibit apical dominance

**Q.101** Both auxins and Gibberellins cause delay in:

- A) Flowering              C) Leaf senescence
- B) Fruiting                D) Bud initiation



ANSWER KEY (Worksheet-3)							
1	B	26	B	51	B	76	C
2	A	27	A	52	A	77	C
3	A	28	B	53	D	78	B
4	B	29	C	54	B	79	C
5	B	30	A	55	B	80	A
6	D	31	C	56	D	81	C
7	B	32	B	57	C	82	D
8	C	33	C	58	B	83	A
9	B	34	B	59	C	84	D
10	C	35	C	60	C	85	C
11	B	36	D	61	C	86	A
12	A	37	B	62	C	87	C
13	D	38	D	63	A	88	D
14	D	39	A	64	A	89	C
15	D	40	B	65	D	90	D
16	B	41	C	66	A	91	B
17	A	42	C	67	A	92	D
18	C	43	A	68	A	93	D
19	C	44	C	69	A	94	D
20	C	45	B	70	C	95	A
21	D	46	C	71	C	96	A
22	B	47	A	72	A	97	A
23	A	48	D	73	D	98	A
24	A	49	A	74	B	99	A
25	C	50	C	75	A	100	B
						101	C

### EXPLANATION

**Q.1** Answer is “Receptors and Effectors”

*Explanation:* Receptors receive stimuli and effectors respond but the neurons or nerve cells connect them together.

**Q.2** Answer is “Synapse and pass from the receptors to effectors”

*Explanation:* Synapse is a cytoplasmic gap between axon endings of one neuron and dendrite endings of the next neuron. Impulse always travel from receptors to effectors via neurons. However at the end of each neuron and before the start of next neuron there is a protoplasmic gap called

synapse. Impulse have to pass through it with the help of neurotransmitter.

**Q.3** Answer is “Receptors, neurons and effectors”

*Explanation:* Receptors, neurons and effectors are three basic dementes of nervous system. Receptors receive the stimulus and pass on it in the form of impulse to neurons, which bring it to the CNS, where it is interpreted and then converted into subjective impressions. Then a direction is generated accordingly which is conveyed to the effectors for response by neurons.

**Q.4** Answer is “Chemoreceptors”

*Explanation:* Such receptors which received chemical stimuli and notice chemical changes in internal environment are called chemoreceptors.

**Q.5** Answer is “Nose”

*Explanation:* As smell is a chemical stimulus, nose as a chemoreceptor is associated with it.

**Q.6** Answer is “Rods and cones”

*Explanation:* Rods and cones are photoreceptors.

**Q.7** Answer is “Expanded tip endings”

*Explanation:* Expanded tip nerve endings receive stimuli of touch, pressure and texture.

**Q.8** Answer is “Photoreceptors”

*Explanation:* Rods and cones being photoreceptors respond to the stimulus of light.

**Q.9** Answer is “Rods and Cones”

*Explanation:* Rods and cones being photoreceptors respond to the stimulus of light.

**Q.10 Answer is “Modalities of sensation”**

**Explanation:** Each principle type of sensation that we experience, pain, touch, sight, sound and so forth is called modalities of sensation. We experience these different modalities while nerve fibers transmit only impulses. However the basic structural elements involved in perception and response of each sensation are similar i.e. receptors to sensory neurons to associative neuron to motor neurons to effectors make a model unit, involved in each sensation.

**Q.11 Answer is “Impulses”**

**Explanation:** Each sensation travels in the form of nerve impulse in nervous system.

**Q.12 Answer is “Type of sensation”**

**Explanation:** Type of sensation is determined by the sensory cells or organs receiving it and the part of CNS involved in its assessment.

**Q.13 Answer is “Touch area of brain”**

**Explanation:** Type of sensation is determined by the sensory cells or organs receiving it and the part of CNS involved in its response. A specific area in brain is called touch area that deals with the sensation of touch.

**Q.14 Answer is “Particular area of the brain”**

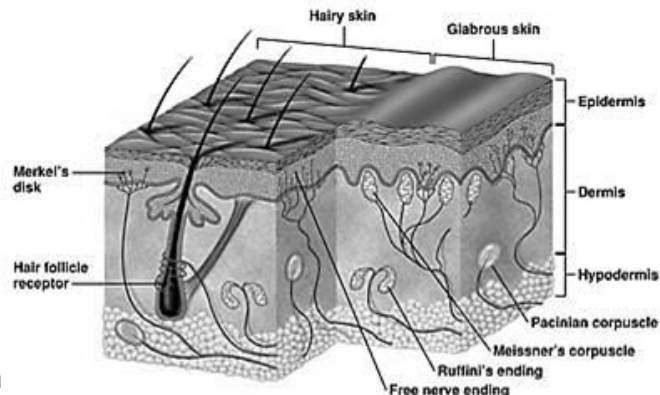
**Explanation:** Type of sensation is determined by the sensory cells or organs receiving it and the part of CNS involved in its response.

**Q.15 Answer is “Five”**

**Explanation:** These are touch, pressure, heat, cold and pain.

**Q.16 Answer is “Touch, pressure, heat, cold and pain”**

**Explanation:** These are touch, pressure, heat, cold and pain stimuli which are received by skin.



**Q.17 Answer is “Joints”**

**Explanation:** The mechanoreceptors associated with receipt of stimulus of vibration are located in joints.

**Q.18 Answer is “Differs greatly”**

**Explanation:** The relative abundance of receptors depends upon significance of sensation to which that particular type of receptor is associated.

**Q.19 Answer is “27 times”**

**Explanation:** The relative abundance of receptors depends upon significance of sensation to which that particular type of receptor is associated. Pain receptors are 27 times more than cold receptors

**Q.20 Answer is “Pain”**

**Explanation:** The relative abundance of receptors depends upon significance of sensation to which that particular type of receptor is associated. Pain receptors are 27 times more than cold receptors.

**Q.21 Answer is “Cold”**

**Explanation:** The relative abundance of receptors depends upon significance of sensation to which that particular type of

receptor is associated. Pain receptors are 27 times more abundant than cold receptors.

**Q.22 Answer is “Not distributed evenly”**

**Explanation:** The distribution of receptors is uneven and it depends upon the role of an organ with respect to that sensation e.g. fingers are usually used for touch so they have more abundant touch receptors.

**Q.23 Answer is “Touch”**

**Explanation:** The distribution of receptors is uneven and it depends upon the role of an organ with respect to that sensation.

**Q.24 Answer is “Normal functions of those two parts of the body”**

**Explanation:** Touch is mainly associated with finger tips, thus finger tips have maximum sensation for touch. Similarly being bilaterally symmetrical animals we always move in forward direction so our front body surface is more sensitive to touch as compared to backside of the body.

**Q.25 Answer is “Motor neurons”**

**Explanation:** Associative neurons prepare a direction and send it via motor neurons to effectors.

**Q.26 Answer is “Stretch receptors”**

**Explanation:** Stretch stimulus is a mechanical stimulus, so its receptors are mechanoreceptors.

**Q.27 Answer is “Brain”**

**Explanation:** CNS including brain is made up of associative neurons which interpret the stimulus and prepare direction to be sent to the effectors via motor neurons. Control centre for touch is located in cerebrum of brain.

**Q.28 Answer is “Effectors”**

**Explanation:** Effectors respond to the stimuli received by receptors.

**Q.29 Answer is “Touch and pain”**

**Explanation:** These are mechanoreceptors of skin which consist of modified sensory neurons having naked nerve endings.

Sensory receptors of the skin	
Modified sensory neurons having naked ends	Specialized cellular corpuscles
	Pressure
Touch	Hot
Pain	Cold

**Q.30 Answer is “Touch, pressure, heat, cold and pain”**

**Explanation:** The sensations of touch, pressure, heat, cold and pain are detected by modified sensory neurons having naked nerve endings (Touch and pain receptors or specialized cellular corpuscles, pressure, hot and cold receptors).

**Q.31 Answer is “Pressure, heat and cold”**

**Explanation:** Specialized cellular corpuscles detect the sensation of pressure, hot and cold.

**Q.32 Answer is “Neurons”**

**Explanation:** Though nervous tissue consists of neurons and neurological tissue. However, the neurons act as chief structural and functional units of nervous system.

**Q.33 Answer is “Neuroglia”**

**Explanation:** Neuroglia or glial cells e.g. Schwann cells are associated with protection and nourishment of neurons or nerve cells.

**Q.34** Answer is “Three”

*Explanation:* Sensory, associative and motor neurons.

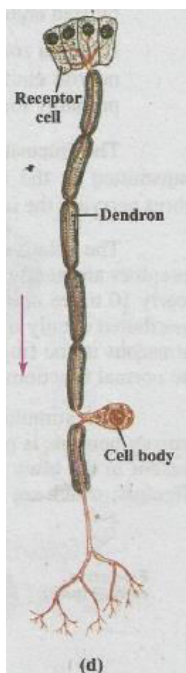
**Q.35** Answer is “Dendrites”

*Explanation:* Dendrites are such cytoplasmic processes which bring nerve impulse towards the cell body.

**Q.36** Answer is “Cell bodies or soma”

*Explanation:* Nissl’s granules which are groups of ribosomes associated with rough E.R and Golgi apparatus are present in cell bodies.

**Q.37** Answer is “A short distance from the cell body”



*Explanation:* Usually the axon is considered the longest part of neurons or nerve cells, however in certain sensory neurons it is very short and their dendron is very long.

**Q.38** Answer is “Protoplasmic processes”

*Explanation:* These are also called cytoplasmic processes and they consist of dendrites (dendron) and axons.

**Q.39** Answer is “Two”

*Explanation:* Axons and dendrites or Dendron are two types of cytoplasmic processes of fibers.

**Q.40** Answer is “Axon”

*Explanation:* These are axons of sciatic nerves which run from the base of the spinal cord to the big toe of each foot.

**Q.41** Answer is “Cell body”

*Explanation:* Nissl’s granules are found in cell body or soma of neuron or nerve cell.

**Q.42** Answer is “Cytoplasm of the axon”

*Explanation:* It is also called axoplasm.

**Q.43** Answer is “The cell body or soma”

*Explanation:* Volumetrically dendrites and axons have very minute volume of cytoplasm as compared to cell body. It is the cell body which have a room to store some food and have a complete cellular machinery to synthesize something.

**Q.44** Answer is “Cell body”

*Explanation:* Axons and dendrites can regenerate by the guidance and resource of nucleus containing cell body, however of cell body is removed there will be neither genetic material nor stored food to regenerate it.

**Q.45** Answer is “Effectors”

*Explanation:* Effectors as muscles or glands respond to the directions which come through motor neurons to them.



**Q.46 Answer is “Reflex arc”**

**Explanation:** Reflex arc is a complete model unit to represent an action controlled by nervous system. It consists of receptor, three types of neurons and effectors. It is used to carry out reflex action.

**Q.47 Answer is “Receptors, neurons and effectors”**

**Explanation:** These are the components of a reflex arc.

**Q.48 Answer is “Reflex action”**

**Explanation:** An immediate and involuntary action of our body.

**Q.49 Answer is “Sensory neuron, associative neuron, motor neuron and muscles”**

**Explanation:** These are components of a reflex circuit in their functional sequence.

**Q.50 Answer is “Skin”**

**Explanation:** Pain sensitive nerve endings are located in the skin.

**Q.51 Answer is “Long fiber”**

**Explanation:** Pain sensitive sensory neurons have long fibers.

**Q.52 Answer is “Informing it of the danger”**

**Explanation:** These prepare the body for some dangerous situation.

**Q.53 Answer is “Chemical reactions and movement of ions”**

**Explanation:** Movement of ions is involved in the movement of nerve impulse.

**Q.54 Answer is “Centralized nervous system”**

**Explanation:** Having brain and spinal cord as central control centres of all human activities.

**Q.55 Answer is “Spinal cord”**

**Explanation:** Because all peripheral nerves pass through the spinal cord.

**Q.56 Answer is “Motor neurons”**

**Explanation:** Motor neurons receive the signals (directions) from CNS and deliver them to effectors.

**Q.57 Answer is “Autonomic nervous system”**

**Explanation:** It is involuntary control centre.

**Q.58 Answer is “Three ways”**

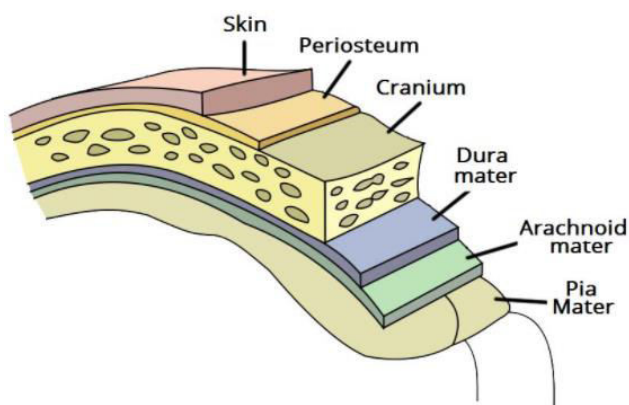
**Explanation:** Bony protection by cranium and vertebral column, membranous protection by triple layers of meninges and fluid protection by CSF.

**Q.59 Answer is “Cranium”**

**Explanation:** It is bony protection of brain i.e., brain case.

**Q.60 Answer is “Triple”**

**Explanation:** Meninges are three membranes that envelope the brain and spinal cord. In mammals the meninges are the dura mater, the arachnoid mater and the pia mater. Cerebrospinal fluid is located in the subarachnoid space between the arachnoid mater and pia mater.



**Q.61** Answer is “Cerebrospinal fluid”

**Explanation:** The cerebrospinal fluid (CSF), similar in composition to blood plasma bathes the neurons of brain and spinal cord and cushions against bumps and jolts.

**Q.62** Answer is “Central canal”

**Explanation:** That is why it is called dorsal hollow nervous system.

**Q.63** Answer is “Forebrain”

**Explanation:** Forebrain consists of Thalamus, limbic system and cerebrum. The limbic system is further sub-divided into hypothalamus, amygdala and hippocampus.

**Q.64** Answer is “Thalamus”

**Explanation:** Thalamus acts as relay centre between cerebrum and limbic system.

**Q.65** Answer is “Limbic system”

**Explanation:** Limbic system works together to produce our most basic and primitive emotions, drives and behavior, including fear, rage, tranquility, hunger, thirst, pleasure and sexual arousal.

**Q.66** Answer is “Basic and primitive”

**Explanation:** Because such emotions and behaviors are also found in primitive animals. Fear, rage, tranquility, hunger, thirst, pleasure and sexual arousal are considered most basic and primitive emotions and drives because these are held by primitive animals as well.

**Q.67** Answer is “Hypothalamus, amygdala and hippocampus”

**Explanation:**

Parts	Functions
Hypothalamus	Through its hormone production and neural connection acts as a major coordinating centre controlling body temperature, hunger the menstrual cycle, water balance, the sleep wake cycle etc.
Amygdala	Produces sensation of pleasure punishment and sexual arousal when stimulated. It is also involved in feeling of fear and rage
Hippocampus	Plays an important role in the formation of long term memory and thus is required for learning.

**Q.68** Answer is “Hypothalamus”

**Explanation:** Hypothalamus is considered major coordinating centre of our body as through its tropic hormones it regulates the activities of other endocrine glands and controls body temperature by acting as thermostat. It also controls water cycle and sleep cycle.

**Q.69** Answer is “Hippocampus”

**Explanation:** Hippocampus plays an important role in the formation of long term memory and thus is required for learning.

**Q.70** Answer is “Cerebrum”

**Explanation:** In humans cerebrum is the largest part of brain which consists of two

hemispheres and rest of the brain is located underneath it. With more recent estimates there are 21-26 billion neuron in the cerebral cortex alone.

**Q.71 Answer is “Tens of billions”**

**Explanation:** In humans cerebrum is the largest part of brain which consists of two hemispheres and rest of the brain is located underneath it. It consists of multiple of ten billion neurons.

**Q.72 Answer is “Cerebral cortex”**

**Explanation:** All voluntary control centers are located in cerebral cortex.

**Q.73 Answer is “Cerebral cortex”**

**Explanation:** Cerebral cortex contains sensory centres. Such as hearing centre, vision centre, taste centre, touch centre, smell centre etc.

**Q.74 Answer is “Cerebral cortex”**

**Explanation:** Sensory centres such as hearing centre, vision centre, taste centre, touch centre, smell centre etc are located in cerebral cortex.

**Q.75 Answer is “Right side of the body”**

**Explanation:** It is criss cross control i.e right hemisphere controls left half of the body whereas left hemisphere controls right half of the body.

**Q.76 Answer is “Reticular formation”**

**Explanation:** Midbrain contains reticular formation, which is a relay centre connecting hindbrain with the forebrain. Reticular formation is very important in screening the input information before they reach higher brain centres.

**Q.77 Answer is “Pons”**

**Explanation:** Certain neurons in pons located above the medulla, appear to influence transitions between sleeps and

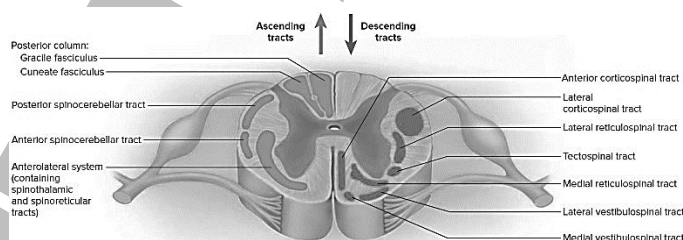
wakefulness and the rate and pattern of breathing.

**Q.78 Answer is “Cerebellum”**

**Explanation:** Like hippocampus it is also involved in memory storage.

**Q.79 Answer is “Spinal cord”**

**Explanation:** On lower side medulla is attached to spinal cord which is an oval and hollow structure.



**Q.80 Answer is “Spinal cord”**

**Explanation:** Spinal cord runs inside the vertebral column as vertebral column provides bony protection to spinal cord.

**Q.81 Answer is “Spinal cord”**

**Explanation:** Inner grey matter of spinal cord is butterfly shaped or H shaped and it consists of cell bodies.

**Q.82 Answer is “Myelinated nerve fibres and tracts”**

**Explanation:** White color is due to myelin which is made up of fats.

**Q.83 Answer is “Spinal cord”**

**Explanation:** All reflex activities are controlled by spinal cord.

**Q.84 Answer is “Thalamus and midbrain”**

**Explanation:** Thalamus acts as a cerebrum between cerebrum and limbic system whereas midbrain acts as a relay centre between forebrain and hindbrain.

**Q.85** Answer is “Sensory neurons, motor neurons”

**Explanation:** PNS consists of sensory and motor neurons only as associative neurons are part of CNS.

**Q.86** Answer is “The nerves”

**Explanation:** Nerves are bundles of axons or dendrites.

**Q.87** Answer is “Nerve”

**Explanation:** Nerves are categorized into three categories on the basis of their composition i.e. motor sensory and mixed.

**Q.88** Answer is “Inter or associative neuron”

**Explanation:** Inter neurons, intermediate neurons associative neurons or relay neurons are part of CNS.

**Q.89** Answer is “Hormone”

**Explanation:** As enzymes speed up the already proceeding chemical reactions, hormones regulate them i.e. speed up or slow down according to the need of the body.

**Q.90** Answer is “Hormones”

**Explanation:** Hormones regulate long term changes like development as well.

**Q.91** Answer is “Chemical coordination”

**Explanation:** Coordination through hormones is called chemical coordination. Endocrine glands secrete hormones.

**Q.92** Answer is “Different parts of the body”

**Explanation:** See location of various endocrine glands in human body.

**Q.93** Answer is “Poured directly into blood which carry them to respective target tissues”

**Explanation:** Hormones use blood stream as a source of transport.

**Q.94** Answer is “Rate of growth and metabolic activities and sexual maturity”

**Explanation:** These are developmental changes which take long time to be accomplished.

**Q.95** Answer is “Distal parts of nephron”

**Explanation:** Vasopressin (ADH) acts upon urine collecting duct to get water actively reabsorbed from filtrate.

**Q.96** Answer is “ADH”

**Explanation:** Deficiency of ADH also called vasopressin will let the water go in urine and volume and frequency of urine will be increased. Thus diabetes insipidus occurs.

**Q.97** Answer is “A large number of  $\beta$ -cells associated with insulin production”

**Explanation:** Because  $\beta$  cells occupy the periphery of islets whereas the remaining central area is occupied by  $\alpha$  - cells .

**Q.98** Answer is “Absciscic acid”

**Explanation:**

Growth promoting hormones	Growth inhibiting hormones
Auxins	Abciscic acid
Gibberellins	Ethane (Ethylene)
Cytokinins (kinetin)	

**Q.99** Answer is “Root elongation”

**Explanation:** Auxins promote cell enlargement in regions behind apex. Promote cell division in cambium. In root, auxins promote growth at very low concentration, but inhibits growth at higher concentration.

**Q.100** Answer is “Promote bud dormancy”

**Explanation:** Auxins promotes bud initiation in shoots but sometimes, antagonistic to cytokinins and is inhibitory.

**Q.101** Answer is “Leaf senescence”

**Explanation:** Auxins and Gibberellins being growth promoting plant hormones cause delay in leaf senescence and inhibit leaf abscission.



**Worksheet-4**

**(Reproduction)**

- Q.1** Repeated division by the cells of the germinal epithelium produce spermatogonia in:  
A) Sperm duct  
B) Seminiferous tubules  
C) Ejaculatory duct  
D) Epididymis
- Q.2** Primary spermatocytes undergo meiotic division to form:  
A) Spermatids  
B) Secondary spermatocytes  
C) Sperms  
D) Spermatogonia
- Q.3** Secondary spermatocytes give rise to spermatids through:  
A) Meiosis-I  
B) Meiosis-II  
C) Mitosis  
D) Repeated division
- Q.4** Secondary spermatocytes originate from:  
A) Primary spermatocytes  
B) Sperms  
C) Spermatogonia  
D) Spermatids
- Q.5** During spermatogenesis each spermatocyte ultimately gives rise to:  
A) Four viable sperms  
B) Two viable sperms  
C) One viable sperm  
D) Three viable sperms
- Q.6** Germ cells in the ovary produce many oogonia which divide to give rise to primary oocytes by:  
A) Meiosis-I  
B) Meiosis-II  
C) Mitosis  
D) Differentiation
- Q.7** Primary oocytes originate mitotically from:  
A) Oogonia  
B) Primary oocytes  
C) Secondary oocytes  
D) Ova

- Q.8** Primary oocytes divide by \_\_\_\_\_ into haploid secondary oocytes and first polar body:  
A) Meiosis-I  
B) Meiosis-II  
C) Mitosis  
D) Differentiation
- Q.9** Haploid secondary oocytes and first polar body are formed meiotically from:  
A) Ova  
B) Oogonia  
C) Primary oocytes  
D) Follicle cells
- Q.10** The primary oocytes divide meiotically into the haploid:  
A) Secondary oocyte  
B) First polar body  
C) Second polar body  
D) Secondary oocyte and first polar body
- Q.11** The secondary oocyte divides meiotically into the haploid:  
A) Secondary oocyte and second polar body  
B) Ovum and secondary polar body  
C) Secondary oocytes and first polar body  
D) Germ cell and first polar body
- Q.12** A \_\_\_\_\_ is established between uterine and foetal tissue for the exchange of oxygen, carbon dioxide, wastes, nutrients and other material.  
A) Umbilical cord  
B) Placenta  
C) Conception  
D) Pregnancy
- Q.13** Gametes production is continuous in:  
A) Human male  
B) Human female  
C) Ovaries of females  
D) Uterus of females
- Q.14** It involves changes in the structure and function of the whole reproductive system:  
A) Menstrual cycle  
B) Menstruation  
C) Oogenesis  
D) Gametogenesis
- Q.15** Only one follicle continues to grow with its primary oocytes while the rest breakdown by:  
A) Ovulation  
B) Menstruation  
C) Follicle degeneration  
D) Follicle atresia



- Q.16 Estrogen stimulates:**  
A) Secretion of FSH  
B) Laying down of endometrium  
C) Secretion of LH  
D) Laying down of endometrium and secretion of LH
- Q.17 Decrease of FSH and increase of estrogen, causes the pituitary gland to secrete:**  
A) Progesterone      C) LTH  
B) LH      D) Prolactin
- Q.18 Follicle cells, after release of the egg, are modified to form a special structure called:**  
A) Placenta      C) Follicle  
B) Corpus luteum      D) Endometrium
- Q.19 This hormone develops the endometrium and makes it receptive for the implantation of zygote:**  
A) Estrogen      C) FSH  
B) Progesterone      D) ICSH
- Q.20 Menstruation usually lasts for:**  
A) 4-8 days      C) 2-5 days  
B) 3-7 days      D) 5-9 days
- Q.21 The discharge of blood and cell debris from vagina at the end of reproductive cycle is called:**  
A) Gestation      C) Menstruation  
B) After birth      D) Implantation
- Q.22 The human menstrual cycle generally repeats every \_\_\_\_\_ days.**  
A) 26      C) 28  
B) 27      D) 29
- Q.23 The uterine cycle in humans involves the preparation of the uterine wall to receive the \_\_\_\_\_ if fertilization occurs.**  
A) Ovum      C) Embryo  
B) Egg      D) Zygote
- Q.24 The ovary under the stimulus of \_\_\_\_\_, also produce \_\_\_\_\_.**  
A) FSH, LH  
B) FSH, Estrogen  
C) LH, FSH  
D) Estrogen, Progesterone

- Q.25 During luteal phase of menstrual cycle, the hormone at its peak:**  
A) Progesterone  
B) Estrogen  
C) LH  
D) GnRH
- Q.26 On which date is a woman most likely to ovulate if the first day of menstrual cycle was first april?**  
A) 5 april      C) 20 april  
B) 14 april      D) 28 april
- Q.27 The shedding of portions of the endometrium during a uterine (menstrual) cycle is called:**  
A) Menstruation      C) Post ovulation  
B) Proliferation      D) Ovulation
- Q.28 Corpus luteum starts secreting a hormone called:**  
A) Oestrogen      C) Oxytocin  
B) Progesterone      D) Testosterone
- Q.29 In human female, the discharge of blood and cell debris is called:**  
A) Ovulation      C) Menstruation  
B) Abortion      D) Secretion
- Q.30 The duration of gestation period in human female is usually:**  
A) 250 days      C) 270 days  
B) 260 days      D) 280 days
- Q.31 In humans, \_\_\_\_\_ takes place in the seminiferous tubules:**  
A) Oogenesis  
B) Spermatogenesis  
C) Fertilization  
D) Development of embryo
- Q.32 Two primary spermatocytes, in the end gives rise to \_\_\_\_\_ sperms:**  
A) Two      B) Four  
C) Six      D) Eight
- Q.33 Each primary oocyte, in the end gives rise to \_\_\_\_\_ ovum/ ova:**  
A) One      C) Three  
B) Two      D) Four

- Q.34 Pick up haploid cell:**  
A) Spermatogonium  
B) Primary spermatocyte  
C) Primary oocyte  
D) Spermatid
- Q.35 Its starts before birth in human females:**  
A) Spermatogenesis C) Menstruation  
B) Fertilization D) Oogenesis
- Q.36 How many sperms are formed from two secondary spermatocyte?**  
A) 1 C) 3  
B) 2 D) 4
- Q.37 They give rise to the primary spermatocytes by direct differentiation:**  
A) Secondary spermatocytes  
B) Spermatogonia  
C) Spermatids  
D) Spermatozoa
- Q.38 Primary oocyte divides meiotically to form:**  
A) Secondary oocytes C) Ovum  
B) Primary oocytes D) Egg
- Q.39 Which one of the following phase does not occur between 14 - 27 days of menstrual cycle?**  
A) Luteal C) Proliferative  
B) Secretory D) Ovulation
- Q.40 The follicle cells, after release of the egg, are modified to form a special structure called:**  
A) Follicles  
B) Corona radiata  
C) corpus luteum  
D) Zona pellucid
- Q.41 In human females, the periodic reproductive cycle is completed in approximately \_\_\_\_\_ days:**  
A) 20 C) 30  
B) 28 D) 40
- Q.42 This hormone develops the endometrium and make it receptive for the implantation of the zygote (placenta formation):**  
A) Androgen C) LH  
B) FSH D) Progesterone

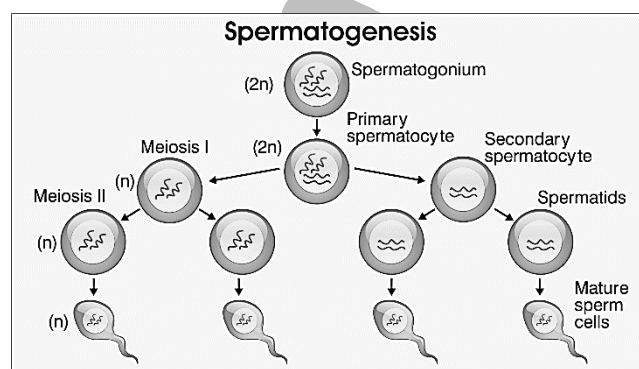
- Q.43 Vascularization of endometrium is induced by:**  
A) LH C) Estrogen  
B) Progesterone D) Testosterone
- Q.44 Pick up the shortest phase of uterine cycle:**  
A) Menstruation phase  
C) Secretory phase  
B) Proliferative phase  
D) Ovulatory phase
- Q.45 The hormone which stimulates and vascularizes the endometrium:**  
A) LH C) Progesterone  
B) FSH D) Estrogen
- Q.46 The hormone, produced by the corpus luteum, that promotes the development of the uterine lining in females is called:**  
A) LH C) Progesterone  
B) FSH D) Estrogen
- Q.47 Pick up the inner lining of uterus:**  
A) Ectometrium C) Endometrium  
B) Myometrium D) Perimetrium
- Q.48 \_\_\_\_\_ cycle is a reproductive cycle found in all female mammals, EXCEPT human being:**  
A) Menstrual C) Oestrous  
B) Ovarian D) Uterine
- Q.49 The release of a \_\_\_\_\_ is timed to coincide with the thickening of the lining of the uterus:**  
A) Polar body  
C) Primary oocyte  
B) Ovum  
D) Secondary oocyte
- Q.50 The \_\_\_\_\_ cycle in humans involves the preparation of the uterine wall to receive the embryo if fertilization occurs:**  
A) Menstrual C) Uterine  
B) Ovarian D) Oestrous

**ANSWER KEY (Worksheet-4)**

1	B	19	B	37	B
2	B	20	B	38	A
3	B	21	C	39	C
4	A	22	C	40	C
5	A	23	C	41	B
6	C	24	B	42	D
7	A	25	A	43	C
8	A	26	B	44	A
9	C	27	A	45	D
10	D	28	B	46	C
11	B	29	C	47	C
12	B	30	D	48	C
13	A	31	B	49	D
14	A	32	D	50	C
15	D	33	A		
16	D	34	D		
17	B	35	D		
18	B	36	D		

**EXPLANATION**

- Q.1** Answer is "Seminiferous tubules"  
*Explanation:* Spermatogenesis occurs in seminiferous tubules.
- Q.2** Answer is "Secondary spermatocytes"  
*Explanation:* Primary spermatocyte undergoes first meiotic division to give rise to two secondary spermatocytes which undergo second meiotic division to give rise to four spermatids which differentiate into four sperms.
- Q.3** Answer is "Meiosis-II"  
*Explanation:* Spermatogonia differentiate into primary spermatocytes which undergo meiotic division to form secondary spermatocytes and spermatids, respectively.
- Q.4** Answer is "Primary spermatocytes"  
*Explanation:* Spermatogonia differentiate into primary spermatocytes which undergo meiotic division to form secondary spermatocytes and spermatids, respectively.



- Q.5** Answer is "Four viable sperms"  
*Explanation:* As all four meiotic products of spermatogenesis survive.
- Q.6** Answer is "Mitosis"  
*Explanation:* Primary oocytes are formed from oogonia by mitosis.
- Q.7** Answer is "Oogonia"  
*Explanation:* Germ cells in the ovary produce many oogonia which divide mitotically to form primary oocytes. These are enclosed in groups of follicle cells. The primary oocyte divides meiotically into haploid secondary and first polar body. Second meiotic division in the oocyte proceeds as far as metaphase but is not completed until the oocyte is fertilized with sperm.
- Q.8** Answer is "Meiosis-I"  
*Explanation:* Primary oocyte undergoes meiosis-I to give rise to a secondary oocyte and a polar body. Which undergo meiosis-II to produce an ovum and three polar bodies.
- Q.9** Answer is "Primary oocytes"  
*Explanation:* Primary oocyte undergoes meiosis-I to give rise to secondary oocyte and first polar body.
- Q.10** Answer is "Secondary oocyte and first polar body"  
*Explanation:* Secondary oocyte and first polar body are formed by Meiosis-I from primary oocyte.

**Q.11** Answer is “Ovum and secondary polar body”

**Explanation:** Secondary oocyte and first polar body divide by meiosis-II to give rise to an ovum and three polar bodies in the end.

**Q.12** Answer is “Placenta”

**Explanation:** Placenta is a physical connection between maternal uterine wall and foetal tissue. It is source of exchange of material between mother and foetus as well as endocrine role is also performed by it to maintain pregnancy.

**Q.13** Answer is “Human male”

**Explanation:** That is why reproductive life of human male is unlimited.

**Q.14** Answer is “Menstrual cycle”

**Explanation:** Changes in whole reproductive system indicate menstrual cycle i.e. changes in uterus as well as in ovary.

**Q.15** Answer is “Follicle atresia”

**Explanation:** When one follicle starts development rest of the follicles degenerate this is called follicle atresia.

**Q.16** Answer is “Laying down of endometrium and secretion of LH”

**Explanation:** Estrogen hormone initiate thickening of uterine wall and stimulates laying down of endometrium. Moreover it inhibits the secretion of FSH and stimulates the secretion of LH.

**Q.17** Answer is “LH”

**Explanation:** It is luteinizing hormone which induces rupturing of mature follicle and formation of corpus luteum.

**Q.18** Answer is “Corpus luteum”

**Explanation:** Corpus luteum is a yellow colored structure formed by the rupturing of follicle during ovulation. It secretes progesterone.

**Q.19** Answer is “Progesterone”

**Explanation:** Progesterone induces conception and maintains pregnancy.

**Q.20** Answer is “3 – 7 days”

**Explanation:** It is 3-7 day on average.

**Q.21** Answer is “Menstruation”

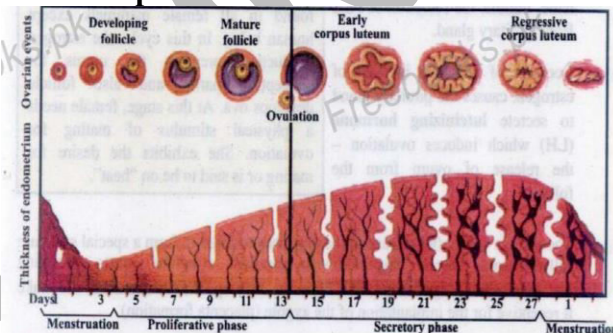
**Explanation:** However discharge of debris from vagina after parturition is called “after birth”.

**Q.22** Answer is “28 days”

**Explanation:** It is a biorhythm of 28 days.

**Q.23** Answer is “Embryo”

**Explanation:**



**Fig. 18.5 The ovarian and uterine cycles in human female**  
The release of a secondary oocyte (ovulation) is timed to coincide with the thickening of the lining of the uterus. The uterine cycle in humans involves the preparation of the uterine wall to receive the embryo if fertilization occurs. Knowing how these two cycles compare, it is possible to determine when pregnancy is most likely to occur.

**Q.24** Answer is “FSH, Estrogen”

**Explanation:** Production of estrogen is induced by FSH.

**Q.25** Answer is “Progesterone”

**Explanation:** Rising levels of progesterone from the corpus luteum act on endometrium, causing the arteries to elaborate and converting the functional layer to a glandular secretory layer.

**Q.26** Answer is “14<sup>th</sup> April”

**Explanation:** Because secretory (Luteal/postovulatory) phase has fixed number of days (15-28). 14<sup>th</sup> day in a normal menstrual cycle of 28 days.

**Q.27** Answer is “Menstruation”

**Explanation:** The shedding of portions of the endometrium during a uterine (menstrual) cycle is called menstruation.

**Q.28** Answer is “Progesterone”

**Explanation:** Corpus luteum starts secreting a hormone called progesterone.

**Q.29** Answer is “Menstruation”

**Explanation:** In human female, the discharge of blood and cell debris is called Menstruation.



**Q.30** Answer is “280 days”

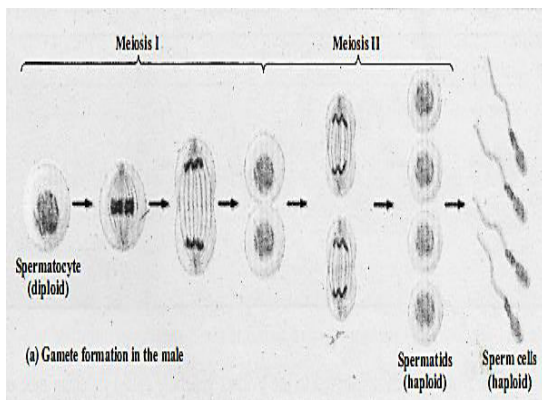
**Explanation:** The duration of gestation period in human female is usually 280 days (Nine months).

**Q.31** Answer is “Spermatogenesis”

**Explanation:** In humans, spermatogenesis takes place in the seminiferous tubules, which are an intricate system of tubules in the testes where spermatogenesis takes place. The seminiferous tubules of an adult human male can sometimes produce over 100 million sperm per day.

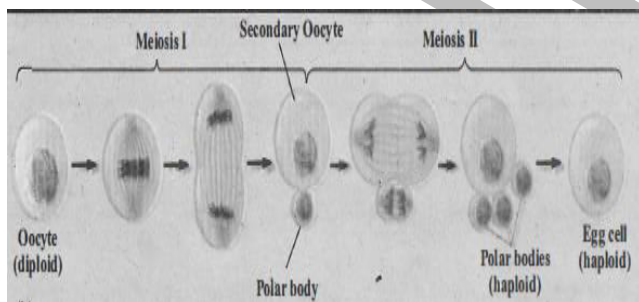
**Q.32** Answer is “Eight”

**Explanation:**



**Q.33** Answer is “One”

**Explanation:**



**Q.34** Answer is “Spermatid”

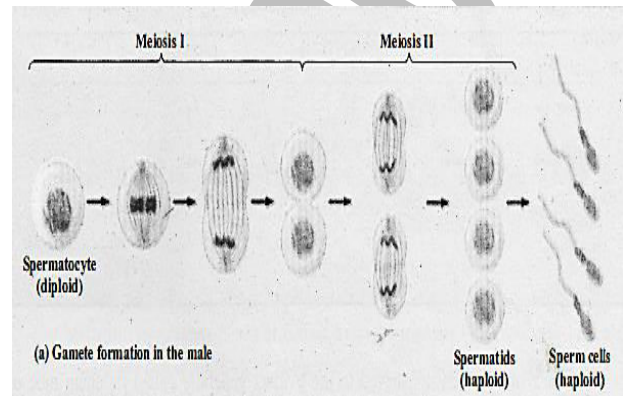
**Explanation:** Spermatid haploid cell.

**Q.35** Answer is “Oogenesis”

**Explanation:** Oogenesis in human females start before birth.

**Q.36** Answer is “4”

**Explanation:**

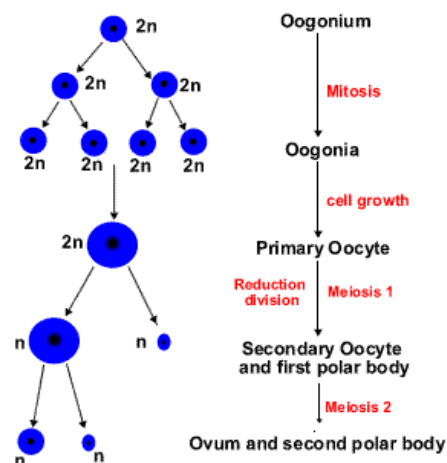


**Q.37** Answer is “Spermatogonia”

**Explanation:** Each testis consists of a highly complex duct system called seminiferous tubules, in which repeated divisions by the cells of the germinal epithelium produce spermatogonia. These increase in size and differentiate into primary spermatocytes.

**Q.38** Answer is “Secondary oocytes”

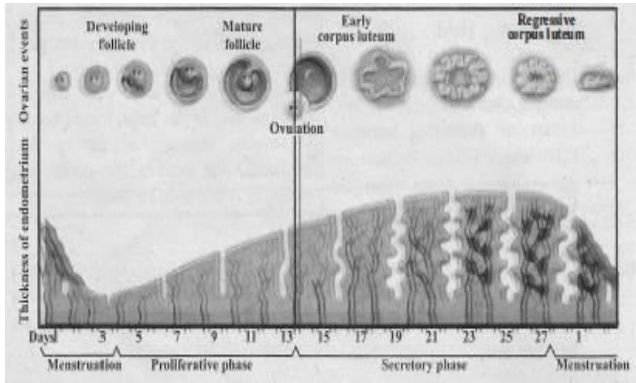
**Explanation:**





**Q.39 Answer is “Proliferative”**

**Explanation:**



**Q.40 Answer is “Corpus luteum”**

**Explanation:** The follicle cells, after release of the egg, are modified to form a special structure called corpus luteum. This yellowish glandular structure starts secreting hormone called progesterone. This hormone develops the endometrium and make it receptive for the implantation of the zygote (placenta formation).

**Q.41 Answer is “28”**

**Explanation:** In human females, the periodic reproductive cycle is completed in approximately 28 days and involves changes in the structure and function of the whole reproductive system.

**Q.42 Answer is “Progesterone”**

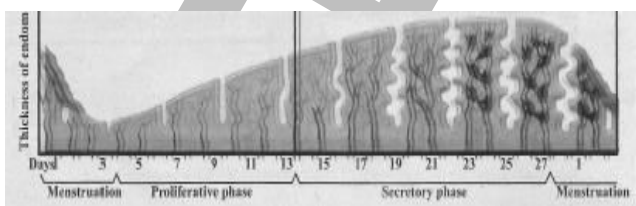
**Explanation:** Progesterone develops the endometrium and make it receptive for the implantation of the zygote (placenta formation).

**Q.43 Answer is “Estrogen”**

**Explanation:** Vascularization of endometrium is induced by estrogen hormone.

**Q.44 Answer is “Menstruation phase”**

**Explanation:** Menstruation phase is the shortest phase of uterine cycle.



**Q.45 Answer is “Estrogen”**

**Explanation:** Estrogen stimulates the endometrium and vascularizes.

**Q.46 Answer is “Progesterone”**

**Explanation:** Glossary page VIII book II.

**Q.47 Answer is “Endometrium”**

**Explanation:** Glossary page IV book II.

**Q.48 Answer is “Oestrous”**

**Explanation:** Oestrous cycle is a reproductive cycle found in all female mammals except human being.

**Q.49 Answer is “Secondary oocyte”**

**Explanation:** The release of a secondary oocyte (ovulation) is timed to coincide with the thickening of the lining of the uterus.

**Q.50 Answer is “Uterine”**

**Explanation:** The uterine cycle in humans involves the preparation of the uterine wall to receive the embryo if fertilization occurs.

**Worksheet-5**  
**(The Cell)**

**Q.1** Contrary to the animal cell, in plant cell nucleus is located in periphery due to the large size of:

- A) Nucleus itself      C) Cell  
B) Vacuole              D) Plastids

**Q.2** The plant cells differ from animal cells in having:

- A) Chloroplast          C) Ribosome  
B) Mitochondria       D) Nucleus

**Q.3** Both animal and plant cells are included in:

- A) Prokaryotic category  
B) Unicellular category  
C) Eukaryotic category  
D) Coenocytic category

**Q.4** The biggest eukaryotic cell is:

- A) Ostrich's egg  
B) Tortoise's egg  
C) Human skin cell  
D) Turtle's egg

**Q.5** The differences between these two types of cells are mainly based upon the structure of their nuclei. The cells are:

- A) Animal and plant cells  
B) Bacterial and viral cells  
C) Prokaryotic and Eukaryotic cells  
D) Muscle and nerve cells

**Q.6** \_\_\_\_\_ cells generally lack many of the membrane bound structures found in \_\_\_\_\_ cells.

- A) Eukaryotic, Prokaryotic  
B) Prokaryotic, Algal  
C) Fungal, Algal  
D) Prokaryotic, Eukaryotic

**Q.7** \_\_\_\_\_ have small sized ribosomes 70S as, compared to \_\_\_\_\_ having 80S.

- A) Prokaryotes, eukaryotes  
B) Protists, eukaryotes  
C) Eukaryotes, prokaryotes  
D) Eukaryotes, protists

**Q.8** Pick up that feature of prokaryotic cells which is missing in eukaryotic cells:

- A) Presence of Extra chromosomal DNA  
B) Presence of cell wall  
C) Presence of ribosomes  
D) Chromosomes submerged in cytoplasm

**Q.9** Modern technology has revealed that lipid bilayer is:

- A) Sandwiched between two protein layers  
B) Embedded in two protein layers  
C) Not sandwiched between two protein layers  
D) Dispersed in two protein layers

**Q.10** As allowing only selective substances to pass through it, the plasma membrane is also called as:

- A) Cell membrane  
B) Differentially permeable membrane  
C) Cytoplasmic membrane  
D) Plasmalemma

**Q.11** The energy required for active transport of substances is provided by:

- A) Food                      C) Coenzymes  
B) Glucose                  D) ATP

**Q.12** In many animal cells, the cell membrane helps to take in material by infoldings in the form of vacuole. This type of intake is termed as:

- A) Pinocytosis              C) Exocytosis  
B) Phagocytosis          D) Endocytosis

**Q.13 Cell membrane transmits nerve impulse from one part of the body to the other in:**

- A) Muscle cells      C) Nerve cells  
B) Bone cells      D) Epithelial cells

**Q.14 The outer most boundary of a plant cell is:**

- A) Cell membrane      C) Pellicle  
B) Cell wall      D) Capsule

**Q.15 DNA content is comparatively low in:**

- A) Prokaryotic cell      C) Plant cell  
B) Eukaryotic cell      D) Animal cell

**Q.16 In which one of the following DNA content is not halved during cell division:**

- A) Eukaryotic cell      C) Animal cell  
B) Prokaryotic cell      D) Plant cell

**Q.17 In which one of the following cells, both transcription and translation occurs in cytoplasm:**

- A) Fungal cells      C) Moneran cells  
B) Protist cells      D) Animal cells

**Q.18 Thylakoids lie freely in cytoplasm in:**

- A) Animal cells      C) Plant cell  
B) Eukaryotic cells      D) Prokaryotic cells

**Q.19 Sap vacuoles are mostly absent in:**

- A) Eukaryotic cells      C) Fungal cells  
B) Prokaryotic cells      D) Plant cells

**Q.20 There is no gametogenesis in:**

- A) Protists      C) Prokaryotes  
B) Fungi      D) Eukaryotes

**Q.21 Microtubules and microfilaments are absent in:**

- A) Bacterial cells      C) Plant cells

- B) Fungal cells      D) Animals cells

**Q.22 Chlorophyll is absent in:**

- A) Animal cells      C) Protist cells  
B) Plant cells      D) Prokaryotic cells

**Q.23 Pick up the characteristic of a plant cell:**

- A) Nucleus lies at centre  
B) Possesses many small vacuoles  
C) Mitochondria are fewer  
D) Mitochondria are numerous

**Q.24 Pick up a characteristic of plant cells:**

- A) Anastral spindle  
B) Amphiasstral spindle  
C) Centrioles are present  
D) Plasmids are present

**Q.25 Cytokinesis occurs by cell plate method in:**

- A) Animal cells      C) Plant cells  
B) Bacterial cells      D) Protist cells

**Q.26 Pick up a characteristic of animal cell:**

- A) Tissue fluid bathes the cells  
B) Tissue fluid is absent  
C) Glyoxisomes are rarely present  
D) Lysosomes are rare

**Q.27 They do not burst when placed in hypotonic solution:**

- A) Animal cells      C) Red blood cells  
B) Plant cells      D) Plant protoplasts

**Q.28 Phospholipid molecules of plasma membrane are found in:**

- A) Parallel arrangement  
B) Alternate arrangement  
C) Scattered arrangement

- D) Zigzag arrangement
- Q.29 Following functions are performed by cell membrane, EXCEPT:**
- A) Cell drinking      C) Cell vomiting  
B) Cell eating      D) Autolysis
- Q.30 Infolds or invaginations in cell membrane are used for following functions, EXCEPT:**
- A) Endocytosis  
B) Phagocytosis  
C) Microvilli formation  
D) Pinocytosis
- Q.31 Diffusion and osmosis are two types of:**
- A) Active transport  
B) Passive transport  
C) Uphill movement  
D) Facilitated transport
- Q.32 Which of the following function is not performed by plasma membrane?**
- A) Ingestion  
B) Secretion  
C) Locomotion  
D) Osmotic resistance
- Q.33 Give an example of passive transport across plasma membrane:**
- A) Plasmolysis and deplasmolysis  
B) Endocytosis and exocytosis  
C) Reabsorption of  $\text{Na}^+$  from ascending limb of loop of Henle  
D) Reabsorption of water from urine collecting duct
- Q.34 A fluid droplet is ingested by plasma membrane through:**
- A) Phagocytosis      C) Endocytosis  
B) Pinocytosis      D) Exocytosis
- Q.35 Which one of the following surfaces of plasma membrane is hydrophilic?**
- A) Outer  
B) Inner  
C) Both outer and inner

- D) Neither outer nor inner
- Q.36 Human naked eye cannot differentiate the two points which have:**
- A) Distance of 1.0 mm between them  
B) Distance of 2.0 mm between them  
C) Distance of 3.0 mm between them  
D) Distance of 2.0  $\mu\text{m}$  between them
- Q.37 Two points located at 2.0  $\mu\text{m}$  distance from each other can be differentiated:**
- A) By means of naked eye  
B) By means of compound microscope  
C) By means of magnifying lens  
D) By means of dissecting microscope
- Q.38 Two points which are 2 – 4 Angstrom apart can be differentiated by:**
- A) Human naked eye  
B) Compound microscope  
C) Electron microscope  
D) Dissecting microscope
- Q.39 Two points which are 2 – 4 Angstrom apart are illuminated for differentiation by:**
- A) Torch light  
B) Beam of electrons  
C) Ordinary sunlight  
D) Red light
- Q.40 The object observed by electron microscope looks upto:**
- A) 250000x greater than actual size  
B) 25000x greater than actual size  
C) 100000x greater than actual size  
D) 10000x greater than actual size
- Q.41 Electron microscope magnifies the object \_\_\_\_\_ greater than that of compound microscope:**
- A) 500x      C) 125000x  
B) 2500x      D) 250000x

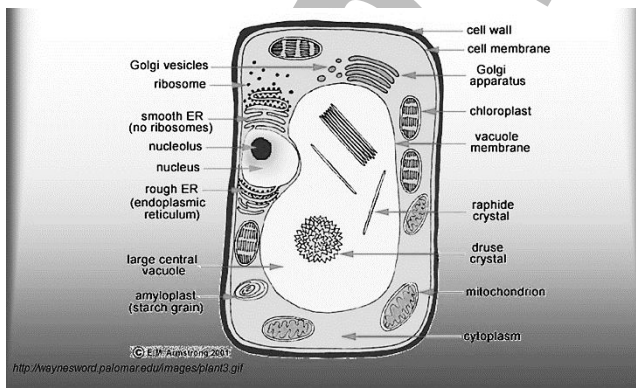


ANSWER KEY (Worksheet-5)			
1	B	21	A
2	A	22	A
3	C	23	C
4	A	24	A
5	C	25	C
6	D	26	A
7	A	27	B
8	D	28	A
9	C	29	D
10	B	30	C
11	D	31	B
12	D	32	D
13	C	33	A
14	B	34	B
15	A	35	C
16	B	36	D
17	C	37	B
18	D	38	C
19	B	39	B
20	C	40	A
		41	A

### EXPLANATION

#### Q.1 Answer is "Vacuole"

**Explanation:** Plant cell have a central, single, larger vacuole, which occupies almost 70% of the area of cell, pushing the nucleus, cytoplasm and cytoplasmic organelles towards periphery.



#### Q.2 Answer is "Chloroplast"

**Explanation:** Chloroplast is a green plastid. It is associated with photosynthesis. Animal cells, being heterotroph lack it. It occurs in plant cells and algal cells. See the figure given above for chloroplast.

#### Q.3 Answer is "Eukaryotic Category"

**Explanation:** Kingdom Animalia, plantae and Protista are included in eukaryotes. They have a definite membrane bound nucleus and membrane bound organelles in their cells. However, bacteria and cyanobacteria are prokaryotic groups. Both animal and plants are multicellular. Aseptate fungi is coenocytic.

#### Q.4 Answer is "Ostrich's egg"

**Explanation:** It is obvious from these figures related to Ostrich's egg:

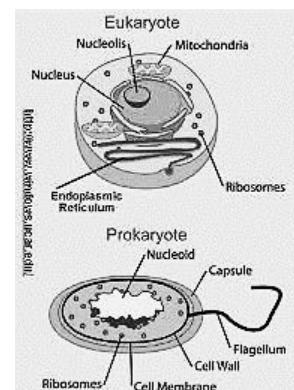
Length – 15 cm

Width – 13 cm

Weight – 1.4 kg

#### Q.5 Answer is "Prokaryotic and Eukaryotic cells"

**Explanation:** Prokaryotic cell lacks a definite membrane bound nucleus, their non-discrete chromosome (DNA) is directly suspended in the cytoplasm. However, the eukaryotic cell have a definite membrane bound nucleus consisting up of a double nuclear membrane which separates its nucleoplasm, discrete chromosomes and nucleoli from cytoplasm.



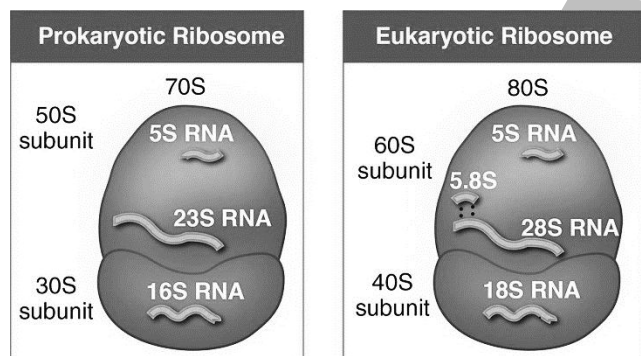
#### Q.6 Answer is "Prokaryotic, Eukaryotic"



**Explanation:** Prokaryotic cells (e.g. bacteria), lack membrane bound organelles, like mitochondria, chloroplast, Golgi apparatus, lysosomes, endoplasmic reticulum etc; however, they contain non-membranous organelles like ribosomes. On the other hand, eukaryotic cells contain all types of organelles i.e. membraneless, single membrane bound and double membrane bound.

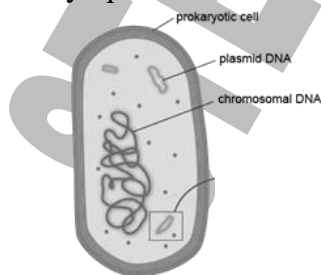
**Q.7 Answer is “Prokaryotic, Eukaryotic”**

**Explanation:** Prokaryotic ribosomes are smaller in size with 70s (rate of sedimentation). They come into being by fusion of two subunits i.e. a smaller subunit with 30s and a larger subunit with 50s. On the other hand eukaryotic ribosomes are larger in size with 80s, rate of sedimentation. They come into being by fusion of two subunits i.e. smaller subunit with 40s rate of sedimentation and larger subunit with 60s rate of sedimentation.



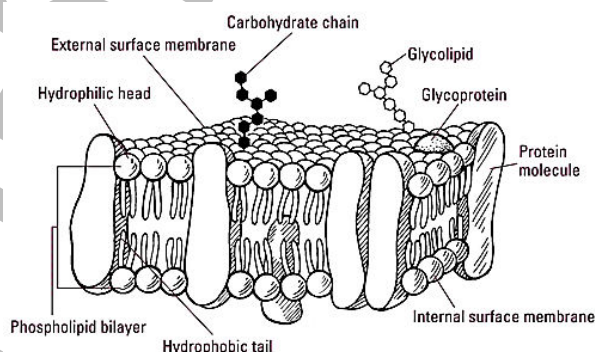
**Q.8 Answer is “Chromosomes submerged in cytoplasm”**

**Explanation:** As prokaryotic cell lacks nuclear membrane; thus, its chromosome/DNA is directly submerged into the cytoplasm.



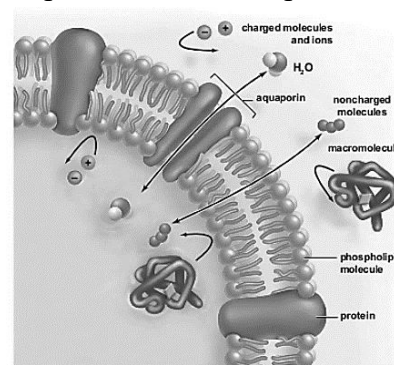
**Q.9 Answer is “Not sandwiched between two protein layers”**

**Explanation:** Modern technology, particularly electron microscope enabled us to improve our understanding about the ultrastructure of plasma membrane. It has led to the proposal of “Fluid Mosaic Model”. According to this model protein do not make any layer. There is a phospholipid bilayer in which protein molecules have been embedded in mosaic manner. So, protein molecules never form any layer to sandwich the phospholipid bilayer.



**Q.10 Answer is “Differentially permeable membrane”**

**Explanation:** As the plasma membrane behave differentially or selectively i.e. allowing the selective substance to cross it, it is called as selectively or differentially permeable membrane. In its selective or differential behavior, it allows the larger hydrocarbon molecules to pass through it but stops smaller ionic or polar substances.

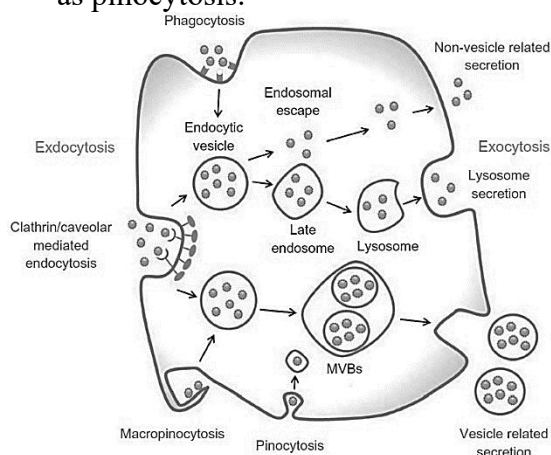


**Q.11 Answer is “ATP”**

**Explanation:** ATP (adenosine triphosphate) is an energy currency of the cell. Its second and third phosphate represents the so called “high energy bonds”.

**Q.12 Answer is “Endocytosis”**

**Explanation:** Endocytosis is a sort of active transport in which a cell transports molecules (food) into the cell by engulfing them. The food is wrapped into a part of cell membrane in the form of vacuole, then it is ingested. If food being ingested in this way is liquid the endocytosis will be called as pinocytosis.

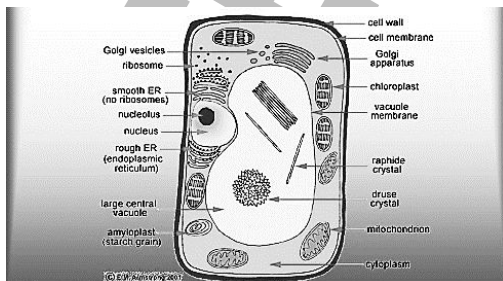


**Q.13 Answer is “Nerve cells”**

**Explanation:** Nerve impulse travels across the cell membrane of nerve cell as a wave of electrochemical change.

**Q.14 Answer is “Cell wall”**

**Explanation:** the outermost boundary of a plant cell is cell wall. Cell membrane comes next to the cell wall. However, in animal cells, cell membrane is the outermost boundary as there is no cell wall.



**Q.15 Answer is “Prokaryotic cell”**

**Explanation:** Prokaryotes typically have one chromosomes. These cells can also have smaller DNA structures called plasmids. The number of base pairs in prokaryotic chromosomes ranges from 160,000 to 12.2 million, depending upon the species. Eukaryotes frequently have multiple types of chromosomes with many more base pairs. For example humans have 23 pairs of chromosomes, containing about 2.9 billion base pairs in total.

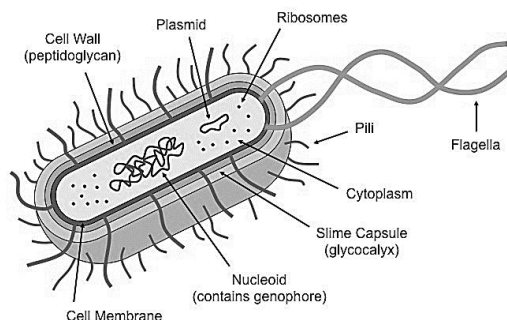
Chemical components		% total cell weight	
		Bacterial cell	Mammalian cell
1.	Water	70	70
2.	Proteins	15	18
3.	Carbohydrates	3	4
4.	Lipids	2	3
5.	DNA	1	0.25
6.	RNA	6	1.1
7.	Other organic molecules (Enzymes, hormones, metabolites)	2	2
8.	Inorganic ions (Na <sup>+</sup> , K <sup>+</sup> , Ca <sup>++</sup> , Mg <sup>++</sup> Cl <sup>-</sup> , SO <sub>4</sub> <sup>2-</sup> etc)	1	1

**Q.16 Answer is “Prokaryotic cell”**

**Explanation:** Prokaryotes are unicellular organisms and lack mitotic cycle. However, in eukaryotes in ‘M’ phase of cell cycle amount of DNA is halved which is doubled again in ‘S’ phase of cell cycle.

**Q.17 Answer is “Moneran cell”**

**Explanation:** Moneran cells being prokaryotic lack nuclear membrane and DNA is directly submerged in cytoplasm so transcription also occurs in cytoplasm.



**Q.18 Answer is “Prokaryotic cells”**

**Explanation:** As there are no plastids (e.g. chloroplasts) so thylakoids are freely scattered in cytoplasm of cyanobacterial prokaryotic cells.

**Q.19 Answer is “Prokaryotic cells”**

**Explanation:** Most of the bacteria lack sap vacuole (a membrane bound organelle), except three genera of filamentous sulphur bacteria, the *Thioploca*, *Beggiatoa* and *Thiomargarita*. Gas vacuoles are present in some species of cyanobacteria

**Q.20 Answer is "Prokaryotes"**

**Explanation:** As prokaryotes lack traditional sexual reproduction, so there is no gametogenesis. However, they get the benefit of sexual reproduction (recombination) through conjugation, transduction and transformation.

**Q.21 Answer is "Bacterial cell"**

**Explanation:** Bacterial cell being prokaryotic have their own cytoskeletal fabric such as FtsZ, MreB, CreS etc. However they lack microtubules and microfilaments of eukaryotes.

**Q.22 Answer is "Animal cells"**

**Explanation:** Kingdom "Animalia" and "Fungi" being exclusively heterotrophic lack chlorophyll. However, the rest of the three kingdoms are either partly (Protista and Monera) or completely (Plantae) autotrophic and have chlorophyll for photosynthesis.

**Q.23 Answer is "Mitochondria are fewer"**

**Explanation:** As plant cells are comparatively less active than animal cells, they need less energy and afford fewer mitochondria.

**Q.24 Answer is "Anastral spindle"**

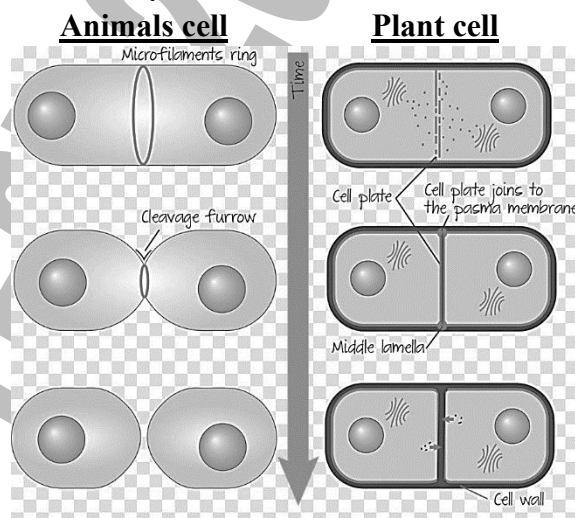
**Explanation:** Plant cells lack centrioles and make spindle without asters.



**Metaphase**

**Q.25 Answer is "Plant cell"**

**Explanation:** In plant cells, cytokinesis occurs in centrifugal way i.e. starts from the centre of the cell and is accomplished towards periphery. Microtubules of spindle are reorganized in the centre of the cell in the form of phragmoplast. In between phragmoplast cell plate formation starts by the fusion of golgi vesicles, which ultimately divides the cell into two halves.



**Q.26 Answer is "Tissue fluid bathes the cells"**

**Explanation:** Tissue fluid or lymph is a characteristic of animal cells. It is absent in plants. Rest of the three choices carry characteristics of animal cells.

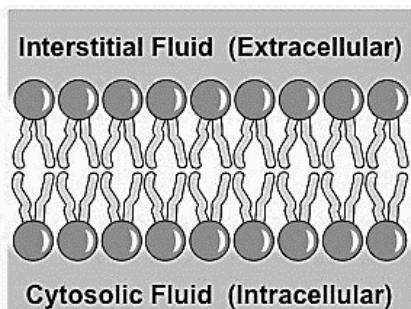
**Q.27 Answer is "Plant cells"**

**Explanation:** Due to the presence of cell wall as an outer rigid boundary plant cells do not burst and resist osmotic pressure or turgor pressure

**Q.28 Answer is "Parallel arrangement"**

**Explanation:** Molecules of phospholipids are arranged in two parallel layers in all cellular membranes.



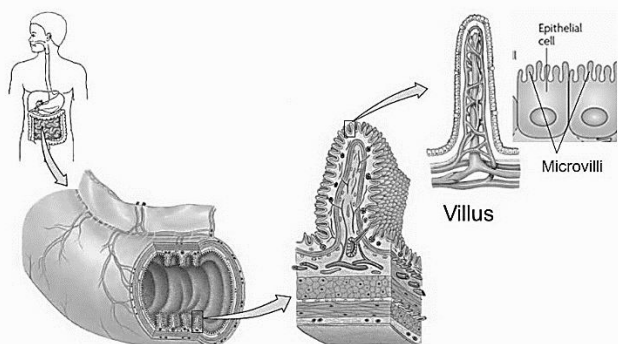


Q.29 Answer is “Autolysis”

**Explanation:** Autolysis is performed by lysosomes, however cell drinking (pinocytosis), cell eating (phagocytosis) and cell vomiting (exocytosis) are performed by cell membrane.

Q.30 Answer is “Microvilli formation”

**Explanation:** Microvilli are outfolds or outvaginations of epithelial cells of villi of ileum of small intestine. They enhance the absorptive surface area.



Q.31 Answer is “Passive transport”

**Explanation:** Active transport or uphill movement is always against concentration gradient whereas facilitated transport may be active as well as passive. However diffusion and osmosis occurs according to concentration gradient. These are types of passive transport.

Q.32 Answer is “Osmotic resistance”

**Explanation:** Osmotic resistance is the function of cell wall, however cell membrane is involved in locomotion through pseudopodia formation, ingestion (endocytosis) and secretion (exocytosis).

Q.33 Answer is “Plasmolysis & deplasmolysis”

**Explanation:** Plasmolysis & deplasmolysis always occur according to concentration gradient i.e. passive transport.

Q.34 Answer is “Pinocytosis”

**Explanation:** Ingestion of a liquid through cell membrane is called pinocytosis. It is also called as cell drinking.

Q.35 Answer is “Both outer and inner”

**Explanation:** Because both outer and inner surfaces consist of heads of phospholipid molecules.

Q.36 Answer is “Distance of 2.0  $\mu\text{m}$  between them”

**Explanation:**

Sr. #	Source of visualization	Resolution
1)	Human naked eye	1.0 mm
2)	Compound microscope	2.0 $\mu\text{m}$
3)	Electron microscope	2 – 4 Angstrom

Q.37 Answer is “By means of compound microscope”

**Explanation:** See explanation of Q # 36.

Q.38 Answer is “Electron microscope”

**Explanation:** See explanation of Q # 36.

Q.39 Answer is “Beam of electrons”

**Explanation:**

	Compound microscope	Electron microscope
Source of illumination	Ordinary light	Beam of electrons
Cost	Millions of Rupees	Thousands of rupees
Size	Handy	Huge
Object	Falls in line of vision	Does not fall in line of vision
Magnification	10000 times	250,000

**Q.40** Answer is “250000x greater than actual size”

*Explanation:* See explanation of Q # 39.

**Q.41** Answer is “500x”

*Explanation:* See explanation of Q # 39.

STEP ENTRY TEST 2020



**Worksheet-6**

**(The Cell)**

**Q.1** Nucleus may be \_\_\_\_\_ or \_\_\_\_\_ in shape.

- A) Irregular, spherical
- B) Rectangular, spherical
- C) Elongated, spherical
- D) Ellipsoidal, square

**Q.2** The example of polynucleate cells is:

- A) Smooth muscle cells
- B) Striated muscle cells
- C) Striped muscle cells
- D) Skeletal muscle cells

**Q.3** In non-dividing phase nucleus contains \_\_\_\_\_ and soluble sap called \_\_\_\_\_ respectively.

- A) Chromatin network, nucleoplasm
- B) Chromosomes, nucleoplasm
- C) Nucleoplasm, chromatin network
- D) Chromatin network, cytoplasm

**Q.4** The hereditary material is in the form of chromosomes, which control:

- A) Reproductive activities of the cell
- B) Somatic activities of the cell
- C) All activities of the cell
- D) Physiological activities of the cell

**Q.5** The membrane that separates the nuclear material from the cytoplasm is:

- A) Plasmalemma
- B) Cytoplasmic membrane
- C) Plasma membrane
- D) Nuclear membrane

**Q.6** The outer and inner nuclear membranes are continuous at certain points, resulting in the formation of:

- A) Endoplasmic reticulum
- B) Nucleolus
- C) Nuclear pores
- D) Chromosomes

**Q.7** The exchange of material between the nucleus and the cytoplasm is carried out through:

- A) Endoplasmic reticulum
- B) Nuclear pores
- C) Vacuoles
- D) Nuclear envelope

**Q.8** The number of nuclear pores in the nuclei of differentiated cells such as erythrocytes is only:

- A) 1-2 nuclear pores/nucleus
- B) 2-3 nuclear pores/nucleus
- C) 3-4 nuclear pores/nucleus
- D) 5-6 nuclear pores/nucleus

**Q.9** The example of undifferentiated cells is that of:

- A) Leucocytes
- B) Erythrocytes
- C) Osteocytes
- D) Egg cells

**Q.10** Number of nucleoli may be:

- A) Many per nucleus
- B) One per nucleus
- C) One or more per nucleus
- D) Zero per nucleus

**Q.11** It is the \_\_\_\_\_ where ribosomes are assembled and then exported to the cytoplasm via nuclear pores.

- A) Nucleus
- B) Nucleoplasm
- C) Nuclear envelope
- D) Nucleolus

**Q.12** During cell division thread like material is converted into darkly stained structures known as:

- A) Nucleoli
- B) Nuclear membrane
- C) Nucleosomes
- D) Chromosomes

**Q.13** The place on chromosomes where spindle fibres are attached during cell division is called:

- A) Centromere
- B) Chromatid

- C) Secondary construction  
D) Nucleosome
- Q.14** Each chromosome consists of \_\_\_\_\_ at the beginning of cell division.
- A) Two non-sister centromeres  
B) Two sister chromatids  
C) Two non-sister chromatids  
D) Two sister centromeres
- Q.15** All the information needed to control the activities of the cell is located on the chromosomes in the form of:
- A) Centromeres      C) Genes  
B) Kinetochores      D) Genetic material
- Q.16** The number of chromosomes in \_\_\_\_\_ remains constant generation after generation.
- A) All individuals of same species  
B) All individuals of different species  
C) Few individuals of same species  
D) Few individuals of different species
- Q.17** In man each cell contains:
- A) 23 chromosomes      C) 8 chromosomes  
B) 46 chromosomes      D) 48 chromosomes
- Q.18** Number of chromosomes in each cell of fruit fly, *Drosophila melanogaster* is:
- A) 46      C) 48  
B) 26      D) 8
- Q.19** In each cell of Garden pea, the number of chromosomes is:
- A) 26      C) 08  
B) 16      D) 14
- Q.20** The number chromosomes in germ cells is:
- A) Tetraploid      C) Haploid  
B) Triploid      D) Diploid
- Q.21** Human sperms and eggs have:

- A) 23 chromosomes      C) 4 chromosomes  
B) 46 chromosomes      D) 13 chromosomes
- Q.22** Number of chromosomes in pollens of onion is:
- A) 14      C) 08  
B) 16      D) 07
- Q.23** Number chromosomes in the sperms of frog is:
- A) 26      C) 14  
B) 13      D) 16
- Q.24** The network of channels which is often continuous with plasma membrane and also appears to be in contact with the nuclear membrane is called as:
- A) Endoplasmic reticulum  
B) Chromatin network  
C) Reticular formation  
D) Microtubular network
- Q.25** Like intermediate filaments \_\_\_\_\_ also provides mechanical support to the cell so that its shape is maintained:
- A) Microfilaments  
B) Microtubules  
C) Golgi apparatus  
D) Endoplasmic reticulum
- Q.26** Two morphological forms of endoplasmic reticulum are:
- A) ER with the ribosome and ER without ribosome  
B) ER with cisternae and ER without cisternae  
C) ER with enzymes and ER without enzymes  
D) Rough endoplasmic reticulum and sarcoplasmic reticulum
- Q.27** The apparatus, which was found virtually in all eukaryotic cells and consists of stacks of flattened membrane bound sacs is called as:
- A) Golgi Apparatus

- B) Granum  
C) Endoplasmic reticulum  
D) Intergranum
- Q.28 Inner concave surface of Golgi apparatus is:**  
A) Maturation face      C) Forming face  
B) Cis face                  D) Proximal face
- Q.29 The direction of flow of protein products synthesized on ribosomes is as under:**  
A) Ribosomes → RER → Transport Vesicles of ER → Golgi apparatus → Golgi vesicles → Plasma membrane  
B) Ribosomes → SER → Transport vesicles of ER → Golgi apparatus → Golgi vesicles → Plasma membrane  
C) Ribosomes → RER → Golgi vesicles → Golgi apparatus → Plasma membrane  
D) Ribosomes → RER → Golgi apparatus → Golgi vesicles → Plasma membrane
- Q.30 Blebs from tips of SER fuse with Golgi apparatus cisternae at:**  
A) Forming face      C) Trans face  
B) Inner face          D) Distal face
- Q.31 In mammals, the pancreas secretes granules containing enzymes. Such granules are formed by:**  
A) SER                  C) Golgi apparatus  
B) RER                  D) Lysosomes
- Q.32 The conjugation of proteins and lipids with carbohydrates is carried out in:**  
A) SER                  C) Golgi apparatus  
B) RER                  D) Mitochondria
- Q.33 Under electron microscope mitochondria appear to be:**  
A) Vesicles, rods or filaments

- B) Stellate, rods or filamentous  
C) Vesicles, star like or filamentous  
D) Round, rods or triangular
- Q.34 The number, shape and internal structure of mitochondria:**  
A) Vary rarely      C) Vary widely  
B) Do not vary      D) Do not resemble
- Q.35 The inner membrane of mitochondrion forms infoldings into the inner chamber called:**  
A) Mitochondrial cristae  
B) Mitochondrial matrix  
C) Mitochondrial stroma  
D) Mitochondrial sap
- Q.36 The inner surface of cristae in the mitochondrial matrix has small knob like structures known as:**  
A) F<sub>1</sub> particles      C) Matrix  
B) F<sub>0</sub> particles      D) F-ATPase
- Q.37 Mitochondrial matrix contains in it a large number of:**  
A) Enzymes and coenzymes  
B) Organic and inorganic salts  
C) Enzymes, coenzymes, organic and inorganic salts  
D) Enzymes, coenzymes, organic and inorganic salts and DNA with ribosomes
- Q.38 Mitochondria extract energy from different components of food and convert it in the form of:**  
A) Glucose                  C) NADPH  
B) ATP                      D) ADP
- Q.39 Animal cells, and cells of some microorganisms and lower plants contain \_\_\_\_\_ located near the exterior surface of the nucleus.**  
A) One centriole

- B) Two centrioles  
C) Two pairs of centrioles  
D) Two mitochondria
- Q.40 Just before the cell divides:**  
A) Chromosomes duplicate  
B) Centrioles duplicate  
C) Ribosomes duplicate  
D) Nucleoli duplicate
- Q.41 Centrioles play important role in the:**  
A) Cytokinesis of plant cell  
B) Karyokinesis of plant cell  
C) Furrowing during cell division  
D) Formation of mitotic apparatus in plants
- Q.42 Cell contains many tiny granular structures known as:**  
A) Ribosomes C) Mitochondria  
B) Nuclei D) Golgi Apparatus
- Q.43 Ribonucleoprotein particles discovered by Palade in cell are:**  
A) Ribosomes C) Nucleosomes  
B) Lysosomes D) Golgi vesicles
- Q.44 Ribosomes exist in two forms in eukaryotic cells, i.e.:**  
A) Freely scattered in cytoplasm and attached with SER  
B) Freely scattered in cytoplasm and attached with RER  
C) Freely scattered in nucleoplasm and attached with RER  
D) Freely scattered in nucleoplasm and attached with SER

- Q.45 Each ribosome consists of:**  
A) Five subunits C) Three subunits  
B) Four subunits D) Two subunits
- Q.46 Pick up the choice which is true about subunits of eukaryotic ribosomes:**  
A) The larger subunits sediments at 60s, while smaller subunits sediments at 40s.  
B) The larger subunit sediments at 50s, while smaller subunit sediments at 30s.  
C) The larger subunit sediments at 60s, while smaller subunit sediments at 30s.  
D) The larger subunit sediments at 50s, while smaller subunit sediments at 40s.
- Q.47 Ribosomal subunits are attached to the mRNA string from:**  
A) 3' end C) 4' end  
B) 2' end D) 5' end
- Q.48 New ribosomes are assembled in the:**  
A) Nucleus C) Mitochondria  
B) Nucleolus D) Golgi apparatus
- Q.49 The factory of ribosomes is the \_\_\_\_\_, while that of protein synthesis is the \_\_\_\_\_.**  
A) Nucleolus, ribosomes  
B) Nucleus, ribosomes  
C) Ribosomes, nucleolus  
D) Nucleolus, mitochondria
- Q.50 Which one of the following is a single membrane enclosed organelle?**  
A) Mitochondria C) Nucleus  
B) Lysosome D) Chloroplast
- Q.51 Which one of the following is a congenital disease?**  
A) Uremia  
B) Glycogenosis  
C) Myocardial infarction

- D) Cerebral infarction
- Q.52 Which one of the following is not true about Tay sach's disease?**
- A) Mental disorder  
B) Congenital disorder  
C) Lysosomal disorder  
D) Cardiovascular disorder
- Q.53 Tay sach's disease is due to deficiency of an enzyme associated with:**
- A) Metabolism                      C) Catabolism  
B) Anabolism                      D) Catalysis
- Q.54 Following organelles are derived from special assemblies of microtubules, EXCEPT:**
- A) Cilia                                  C) Centrioles  
B) Flagella                              D) Microbodies
- Q.55 Cyclosis occurs due to the involvement of:**
- A) Microtubules  
B) Microfilaments  
C) Intermediate filaments  
D) Myofilaments
- Q.56 Intermediate filaments are called so, because they have intermediate:**
- A) Position in cell                  C) Length  
B) Composition                      D) Diameter
- Q.57 Absence of an enzyme that is involved in the catabolism of lipids may ultimately result in:**
- A) Glycogenosis  
B) Lysosomal disorder  
C) Mental retardation  
D) Storage disease
- Q.58 The most undesirable consequence of Tay Sach's disease is:**

- A) Accumulation of lipids in brain cells  
B) Mental retardation  
C) Death  
D) Absence of an enzyme involved in catabolism of lipids
- Q.59 Following events are associated with a lysosomal disorder called Tay Sach's disease. Arrange them in a specific sequence with respect to their occurrence:**
- Mental retardation
  - Inheritance of abnormal gene
  - Accumulation of lipids in brain cells
  - Lack of catabolism of lipids
  - Absence of an enzyme
- A) i, ii, iii, iv, v                      C) ii, iv, i, iii, v  
B) v, iv, iii, ii, i                      D) ii, v, iv, iii, i
- Q.60 Events associated with lysosomal disorders are mentioned here below, arrange them in a sequence with respect to their occurrence:**
- Mutation
  - Storage diseases
  - Accumulation of substances within the cells
  - Deficiency of lysosomal enzymes
  - Metabolic sluggishness
- A) i, ii, iii, iv, v                      C) v, iv, iii, ii, i  
B) i, iv, v, iii, ii                      D) ii, iii, iv, v, i
- Q.61 Autophagy in a cell is carried out by:**
- A) Lysosome                          C) Glyoxisome  
B) Peroxisome                      D) Mesosome
- Q.62 Autophagy is carried out by:**
- A) Lysosomes  
B) Autophagosomes  
C) Heterophagosomes  
D) Peroxisomes



- Q.63** The organelle that protects the cells from invading organisms or any other foreign object is:
- A) Lysosome
  - B) Transport vesicle of endoplasmic reticulum
  - C) Golgi vesicle
  - D) Autophagosome
- Q.64** The proteins found in muscles are also found in:
- A) Cytoskeleton
  - B) Exoskeleton
  - C) Endoskeleton
  - D) Cartilage
- Q.65** Cytoskeletal fabric consists of following structural components EXCEPT:
- A) Microtubules
  - B) Cytosol
  - C) Microfilament
  - D) Intermediate filaments
- Q.66** Amoeboid movements are because of:
- A) Intermediate filaments
  - B) Microtubules
  - C) Microfilaments
  - D) Cytoskeleton
- Q.67** Determination of cell shape and integration of cellular compartments is the role of:
- A) Microfilaments
  - B) Cell membrane
  - C) Intermediate filaments
  - D) Cell wall

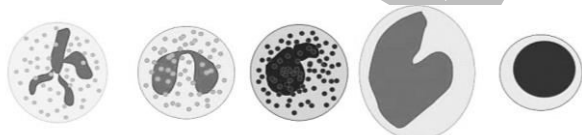
**ANSWER KEY (Worksheet-6)**

1	A	21	A	41	C	61	A
2	D	22	C	42	A	62	B
3	A	23	B	43	A	63	A
4	C	24	A	44	B	64	A
5	D	25	D	45	D	65	B
6	C	26	A	46	A	66	C
7	B	27	A	47	D	67	C
8	C	28	A	48	B		
9	D	29	A	49	A		
10	C	30	A	50	B		
11	D	31	C	51	B		
12	D	32	C	52	D		
13	A	33	A	53	C		
14	B	34	C	54	D		
15	C	35	B	55	B		
16	A	36	A	56	D		
17	B	37	D	57	C		
18	D	38	B	58	C		
19	D	39	B	59	D		
20	C	40	B	60	B		

**EXPLANATION**

**Q.1** Answer is “Irregular, Spherical”

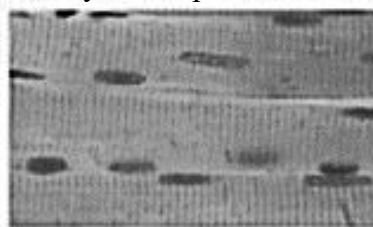
**Explanation:** Most of the nuclei are spherical in shape, however nuclei of certain cells (like various types of WBCs.) have irregular shapes e.g. the nucleus of neutrophils is two to five lobed and that of Eosinophil and Basophil is bilobed.



neutrophil eosinophil basophil monocyte lymphocyte

**Q.2** Answer is “Skeletal Muscle cell”

**Explanation:** Skeletal muscle cells are highly elongated and become unwieldy to be controlled by a single nucleus; thus contain many nuclei per cell.



**Q.3** Answer is “Chromatin network, nucleoplasm”

**Explanation:** In non-dividing cell (interphase) DNA of chromosomes have been decondensed and uncoiled. In this form it is called chromatin network. However, during cell division through recondensation and recoiling this chromatin network is converted into discrete structures called chromosomes. Chromatin network is suspended in a fluid substance called nucleoplasm.

**Q.4** Answer is “All activities of cell”

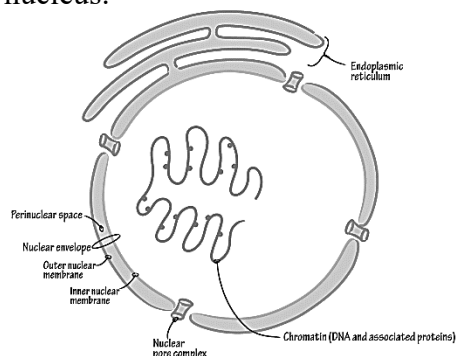
**Explanation:** All activities of a cell are controlled by its genetic material or DNA, through the genes; called units of inheritance. Genes are located on chromosomes.

**Q.5** Answer is “Nuclear membrane”

**Explanation:** In eukaryotic cells nuclear membrane or nuclear envelope separates the nuclear material from cytoplasm. It is double membrane having pores inside it.

**Q.6 Answer is “Nuclear pores”**

**Explanation:** Pores are formed by the fusion of outer and inner nuclear membranes at certain points which are source of communication between cytoplasm and nucleus.

**Q.7 Answer is “Nuclear Pores”**

**Explanation:** Nuclear pores are source of communication between nucleus and cytoplasm. Cytoplasm is the centre of metabolism for cell and each metabolic activity is controlled by genetic information located on chromosomes in the nucleus.

**Q.8 Answer is “3-4 nuclear pores / nucleus”**

**Explanation:** A differentiated cell which have been assigned a specific role and is not destined to divide further is less active metabolically and need less guidance from chromosomes and genes. Thus have less nuclear pores for communication with nucleus.

**Q.9 Answer is “Egg cells”**

**Explanation:** Egg cell is an undifferentiated cell which undergoes repeated mitoses after fertilization for development and remains highly active. That is why it needs much communication with nucleus and as a result much number of nuclear pores. i.e. upto 30,000 per nucleus.

**Q.10 Answer is “one or more per nucleus”**

**Explanation:** Number of nucleoli varies in different types of diploid cells, minimum being one and maximum may be in thousands. It depends upon the activeness of cell.

**Q.11 Answer is “Nucleolus”**

**Explanation:** Nucleoli are factories of ribosome synthesis whereas, ribosomes are factories of protein synthesis. Ribosomes are synthesized and assembled in nucleoli, then ribosomes synthesize proteins.

**Q.12 Answer is “Chromosomes”**

**Explanation:** Nucleus of a non-dividing cell contain chromatin material in form of network which have been obtained by uncoiling and decondensation of chromosomes. As the cell division starts the chromatin material is recoiled/recondensed to acquire the shape of chromosomes. Chromosomes appear as thread like structures in nucleus at that time under microscope.

**Q.13 Answer is “Centromere”**

**Explanation:** Centromere or primary constriction is that part of chromosome that links sister chromatids or a dyad. During mitosis, spindle fibers are attached to centromere via the kinetochore.

**Q.14 Answer is “Two sister chromatids”**

**Explanation:** Both chromatids of same chromosome are sister to each other whereas they are non-sister to the chromatids of other homologue. During gametogenesis both sister chromatids are separated and each goes to a separate gamete. However, in S phase of cell cycle each chromatid synthesizes its sister chromatid again.

**Q.15 Answer is “Genes”**

**Explanation:** Genes are physical units of heredity located on chromosomes.

**Q.16** Answer is “All Individuals of same species”

**Explanation:** The number of chromosomes is fixed for a species and any change in it leaves drastic impact on that individual. Such individuals are usually abnormal e.g. Down’s syndrome with 47 chromosomes and Turner’s syndrome with 45 chromosomes.

**Q.17** Answer is “46 chromosomes”

**Explanation:** It is normal diploid number of chromosomes in human being, however gametes or germ cells being haploid contain half (23) number of chromosomes.

**Q.18** Answer is “08”

**Explanation:** *Drosophila* have four pairs of chromosomes i.e. four homologous pairs of chromosomes in female *Drosophila* whereas three homologous pairs and one non homologous pair of chromosomes in male *Drosophila*.



Female

Male

**Q.19** Answer is “14”

**Explanation:** It is normal diploid number of chromosomes in garden pea.

**Q.20** Answer is “Haploid”

**Explanation:** As germ cells are products of meiosis.

**Q.21** Answer is “23 Chromosomes”

**Explanation:** This is haploid number of human chromosomes as eggs and sperms are meiotic products.

**Q.22** Answer is “08”

**Explanation:** Pollens or microspores are also haploid, formed by meiosis from a diploid microsporocyte or a pollen mother cell. The normal diploid number of chromosomes in onion is 16.

**Q.23** Answer is “13”

**Explanation:** Normal diploid number of chromosomes in frog is 26.

**Q.24** Answer is “Endoplasmic reticulum”

**Explanation:** Endoplasmic reticulum is a source of communication between nucleus of a cell and its external environment.

**Q.25** Answer is “Endoplasmic reticulum”

**Explanation:** Endoplasmic reticulum being a network present all around the nucleus upto cell membrane acts like spokes of a wheel to maintain the shape of the cell.

**Q.26** Answer is “ER with ribosomes and ER without ribosomes”

**Explanation:** ER with ribosomes are called rough endoplasmic reticulum (RER) whereas ER without ribosomes is called smooth endoplasmic reticulum (SER). Sarcoplasmic reticulum is the SER of muscle cells.

**Q.27** Answer is “Golgi Apparatus”

**Explanation:** A Golgi body is flattened membrane bound sac whereas a Golgi apparatus is a stack of Golgi bodies, whereas as Golgi complex is a Golgi apparatus along with transport vesicles of endoplasmic reticulum and Golgi vesicles.

**Q.28** Answer is “Maturation face”

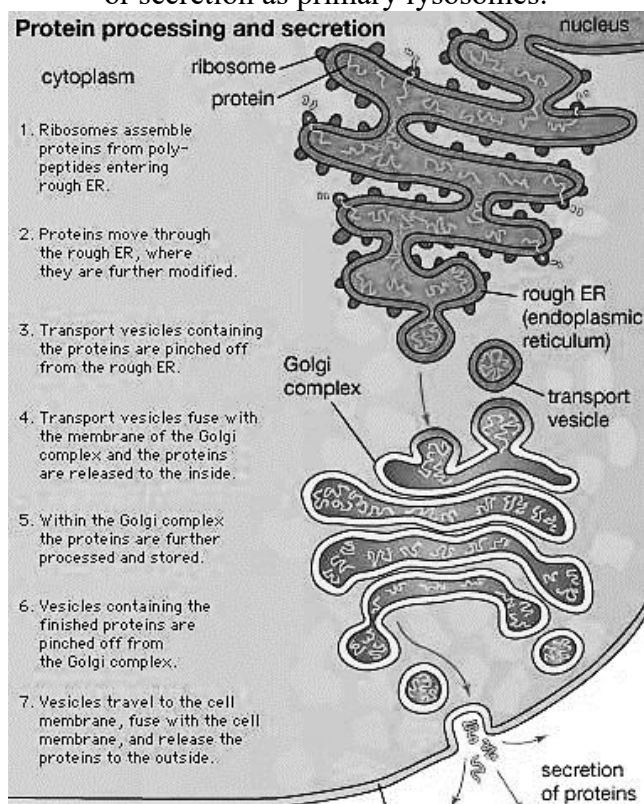
**Explanation:** It is also called trans face being away from the endoplasmic reticulum. From this face transport vesicles of Golgi bodies are pinched off having finished products inside them. That is why it is called maturation face.

**Q.29** Answer is “Ribosomes → RER → Transport Vesicles of ER → Golgi



apparatus → Golgi vesicles → Plasma membrane.”

**Explanation:** Raw proteins are synthesized by ribosomes on RER and then dumped into cisternae of RER. From RER these raw proteins are pinched off in transport vesicles of RER. These transport vesicles of RER are fused together at forming face of Golgi apparatus to form golgi bodies. During the movement of these golgi bodies from forming face to maturation face these raw proteins are converted into finished products (conjugated molecules). Then these are packed in golgi vesicles which are pinched off from maturation face. These vesicles move to the cell membrane for exocytosis or secretion as primary lysosomes.



**Q.30 Answer is “Forming Face”**

**Explanation:** Blebs from tips of SER are actually transport vesicles of endoplasmic reticulum which coalesce together to give rise to a golgi body at the forming face of golgi apparatus.

**Q.31 Answer is “Golgi Apparatus”**

**Explanation:** these granules are actually golgi vesicles containing digestive enzymes in inactive form, which are activated after being released into duodenum.

**Q.32 Answer is “Golgi Apparatus”**

**Explanation:** All finished products like conjugated molecules are synthesized in golgi apparatus after receiving their raw material from endoplasmic reticulum. That is why golgi apparatus is called finishing, packing and distribution section of the factory of cell. See the figure given at end of the explanation of question # 30.

**Q.33 Answer is “Vesicles, rods or filaments”**

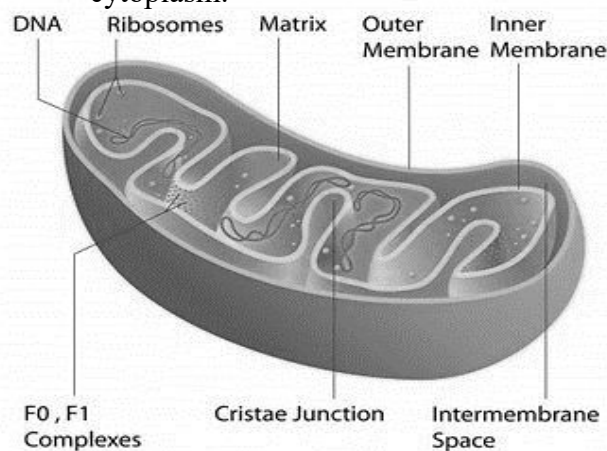
**Explanation:** Mitochondria may be of rod shape, vesicle shape or filamentous shape.

**Q.34 Answer is “Vary widely”**

**Explanation:** Number of mitochondria depends upon the activity of the cell. Similarly shape and internal structure may also be different in different organisms.

**Q.35 Answer is “Mitochondrial matrix”**

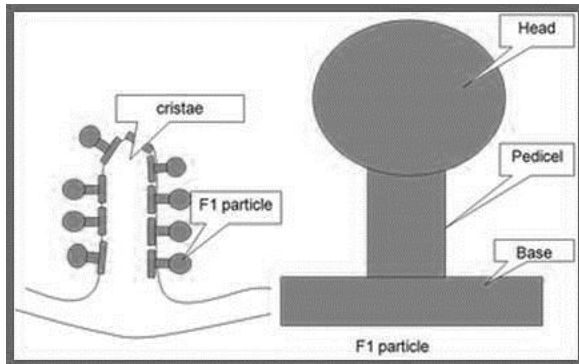
**Explanation:** The inner space of mitochondria within the inner membrane in which cristae lie is called matrix. The word matrix indicates that this space is viscous as compared to relatively aqueous cytoplasm.





Q.36 Answer is “F<sub>1</sub> particles”

**Explanation:** These are the knob like tips of ATP synthase (F<sub>1</sub> ATPase) embedded in the thylakoid membrane. The embedded part of ATP synthase is called F<sub>0</sub> particle.



Q.37 Answer is “Enzymes, Co-enzymes, Organic and inorganic salts and DNA with ribosomes”

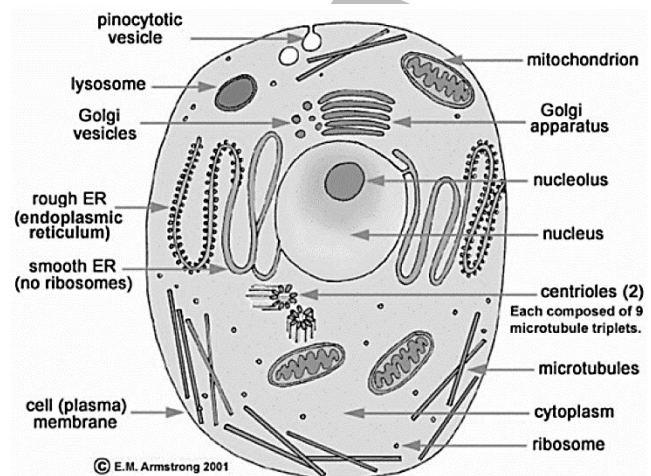
**Explanation:** Mitochondria are power houses of the cells where two important phases of aerobic respiration are accomplished i.e., Krebs cycle and respiratory electron transport chain. Thus all enzyme, coenzymes and other substances related to these pathways are present in mitochondria. ATPs are synthesized here. However, some extra chromosomal DNA along with ribosomes are also found in mitochondria.

Q.38 Answer is “ATP”

**Explanation:** Being power house of the cell mitochondria are involved in synthesis of most of the energy in the form of ATP through aerobic respiration i.e. through Krebs cycle and electron transport chain.

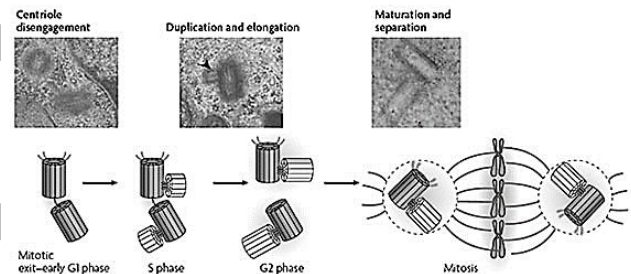
Q.39 Answer is “Two centrioles”

**Explanation:** Centrioles are located on the outer surface of nucleus making right angle with each other in a non-dividing cell.



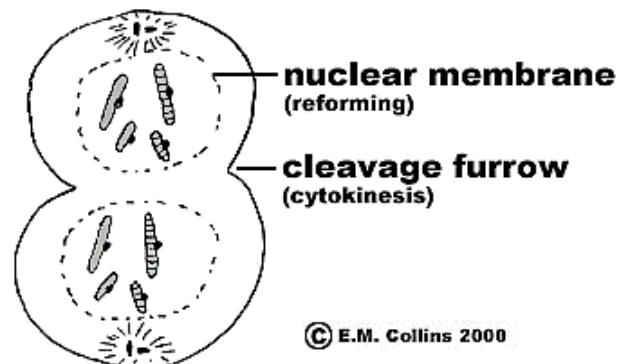
Q.40 Answer is “Centrioles duplicate”

**Explanation:** Duplication of centrioles is the first indication of initiation of cell division in animal cells.



Q.41 Answer is “Furrowing during cell division”

**Explanation:** In animal cells cytokinesis occurs through furrowing and it starts at the central point between centriole pairs positioned on opposite poles of the dividing cell.



**Q.42** Answer is “Ribosomes”

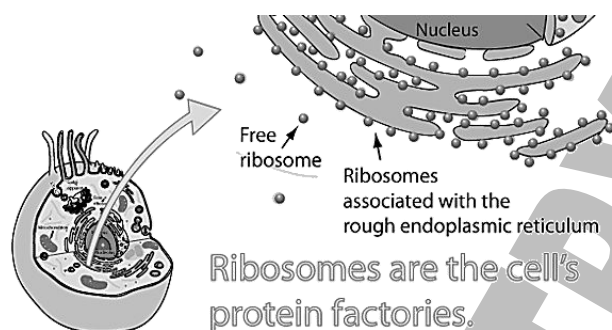
**Explanation:** Ribosomes are tiny membraneless granular structures of both prokaryotic and eukaryotic cells.

**Q.43** Answer is “Ribosomes”

**Explanation:** Ribosomes are made up of RNA and proteins. Palade discovered the ribosomes.

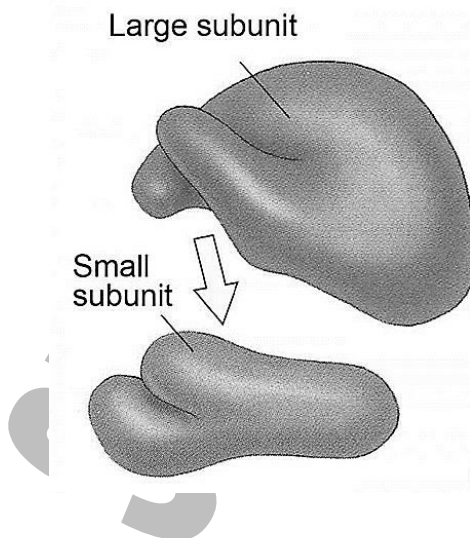
**Q.44** Answer is “Freely scattered in cytoplasm and attached with RER”

**Explanation:** Ribosomes are of two types with respect to their spatial distribution in cell i.e., free and attached with membrane of endoplasmic reticulum. Such endoplasmic reticulum become rough surfaced (RER).



**Q.45** Answer is “Two subunits”

**Explanation:** The larger subunit and smaller subunit.

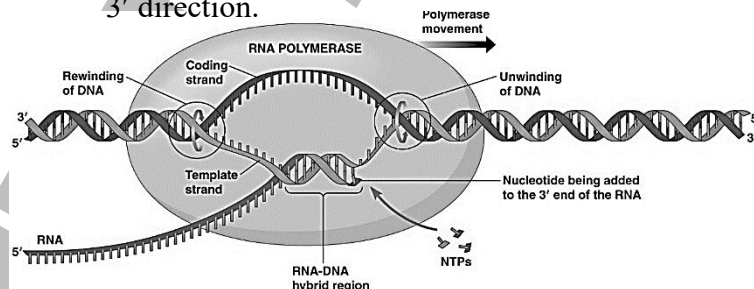


**Q.46** Answer is “the larger submit sediment at 60s, while smaller submits sediment at 40s”

**Explanation:** The larger subunit (60S) have higher rate of sedimentation as compared to smaller one (40S), for eukaryotes.

**Q.47** Answer is “5 end”

**Explanation:** The genetic message, transcribed on mRNA is translated in 5' to 3' direction.



**Q.48** Answer is “Nucleolus”

**Explanation:** As nucleolus is the factory of ribosome synthesis.

**Q.49** Answer is “Nucleolus, Ribosomes”

**Explanation:** Nucleoli synthesize the ribosomes and in turn ribosomes synthesize the proteins.

**Q.50** Answer is “Lysosomes”

**Explanation:** Lysosomes have single membrane.

**Q.51** Answer is “Glycogenosis”

**Explanation:** It is a lysosomal disorder which is inherited by birth as a genetic deficiency.

**Q.52** Answer is “Cardiovascular disorder”

**Explanation:** Tay sach's diseases is a congenital disorder due to deficiency of a particular lysosome (enzyme) associated with catabolism of lipids. As a result, lipids accumulate in brain and a mental disorder appears which may lead to death.

**Q.53 Answer is “Catabolism”**

**Explanation:** Glyoxisomes contain such enzymes which are associated with conversion of stored fatty acids to carbohydrates in seedlings of oil yielding plants.

**Q.54 Answer is “Microbodies”**

**Explanation:** Microbodies are cell organelles like peroxisomes and glyoxisomes.

**Q.55 Answer is “Microfilaments”**

**Explanation:** Microfilaments made up of contractile actin proteins contract and relax rhythmically in a cell and generate a pumping pressure which forces the cytoplasm to carry out a mass movement or streaming movement in clockwise manner around the nucleus. It is called cyclosis.

**Q.56 Answer is “Diameter”**

**Explanation:** The diameter of intermediate filaments is in-between that of microtubules and microfilaments.

**Q.57 Answer is “Mental retardation”**

**Explanation:** Due to the deficiency of such enzymes lipids are accumulated in the brain cells which lead to mental retardation or even death. Disorder is called Tay Sach’s disease.

**Q.58 Answer is “Death”**

**Explanation:** The worst consequence of the accumulation of lipids in brain is death of human being. Even with the best care, children with infantile Tay Sach’s disease usually die at the age of 4.

**Q.59 Answer is “ii, v, iv, iii, i”**

**Explanation:** When someone inherits abnormal gene associated with the synthesis of that enzyme required for catabolism of lipids, the person will lack such enzymes. As a consequence there will be no catabolism of lipids and lipids will

get accumulated into the brain cells. It will result in mental retardation.

**Q.60 Answer is “i, iv, v, iii, ii”**

**Explanation:** When the gene associated with enzyme synthesis is mutated, the enzyme becomes deficient and as a result that metabolic process becomes sluggish and the substrate (substance) starts accumulation. This results in storage disease.

**Q.61 Answer is “Lysosome”**

**Explanation:** The lysosomes associated with autophagy or self-eating are called autophagosomes. Such lysosomes engulf some worn out parts of cell and digest it.

**Q.62 Answer is “Autophagosomes”**

**Explanation:** Lysosomes associated with self-eating (autophagy) are called autophagosomes.

**Q.63 Answer is “Lysosome”**

**Explanation:** Pathogen often hijack endocytic pathway such as pinocytosis in order to gain entry into the cell. The lysosome prevents easy entry into the cell by hydrolyzing the biomolecules of pathogen necessary for their replication strategies. Reduced lysosomal activity is an increase in viral infectivity.

**Q.64 Answer is “Cytoskeleton”**

**Explanation:** Actin, myosin and tropomyosin and other proteins which are part of muscles are also part of cytoskeleton.

**Q.65 Answer is “Cytosol”**

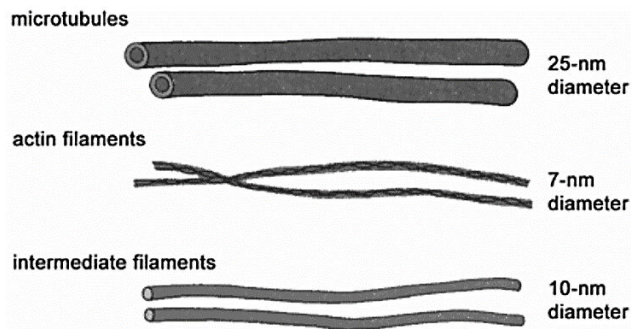
**Explanation:** Cytosol is the soluble or solution part of cytoplasm whereas cytoskeleton consists of three components i.e. microtubules, microfilaments and intermediate filaments.

**Q.66 Answer is “Microfilament”**

**Explanation:** Microfilaments are associated with streaming movement or mass movement of cytoplasm, called cyclosis. Any intracellular movement of cytoplasm is carried out by the rhythmic contraction of microfilaments and for pseudopodial movement intracellular movement of cytoplasm is required.

**Q.67** Answer is “Intermediate filament”

**Explanation:** intermediate filaments are aggregated on the inner surface of cell membrane as well as in the space between cell membrane and nucleus and provide support to the cell membrane to maintain its shape on one hand and other hand maintain the inner compartment of the cell.





**Worksheet-7**  
**(Biological Molecules)**

**Q.1 Cellulose of wood, cotton and paper is an example of:**

- A) Carbohydrates      C) Nucleic acids  
B) Proteins              D) Lipids

**Q.2 The main constituents of cell walls in plants, algae, fungi and eukaryotic microorganisms are:**

- A) Carbohydrates      C) Proteins  
B) Lipids                D) Nucleic acids

**Q.3 Carbohydrates are composed of:**

- A) Carbon, nitrogen and oxygen  
B) Carbon, hydrogen, oxygen and phosphorus  
C) Carbon, hydrogen, oxygen and nitrogen  
D) Carbon, hydrogen and oxygen

**Q.4 In simple carbohydrates the ratio of hydrogen and oxygen is same as in:**

- A) Lipids                C) Water  
B) Proteins            D) Nucleic acids

**Q.5 The general formula of carbohydrates is  $C_x(H_2O)_y$  where 'x' is the whole number:**

- A) From three to many thousands  
B) From three to seven thousands  
C) From three to three thousands  
D) From seven to many thousands

**Q.6 Polyhydroxy aldehydes or polyhydroxy ketones are:**

- A) Carbohydrates      C) Lipids  
B) Proteins              D) Nucleic acids

**Q.7 The example of polyhydroxy ketone is:**

- A) Glucose              C) Dihydroxyacetone  
B) Glyceraldehyde    D) Ribose

**Q.8 "Complex substances which on hydrolysis yield polyhydroxy aldehyde or ketone subunits" are:**

- A) Monosaccharides and oligosaccharides  
B) Glucose and fructose  
C) Monosaccharides and polysaccharides  
D) Oligosaccharides and polysaccharides

**Q.9 The sources of carbohydrates are:**

- A) Bacteria              C) Protists  
B) Green plants        D) Protozoans

**Q.10 Carbohydrates in cell combine with \_\_\_\_\_ and \_\_\_\_\_ and the resulting compounds are called glycoproteins and glycolipids respectively.**

- A) Lipids, Proteins  
B) Carbohydrates, Proteins  
C) Carbohydrates, Lipids  
D) Proteins, Lipids

**Q.11 Both glycoproteins and glycolipids are components of:**

- A) Plant cell walls  
B) Algal cell walls  
C) Fungal cell wall  
D) Biological membrane

**Q.12 Carbohydrates are also called:**

- A) Saccharides  
B) Polyhydroxy aldehydes  
C) Polyhydroxy ketone  
D) Condensation products



**Q.13 Carbohydrates are classified into:**

- A) Three groups
- B) Seven groups
- C) Three to seven groups
- D) More than seven groups

**Q.14 These are simple sugars:**

- A) Polysaccharides      C) Disaccharides
- B) Oligosaccharides    D) Monosaccharides

**Q.15 These are easily soluble in water:**

- A) Carbohydrates      C) Oligosaccharides
- B) Monosaccharides    D) Polysaccharides

**Q.16 All carbon atoms in a monosaccharide \_\_\_\_\_ have hydroxyl group.**

- A) Except one              C) Except two
- B) Without exception    D) Except last

**Q.17 Aldo-triose differs from keto-triose with respect to:**

- A) Number of carbon atoms
- B) Position of carbon atoms
- C) Position of hydrogen atoms
- D) Position of hydrogen and oxygen atoms

**Q.18 Pick up the triose:**

- A) Glyceraldehyde      C) Ribose
- B) Fructose              D) Glucose

**Q.19 Pick up the keto-triose:**

- A) DAP                    C) G.6.P
- B) RuBP                  D) G.3.P

**Q.20 In nature monosaccharides with \_\_\_\_\_ carbon atoms are found.**

- A) One to three          C) Three to seven
- B) One to seven        D) Three to thousands

**Q.21 The general formula of monosaccharides is:**

- A)  $(CH_2O)_n$               C)  $C_n(H_2O)_y$
- B)  $C_n(H_2O)_n$           D)  $C_y(H_2O)_n$

**Q.22 \_\_\_\_\_ and \_\_\_\_\_ are most common monosaccharides.**

- A) Trioses, tetroses
- B) Tetroses, pentoses
- C) Pentoses, hexoses
- D) Hexoses, heptoses

**Q.23 It is an aldo-hexose:**

- A) Fructose              C) Ribulose
- B) Glucose              D) Ribose

**Q.24 Most of the monosaccharides form a \_\_\_\_\_ when in solution.**

- A) Straight chain        C) Ring structure
- B) Branched chain      D) Folded structure

**Q.25 Ribose forms a \_\_\_\_\_ cornered ring:**

- A) Three                    C) Six
- B) Four                    D) Five

**Q.26 Glucose forms a six cornered ring called:**

- A) Glucopyranose
- B) Fructofuranose
- C) Ribofuranose
- D) Deoxyribofuranose

**Q.27 \_\_\_\_\_ corners of ribofuranose are occupied by carbon.**

- A) Three                    C) Four
- B) Two                    D) Five

**Q.28 \_\_\_\_\_ corners of Glucopyranose are occupied by carbon atoms.**

- A) Three                    C) Five
- B) Four                    D) Six

**Q.29 In free state, glucose is present in:**

- A) Grapes                  C) Dates
- B) Figs                    D) All fruits

**Q.30 In combined form glucose is found in:**

- A) Many disaccharides & polysaccharides
- B) All oligosaccharides & polysaccharides
- C) All disaccharides & polysaccharides
- D) All trisaccharides & polysaccharides

**Q.31 Starch, cellulose and glycogen yield \_\_\_\_\_ on complete hydrolysis:**

- A) Fructose C) Glucose  
B) Mannose D) Galactose

**Q.32 Glucose is naturally produced in:**

- A) Green plants C) Animals  
B) Protists D) Fungi

**Q.33 The chemical energy stored in 10 grams of glucose is:**

- A) 7170.6 Kcal C) 717.6 Kcal  
B) 7017.6 Kcal D) 17107.6 Kcal

**Q.34 These are comparatively less sweet in taste and less soluble in water:**

- A) Monosaccharides C) Disaccharides  
B) Oligosaccharides D) Polysaccharides

**Q.35 The ones yielding two monosaccharides on hydrolysis are:**

- A) Trisaccharides C) Pentasaccharides  
B) Tetrasaccharides D) Disaccharides

**Q.36 The molecular formula of sucrose is:**

- A)  $C_{12}H_{22}O_{11}$  C)  $C_3H_6O_3$   
B)  $C_6H_{12}O_6$  D)  $C_5H_{10}O_5$

**Q.37 Carbon number \_\_\_\_\_ of glucose and \_\_\_\_\_ of fructose respectively make a glycosidic bond to give rise to a sucrose.**

- A) 4, 4 C) 1, 4  
B) 1, 2 D) 2, 1

**Q.38 How many carbons are kept outside the ring in glucose?**

- A) 01 C) 02  
B) 03 D) 04

**Q.39 The most complex and the most abundant carbohydrates in nature are:**

- A) Monosaccharides C) Disaccharides  
B) Oligosaccharides D) Polysaccharides

**Q.40 The carbohydrates which are only sparingly soluble in water are:**

- A) Monosaccharides C) Oligosaccharides  
B) Disaccharides D) Polysaccharides

**Q.41 Starches are of \_\_\_\_\_ types.**

- A) One C) Three  
B) Two D) Four

**Q.42 It consists of an unbranched chain of  $\alpha$  glucose monomers:**

- A) Amylopectin C) Cellulose  
B) Glycogen D) Amylose

**Q.43 Amylopectin starches have \_\_\_\_\_ chains and are \_\_\_\_\_ in hot or cold water.**

- A) Unbranched, soluble  
B) Unbranched, insoluble  
C) Branched, soluble  
D) Branched, insoluble

**Q.44 \_\_\_\_\_ gives blue color with iodine.**

- A) Glycogen C) Dextrin  
B) Cellulose D) Starches

**Q.45 It is found abundantly in muscle and liver cells:**

- A) Starch C) Glycogen  
B) Chitin D) Amylose

**Q.46 Cotton is a pure form of:**

- A) Starch C) Cellulose  
B) Amylopectin D) Pectins

**Q.47 It is highly insoluble in water:**

- A) Glycogen C) Cellulose  
B) Amylose D) Agar

**Q.48** Pick up the one which yields glucose molecules upon hydrolysis:

- A) Starch
- B) Glycogen
- C) Cellulose
- D) Starch, Glycogen and Cellulose

**Q.49** In the herbivores, cellulose is digested because of:

- A) Bacteria
- B) Yeasts
- C) Protozoa
- D) Bacteria, Yeasts and Protozoa

**Q.50** The bacteria, yeast and protozoans found in the digestive tract of herbivores secrete:

- A) Amylase
- B) Cellulase
- C) Lipase
- D) Ptyalin

**Q.51** It gives no color with iodine:

- A) Amylose
- B) Amylopectin
- C) Glycogen
- D) Cellulose

**Q.52** They are insoluble in water and soluble in organic solvents:

- A) Nucleic acids
- B) Carbohydrates
- C) Lipids
- D) Proteins

**Q.53** Lipids as hydrophobic compounds are component of:

- A) Genetic material
- B) Cell wall
- C) Cytoplasm
- D) Cellular membrane

**Q.54** Lipids store double amount of energy, as compared to the equal amount of carbohydrates, because of:

- A) Higher proportion of C-H bonds
- B) Higher proportion of C-N bonds
- C) Higher proportion of C-O bonds
- D) Lower proportion of C-O-P bonds

**Q.55** Some \_\_\_\_\_ provide insulation against atmospheric heat and cold.

- A) Lipids
- B) Carbohydrates
- C) Nucleic acids
- D) Proteins

**Q.56** Pick up the one which is not a lipid:

- A) Acylglycerols and waxes
- B) Phospholipids and sphingolipids
- C) Carotenoids and steroids
- D) Dextrins and pectins

**Q.57** Triacylglycerols are also called as:

- A) Saccharolipids or sphingolipids
- B) Glycerolipids or polyketides
- C) Triglycerides or neutral lipids
- D) Isoprene or neutral lipids

**Q.58** Chemically \_\_\_\_\_ can be defined as esters of fatty acids and alcohol.

- A) Phospholipids
- B) Waxes
- C) Acylglycerols
- D) Terpenoids

**Q.59** A compound produced as a result of a chemical reaction of an alcohol with an acid, where a water molecule is released, is called:

- A) Acylglycerol
- B) Ester
- C) Fatty acid
- D) Wax

**Q.60** For ester formation \_\_\_\_\_ is released from alcohol and \_\_\_\_\_ is released from acid, which combine to form a water molecule.

- A) H, OH                      C) OH, H  
B) H, H                      D) OH, OH

**Q.61** \_\_\_\_\_ is composed of one glycerol and three fatty acids.

- A) Acylglycerol              C) Monoglyceride  
B) Triglyceride              D) Diacylglycerol

**Q.62** The number of carbon atoms in fatty acids may be:

- A) 2-7                      C) 2-30  
B) 3-7                      D) 2-40

**Q.63** Fatty acids contain even number of carbon atoms in straight chain attached with \_\_\_\_\_ atoms and having \_\_\_\_\_.

- A) Hydrogen, an acidic group  
B) Oxygen, an alcohol  
C) Oxygen, an acid group  
D) Hydrogen, an alcohol

**Q.64** Pick up the character which does not belong to unsaturated fatty acids:

- A) No double bond  
B) One the six double bonds  
C) Low melting point  
D) Part of plant fats

**Q.65** In animals the fatty acids are \_\_\_\_\_ while in plants these may be \_\_\_\_\_ or \_\_\_\_\_.

- A) Unbranched, branched, ringed  
B) Branched, ringed, unbranched  
C) Ringed, branched, unbranched  
D) Ringed, unbranched, branched

**Q.66** Solubility of fatty acids in organic solvents and their melting points increase with increase in the:

- A) Number of carbon atoms in chain  
B) Number of oxygen atoms in chain  
C) Number of hydrogen atoms in chain  
D) Number of acid groups in chain

**Q.67** \_\_\_\_\_ is much more soluble in organic solvent than \_\_\_\_\_.

- A) Acetic acid, butyric acid  
B) Butyric acid, palmitic acid  
C) Palmitic acid, butyric acid  
D) Palmitic acid, oleic acid

**Q.68** Melting point of palmitic acid is:

- A) 61.3°C                      C) 80°C  
B) 63.1°C                      D) -8°C

**Q.69** Melting point of butyric acid is:

- A) 61.3°C                      C) 80°C  
B) 63.1°C                      D) -8°C

**Q.70** The smallest fatty acid is:

- A) Oleic acid                      C) Butyric acid  
B) Palmitic acid                      D) Acetic acid

**Q.71** A saturated fatty acid with four carbon atoms is:

- A) Oleic acid                      C) Butyric acid  
B) Palmitic acid                      D) Acetic acid

**Q.72** A saturated fatty acid with sixteen carbon atoms is:

- A) Acetic acid                      C) Palmitic acid  
B) Butyric acid                      D) Oleic acid



**Q.73** Fats containing \_\_\_\_\_ fatty acids are usually liquid at room temperature and are said to be oils.

- A) Saturated
- B) Straight chain
- C) Unsaturated
- D) Saturated unbranched

**Q.74** Fats containing \_\_\_\_\_ fatty acids are solid at room temperature.

- A) Unsaturated
- B) Branched
- C) Saturated
- D) Ringed

**Q.75** Fat containing unsaturated fatty acids are usually represented by:

- A) Oils
- B) Solid fats
- C) Butter
- D) Banaspati

**Q.76** \_\_\_\_\_ fats are solid at room temperature.

- A) Animal
- B) Plant
- C) All
- D) No

**Q.77** Fats and oils are:

- A) Lighter than water
- B) Havier than water
- C) Less viscous than water
- D) More denser than water

**Q.78** The specific gravity of fats and oils is:

- A) 0.08
- B) 0.8
- C) 0.008
- D) 8.0

**Q.79** They are non crystalline but some can be crystallized under specific conditions:

- A) Carbohydrates
- B) Monosaccharides
- C) Fats and oils
- D) Sucrose

**Q.80** Glycerol, fatty acids and phosphoric acid gives rise to:

- A) Phospholipid
- B) Phosphatidic acid
- C) Phosphatidyl choline
- D) Phosphatidylethnoline

**Q.81** Phosphatidic acid upon combining with a nitrogenous base gives rise to:

- A) Phosphatidic acid
- B) Phosphatidylcholine
- C) Phospholipid
- D) Lecithin

**Q.82** A phosphatidic acid upon combining with a choline gives rise to:

- A) Phosphatidic acid
- B) Phosphatidylcholine
- C) Phospholipids
- D) Phosphatidylserine

**Q.83** Condensation of a glycerol with two fatty acids and one phosphoric acid yields:

- A) One molecule of water
- B) Two molecules of water
- C) Three molecules of water
- D) Four molecules of water

**Q.84** The most widely spread acylglycerol is:

- A) Triacylglycerol
- B) Diacylglycerol
- C) Monoacyl glycerol
- D) Monoglyceride

**Q.85** Biological macromolecules are polymers that are formed when \_\_\_\_\_ are joined by a \_\_\_\_\_ reaction.

- A) Monomers, dehydration
- B) Subunits, reduction
- C) Multimers, dehydration
- D) Monomers, hydrolysis

**Q.86** Which one of the following characteristics is not common among to carbohydrates, lipids and proteins?

- A) They are composed of a carbon backbone with functional group attached
- B) Their polymers are broken apart by hydrolysis
- C) Monomers of these molecules undergo dehydration synthesis to form polymers.
- D) The molecules are held together by ionic bondings

**Q.87** The first phospholipid identified in biological tissue was:

- A) Phosphatidylcholine
- B) Phosphatidylethanolamine
- C) Phosphatidylserine
- D) Phosphatidic acid

**Q.88** The polar region of a phospholipid molecule is:

- A) Hydrophobic head
- B) Hydrophilic head
- C) Hydrophilic tail
- D) Hydrophobic tail

**Q.89** The non-polar region of a phospholipid molecule consists of:

- A) Glycerol
- B) Alcohol
- C) Phosphoric acid
- D) Fatty acids

**Q.90** In phosphatidic acid fatty acids are attached to carbon no. \_\_\_\_\_ of glycerol.

- A) 01
- B) 02
- C) 01 and 02
- D) 03

**Q.91** In phosphatidic acid, phosphoric acid is attached to carbon no. \_\_\_\_\_ of glycerol.

- A) 01
- B) 02
- C) 03
- D) 04

**Q.92** For synthesis of a phospholipid, nitrogenous base is attached to \_\_\_\_\_ of phosphatidic acid.

- A) First fatty acid
- B) Second fatty acid
- C) Phosphoric acid
- D) Glycerol

**Q.93** The organic biomolecules that store maximum amount of potential energy are:

- A) Carbohydrates
- B) Proteins
- C) Nucleic acids
- D) Lipids

**Q.94** Lipids provide water barrier to:

- A) Birds
- B) Fur containing animals
- C) Insects
- D) Birds and fur containing animals

**ANSWER KEY (Worksheet-7)**

1	A	25	D	49	D	73	C
2	A	26	A	50	B	74	C
3	D	27	C	51	D	75	A
4	C	28	C	52	C	76	A
5	A	29	D	53	D	77	A
6	A	30	A	54	A	78	B
7	C	31	C	55	A	79	C
8	D	32	A	56	D	80	B
9	B	33	C	57	C	81	C
10	D	34	B	58	C	82	B
11	D	35	D	59	B	83	C
12	A	36	A	60	C	84	A
13	A	37	B	61	B	85	A
14	D	38	A	62	C	86	D
15	B	39	D	63	A	87	A
16	A	40	D	64	A	88	B
17	C	41	B	65	A	89	D
18	A	42	D	66	A	90	C
19	A	43	D	67	C	91	C
20	C	44	D	68	B	92	C
21	A	45	C	69	D	93	D
22	C	46	C	70	D	94	D
23	B	47	C	71	C		
24	C	48	D	72	C		

**EXPLANATION**

**Q.1** Answer is “Carbohydrates”

**Explanation:** Wood, cotton and paper are made up of a polysaccharide called cellulose.

**Q.2** Answer is “Carbohydrates”

**Explanation:** Cellulose, hemicellulose and pectins are the main components of the cell wall of plants and algae, whereas chitin is the main component of the cell wall of fungi. All of them are polysaccharide carbohydrates.

**Q.3** Answer is “Carbon, Hydrogen and Oxygen”

**Explanation:** Carbohydrates are commonly called as hydrated carbons i.e., water (Hydrogen and Oxygen) and

carbons. It means they have three elements, carbon, oxygen and hydrogen.

**Q.4** Answer is “Water”

**Explanation:** By simple carbohydrates we mean monosaccharides with general formula of  $C_n(H_2O)_n$ . In each monosaccharide, there are two hydrogen atoms and one oxygen atom against each carbon atom.

**Q.5** Answer is “From three to many thousands”

**Explanation:** The smallest carbohydrate is a triose (monosaccharide) whereas the complex carbohydrates (Polysaccharides) may consist of hundreds or thousands of Monosaccharide units.

**Q.6** Answer is “Carbohydrates”

**Explanation:** Chemically carbohydrates are either polyhydroxy aldehydes or polyhydroxy ketones or their condensation products.

**Q.7** Answer is “Dihydroxyacetone”

**Explanation:** It is a keto triose.

**Q.8** Answer is “Oligosaccharides and polysaccharides”

**Explanation:** Because these are condensation products of polyhydroxyaldehydes or polyhydroxy ketone units, thus they yield same upon their hydrolysis.

**Q.9** Answer is “Green plants”

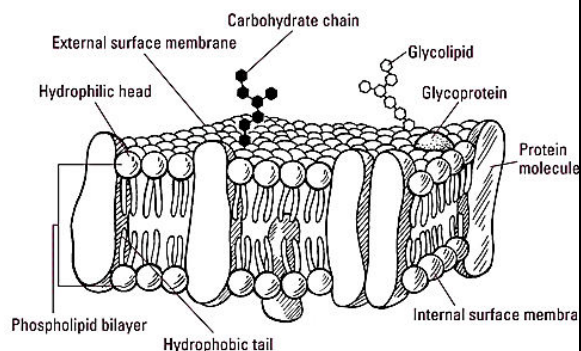
**Explanation:** Carbohydrates are the primary products of the living world synthesized by photosynthesis. Rest of the all organic biomolecules are derivatives of carbohydrates.

**Q.10** Answer is “Proteins and lipids”

**Explanation:** When carbohydrates are conjugated with proteins they yield glycoproteins and when conjugated with lipids they yield glycolipids. Both of them are part of biological membranes.

**Q.11 Answer is “Biological membranes”**

**Explanation:** Basic framework of cellular membranes is provided by proteins and lipids, however carbohydrates are conjugated with them to synthesize glycoproteins and glycolipids which act as cell markers and tissue markers.

**Q.12 Answer is “Saccharides”**

**Explanation:** It have been derived from a Greek word sackaron which means sugar.

**Q.13 Answer is “Three groups”**

**Explanation:** Monosaccharides, Oligosaccharides and polysaccharides as per text book.

**Q.14 Answer is “Monosaccharides”**

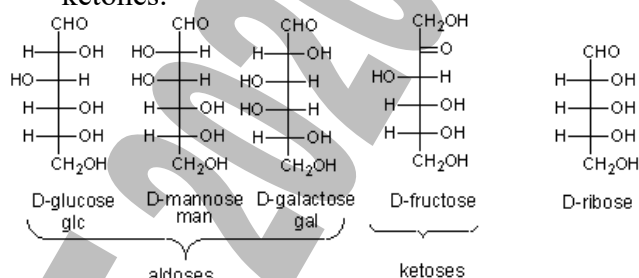
**Explanation:** Monosaccharides, also called simple sugars, are the simplest form of sugar and the most basic units of carbohydrates. They cannot be further hydrolyzed to simpler chemical compounds.

**Q.15 Answer is “Monosaccharides”**

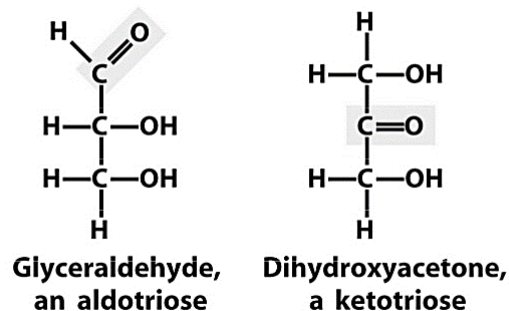
**Explanation:** Monosaccharides such as glucose and fructose are crystalline solids at room temperature, but they are quite soluble in water, each molecule having several OH groups that readily engage in hydrogen bonding.

**Q.16 Answer is “Except one”**

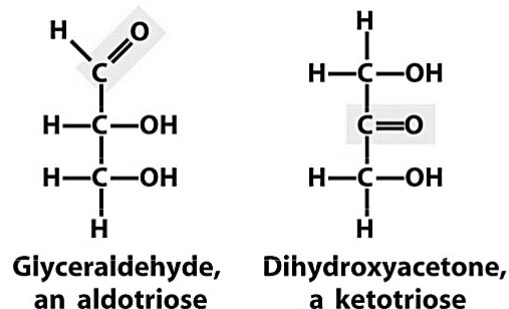
**Explanation:** That is why they are called polyhydroxy aldehydes or polyhydroxy ketones.

**Q.17 Answer is “Position of hydrogen atoms”**

**Explanation:** If two hydrogen atoms from carbon number two of aldotriose are shifted to carbon number one it becomes Keto triose and *vice versa*.

**Q.18 Answer is “Glyceraldehyde”**

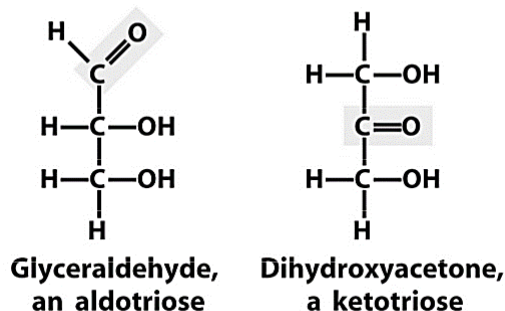
**Explanation:** It is an aldotriose i.e. a monosaccharide of three carbon atoms.





Q.19 Answer is "DAP"

**Explanation:** Dihydroxyacetone phosphate is a ketotriose.



Q.20 Answer is "Three to seven"

**Explanation:** Trioses to heptoses

Q.21 Answer is " $(\text{CH}_2\text{O})_n$ "

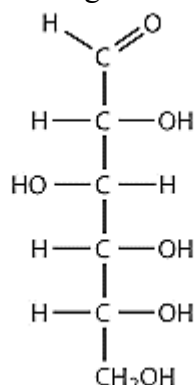
**Explanation:** These are hydrated carbons i.e. having a water molecule against each carbon.

Q.22 Answer is "Pentoses and hexoses"

**Explanation:** Pentoses being part of nucleic acids and hexoses (glucose) being substrate for aerobic respiration are most common carbohydrates of nature.

Q.23 Answer is "Glucose"

**Explanation:** Having aldehyde group and six carbon atoms glucose is an aldohexose.



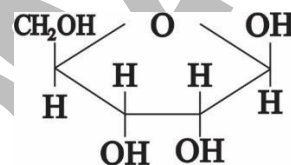
Q.24 Answer is "Ring structure"

**Explanation:** In solution form non cyclic monosaccharides acquire cyclic form and

two types of ring structures are formed i.e. furan (5 cornered) and pyran (6 cornered).

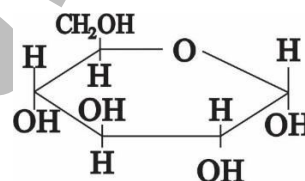
Q.25 Answer is "Five"

**Explanation:** Ribofuranose is a five cornered ring.



Q.26 Answer is "Glucopyranose"

**Explanation:** Six cornered ring of glucose is also called glucopyranose.

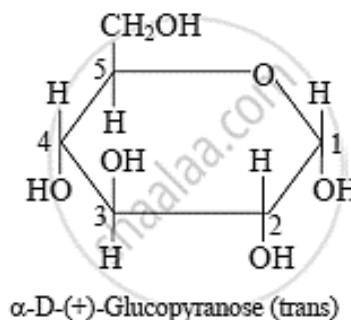


Q.27 Answer is "Four"

**Explanation:** Out of five corners one is occupied by oxygen and rest of the four corners are occupied by carbon atoms whereas, and fifth carbon remains outside the ring.

Q.28 Answer is "Five"

**Explanation:** One corner is occupied by oxygen and rest of the four by carbon atoms, whereas sixth carbon remaining outside the ring.



Q.29 Answer is "All fruits"

**Explanation:** It is found in all fruits however it is abundant in grapes, dates and figs.

**Q.30** Answer is "Many disaccharides and poly saccharides"

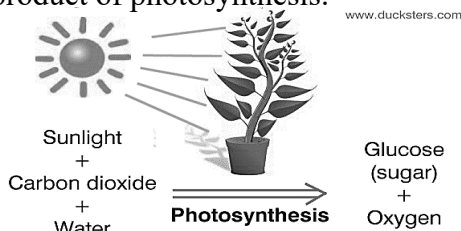
**Explanation:** Glucose is part of sucrose, maltose and fructose which are disaccharides. Similarly, cellulose starch and glycogen are polymers of glucose. However, some disaccharides and polysaccharides may have a monomer other than glucose.

**Q.31** Answer is "Glucose"

**Explanation:** Starch glycogen and cellulose are polymers of glucose monomers and they are synthesized by condensation of glucose monomers. Thus yield glucose monomers upon hydrolysis.

**Q.32** Answer is "Green plants"

**Explanation:** Green plants being chlorophyllous photosynthetic plants carry out photosynthesis and produce glucose as a product of photosynthesis.



**Q.33** Answer is "717.6 Kcal"

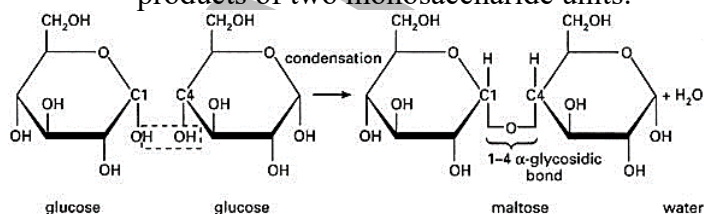
**Explanation:** As per figure given in the text book of biology part-I.

**Q.34** Answer is "Oligosaccharides"

**Explanation:** These are intermediate or moderate carbohydrates having properties in between monosaccharides and polysaccharides. However, disaccharides are soluble like monosaccharides.

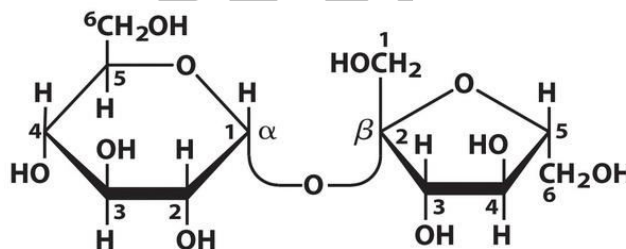
**Q.35** Answer is "Disaccharides"

**Explanation:** These are Condensation products of two monosaccharide units.



**Q.36** Answer is " $C_{12}H_{22}O_{11}$ "

**Explanation:** Condensation product of a glucose and a fructose monomers with removal of two hydrogen atoms and one oxygen ( $H_2O$ ). 1, 2 glycosidic bond is formed as a consequence.



**Sucrose**

$\alpha$ -D-glucopyranosyl  $\beta$ -D-fructofuranoside  
 $Glc(\alpha 1 \leftrightarrow 2\beta)Fru$

**Q.37** Answer is "1,2"

**Explanation:** It is condensation product of D-glucopyranose and L-fructofuranose. Thus carbon no.1 of glucose and carbon no.2 of fructose are involved. See the figure given in explanation of Q # 36.

**Q.38** Answer is "01"

**Explanation:** Only carbon no. 6 is kept outside the ring in case of glucose.

**Q.39** Answer is "Polysaccharides"

**Explanation:** cellulose being a part of algal cell wall and plant cell wall becomes the most abundant carbohydrate of nature. Moreover, the polysaccharides are the most complex carbohydrates as well because they are made up of thousands of monosaccharide units.

**Q.40** Answer is "Polysaccharides"

**Explanation:** Out of polysaccharides only amylose starch is soluble in hot water.

**Q.41** Answer is "Two"

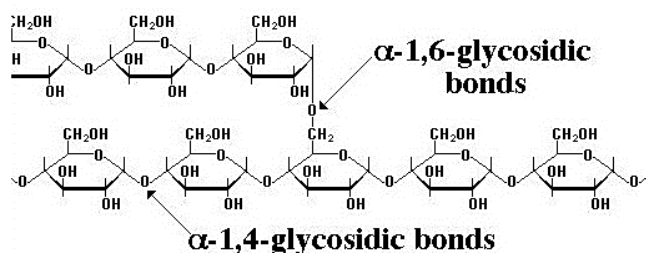
**Explanation:** Amylose and amylopectin

**Q.42 Answer is “Amylose”**

**Explanation:** Amylose is a helical polymer made of  $\alpha$ -D glucose units, bonded to each other through  $\alpha(1-4)$  glycosidic bonds.

**Q.43 Answer is “Branched, insoluble”**

**Explanation:** It consists of linear chains of glucose linked by  $\alpha$  1-4 glycosidic bonds and branches attached by  $\alpha$  1-6 glycosidic bonds occurring every 24 to 30 glucose units.

**Q.44 Answer is “Starches”**

**Explanation:** The iodine test is used to test the presence of starch. Starch turns its color to dark blue-black upon addition of aqueous solutions of the triiodide anion, due to the formation of an intermolecular charge-transfer complex.

**Q.45 Answer is “Glycogen”**

**Explanation:** In animals, surplus glucose is converted into insoluble glycogen and then it is stored in muscle and liver cells. This conversion is regulated by insulin.

**Q.46 Answer is “Cellulose”**

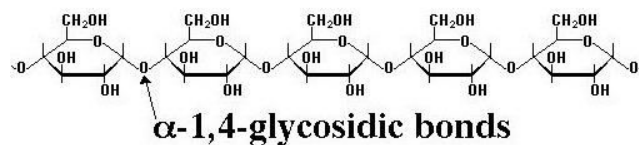
**Explanation:** Because cotton fiber is derived from the epidermis of cotton seeds as epidermal appendages i.e. the outgrowths of the outer cell walls of epidermal cells. And cell wall is made up of cellulose.

**Q.47 Answer is “Cellulose”**

**Explanation:** Because of its high molecular weight and crystalline structure, cellulose is soluble in water and has a poor ability to absorb water.

**Q.48 Answer is “Starch, Glycogen & celluloses”**

**Explanation:** All of them are polymers of glucose monomers and are synthesized by condensation of glucose monomers, thus yield glucose monomer upon hydrolysis.

**Q.49 Answer is “Bacteria, Yeast and protozoa”**

**Explanation:** Cellulase enzyme needed for the digestion of cellulose is not produced by the herbivores themselves. It is produced by symbiotic bacteria, yeast and protozoa found in their gut.

**Q.50 Answer is “Cellulase”**

**Explanation:** Cellulase is any of several enzymes produced chiefly by fungi, bacteria and protozoans that catalyze the cellulolysis, the decomposition of cellulose and of some related polysaccharides.

**Q.51 Answer is “Cellulose”**

**Explanation:** Due to straight chains of  $\beta$ , D-glucose and absence of spiral configuration it is difficult for iodine to combine with cellulose. However, amylose gives blue colour while amylopectin gives purple colour with iodine.

**Q.52 Answer is “Lipids”**

**Explanation:** Lipids having fatty acids are insoluble in water but readily soluble in organic solvents.

**Q.53 Answer is “Cellular membranes”**

**Explanation:** Basic framework of all cellular membranes is made up of phospholipid bilayers.

**Q.54** Answer is “Higher proportion of carbon hydrogen bonds”

**Explanation:** Lipids have more hydrogen atoms than equal amount of carbohydrates and less oxygen atoms than equal amount of carbohydrates. Thus, number of C – H bonds is increased

**Q.55** Answer is “Lipids”

**Explanation:** Lipids are poor conductor of heat and electric current that is why they are used as insulator.

**Q.56** Answer is “Dextrins and Pectins”

**Explanation:** Dextrins and Pectins are polysaccharides.

**Q.57** Answer is “Triglycerides or neutral lipids”

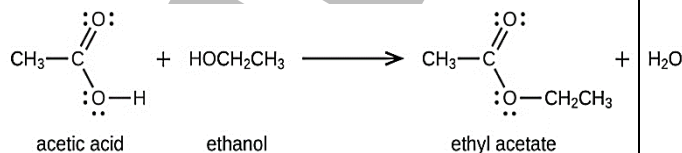
**Explanation:** Triglyceride is synonymous to triacylglycerol and having no charge they are also called neutral lipids. They are formed by triple esterification i.e. three fatty acids are esterified with one glycerol and three water molecules are produced.

**Q.58** Answer is “Acylglycerols”

**Explanation:** Acylglycerols are condensation products of fatty acids (Acyl) and a Trihydroxy alcohol (glycerol). Three fatty acids make three ester bonds with three carbons of glycerol and three water molecules are removed.

**Q.59** Answer is “Ester”

**Explanation:** Esters are formed by condensation of acid and alcohol, water molecule is removed and both acid and alcohol are bonded together by an ester bond.



**Q.60** Answer is “OH, H”

**Explanation:** It is actually a dehydration synthesis and water is formed by taking OH from glycerol and H from fatty acid.

**Q.61** Answer is “Triglyceride”

**Explanation:** Tri-means three fatty acids (Acyls) glyceride means – glycerol.

**Q.62** Answer is “2-30”

**Explanation:** Fatty acids have carbon atoms in even number from two to thirty.

**Q.63** Answer is “Hydrogen, an acidic group”

**Explanation:** Each fatty acid is a hydrocarbon chain attached with a carboxylic acid.

**Q.64** Answer is “no double bond”

**Explanation:** Unsaturated fatty acids always have lesser hydrogen atoms than their fullest capacity, thus the valency of carbon is satisfied by double bond. So having no double bond is not true with respect to them.

**Q.65** Answer is “Unbranched, Branched, ringed”

**Explanation:** The fatty acids of animals are saturated and unbranched, having higher melting points. That is why these are not advised to be taken in diet. Whereas, the fatty acids of plants are unsaturated branched or ringed, having lower melting points and are advised to be taken in diet.

**Q.66** Answer is “Number of carbon atoms in chain”

**Explanation:** By increasing the number of carbon atoms in a fatty acid its solubility in organic solvents and its melting point increases and vice versa. e.g. melting point of palmitic acid (C-16) is 63.1 °C and that of butyric acid (C-4) is -8°C.



**Q.67 Answer is “Palmitic acid, butyric acid”**

**Explanation:** By increasing the number of carbon atoms in a fatty acid its solubility in organic solvents and its melting point increases and vice versa. e.g. melting point of palmitic acid (C-16) is  $63.1^{\circ}\text{C}$  and that of butyric acid (C-4) is  $-8^{\circ}\text{C}$ .

**Q.68 Answer is “ $63.1^{\circ}\text{C}$ ”**

**Explanation:** Melting point of palmitic acid is high that that is why doctors discourage it to be taken diet as it may cause some cardiovascular disorder.

**Q.69 Answer is “ $-8^{\circ}\text{C}$ ”**

**Explanation:** Having less number of carbon atoms (4) the butyric acid have low melting point.

**Q.70 Answer is “Acetic acid”**

**Explanation:** It has two carbon atoms

**Q.71 Answer is “Butyric acid”**

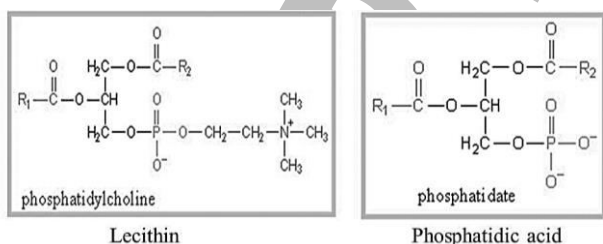
**Explanation:** Butyric acid have four carbon atoms and no double bond.

**Q.72 Answer is “Palmitic acid”**

**Explanation:** It have sixteen carbon atoms with no double bond.

**Q.73 Answer is “unsaturated”**

**Explanation:** Unsaturated fatty acids have low melting points and they usually occur in plant fats.



**Q.74 Answer is “saturated”**

**Explanation:** Saturated fatty acids have higher melting points and they are part of animal fats.

**Q.75 Answer is “Oils”**

**Explanation:** Such fatty acids which are liquid at room temperature are called oils.

**Q.76 Answer is “Animal”**

**Explanation:** Animal fats being saturated have high melting points.

**Q.77 Answer is “Lighter than water”**

**Explanation:** Fats and oils have a specific gravity of about 0.8. That is why they are lighter than water

**Q.78 Answer is “0.8”**

**Explanation:** Fats are lighter than water specific gravity less than 1.0 i.e. 0.8.

**Q.79 Answer is “fats and Oils”**

**Explanation:** Having no definite geometry and no sharp melting points, they are so.

**Q.80 Answer is “Phosphatidic acid”**

**Explanation:** A glycerol is condensed with two fatty acids on its first two carbons and with phosphoric acid at its third carbon to get phosphatidic acid and three molecules of water are released.

**Q.81 Answer is “Phospholipids”**

**Explanation:** Phospholipids are derivatives of phosphatidic acid and nitrogenous base like choline, serine and ethanolamine.

**Q.82 Answer is “Phosphatidylcholine”**

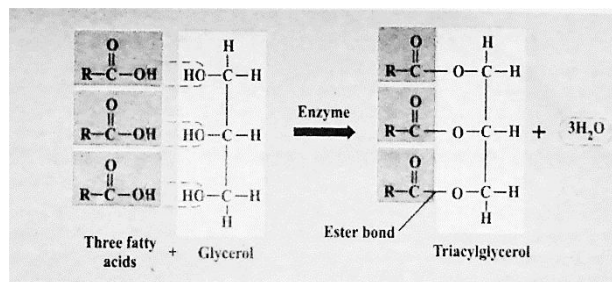
**Explanation:** It is most common phospholipid of nature. It consists of a glycerol, two fatty acids, a phosphoric acid and a choline.

**Q.83 Answer is “Three molecules of water”**

**Explanation:** It involves triple esterification thus three molecules of water are produced.

**Q.84** Answer is “Triacylglycerol”

**Explanation:** Common fats and oils.



**Q.85** Answer is “Monomers, dehydration”

**Explanation:** Biological macromolecules are polymers that are formed when monomers are joined by a dehydration reaction.

**Q.86** Answer is “The molecules are held together by ionic bondings”

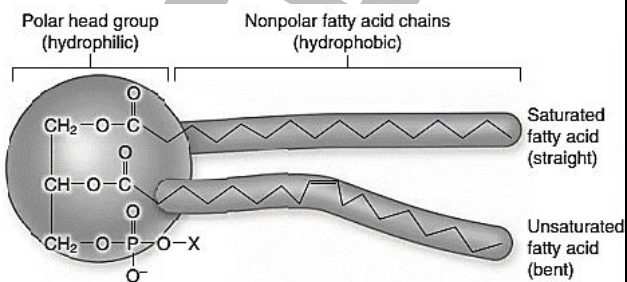
**Explanation:** The molecules are held together by covalent bonds.

**Q.87** Answer is “Phosphatidylcholine”

**Explanation:** The first phospholipid identified in 1847 as such in biological tissues was lecithin or phosphatidylcholine, in egg yolk of chickens by French Chemist and pharmacist, Theodore Nicolas Gobley.

**Q.88** Answer is “Hydrophilic head”

**Explanation:** The head of a phospholipid molecule which consists of glycerol phosphoric acid and nitrogenous base is polar and hydrophilic whereas tails which consist of fatty acids are non-polar and hydrophobic. That is why heads are kept on surface.



**Q.89** Answer is “Fatty acids”

**Explanation:** Tails of phospholipids consist of fatty acids and we know that fatty acids are hydrophobic and non-polar.

**Q.90** Answer is “01 and 02”

**Explanation:** Two fatty acids are attached to carbon number 1 and 2 of glycerol whereas phosphoric acid is attached to carbon number 3 of glycerol. As a consequence phosphatidic acid is formed. Then choline base is condensed with phosphoric acid to complete a phosphatidylcholine or Lecithin molecule.

**Q.91** Answer is “03”

**Explanation:** Phosphoric acid is attached to carbon no.3 of glycerol, first two carbons are condensed with fatty acids.

**Q.92** Answer is “Phosphoric acid”

**Explanation:** Nitrogenous bases (Choline, serine or ethanolamine) are attached to the phosphoric acids which have been already condensed with carbon no. 3 of glycerol. In this way a phospholipid is formed.

**Q.93** Answer is “Lipids”

**Explanation:** Lipids having maximum number of C – H bonds are capable to store maximum potential energy as compared to equal amount of carbohydrates and proteins.

**Q.94** Answer is “Birds and Fur containing animals”

**Explanation:** A thin coating of fats on the fur of animals and feathers of birds save them from absorbing rainwater and enable them to thermoregulate in winter.

**Worksheet-8**  
**(Biological Molecules)**

**Q.1 The most abundant organic compounds to be found in the cells are:**

- A) Proteins                      C) Nucleic acids  
B) Lipids                        D) Carbohydrates

**Q.2 All \_\_\_\_\_ are proteins and in this way they control the whole metabolism of the cell.**

- A) Hormones  
B) Antibodies  
C) Enzymes  
D) Immunoglobulins

**Q.3 The organic biomolecules that exhibit maximum physiological diversity in living being are:**

- A) Lipids                        C) Nucleic acids  
B) Proteins                      D) Carbohydrates

**Q.4 Some proteins work as carriers and transport specific substances for example:**

- A) Immunoglobulins    C) Albumins  
B) Enzymes                D) Hemoglobin

**Q.5 The protein that prevent the loss of blood from the body after injury is:**

- A) Albumin                  C) Globulin  
B) Fibrin                      D) Keratin

**Q.6 These are polymers of amino acids:**

- A) Hormones                C) Hemoglobin  
B) Enzymes                 D) Proteins

**Q.7 Amino acids mostly contain following elements:**

- A) Carbon, nitrogen, oxygen, hydrogen  
B) Carbon, nitrogen, sulphur, oxygen, hydrogen  
C) Carbon, sulphur, oxygen, hydrogen  
D) Carbon, nitrogen, sulphur, oxygen

**Q.8 All the amino acids invariably have following components, EXCEPT:**

- A)  $\text{NH}_2$                       C)  $\text{COOH}$   
B) H                            D)  $\text{CH}_3$

**Q.9 All the amino acids have an amino group and a carboxyl group attached to the same carbon atom, also known as:**

- A) Central carbon    C) Alpha carbon  
B) Major carbon      D) Beta carbon

**Q.10 Amino acids mainly differ due to the type or nature of:**

- A) Carboxyl group    C) Amino group  
B) R-group              D) Methyl group

**Q.11 The \_\_\_\_\_ group of one amino acid may react with the \_\_\_\_\_ group of another releasing a molecule of water to form a dipeptide.**

- A) Functional, Amino  
B) Amino, Amino  
C) Carboxyl, Carboxyl  
D) Carboxyl, Amino

**Q.12 If R-group is a hydrogen atom, the amino acid will be:**

- A) Alanine                  C) Leucine  
B) Glycine                 D) Tyrosine

**Q.13 Peptide bond is a:**

- A) C-O bond                C) C-C bond  
B) C-N bond                D) C-O-P bond

**Q.14 A dipeptide have an/a \_\_\_\_\_ group at one end and a \_\_\_\_\_ group at the other end of molecule.**

- A) Amino, Carboxyl  
B) Amino, Functional  
C) Functional, Carboxyl  
D) Amino, Amino

**Q.15 A dipeptide glycylalanine consists of:**

- A) Glycine and glycine
- B) Glycine and alanine
- C) Alanine and alanine
- D) Glycine and valine

**Q.16 Each protein has specific properties which are determined by the:**

- A) Number of amino acids
- B) Specific sequence of the amino acids
- C) Shape of the amino acids
- D) Number and specific sequence of amino acids

**Q.17 Proteins have \_\_\_\_\_ levels of organization.**

- A) Two
- B) Three
- C) Four
- D) Five

**Q.18 F. Sanger was the first scientist who determined the \_\_\_\_\_ structure of a protein molecule.**

- A) Primary
- B) Secondary
- C) Tertiary
- D) Quaternary

**Q.19 One chain of insulin consists of \_\_\_\_\_ amino acids and the other has \_\_\_\_\_ amino acids.**

- A) 21, 30
- B) 20, 31
- C) 31, 20
- D) 22, 29

**Q.20 Both chains of insulin are held together by:**

- A) Peptide bonds
- B) Hydrogen bonds
- C) Disulphide bonds
- D) Glycosidic bonds

**Q.21 The primary structure of proteins is stabilized by:**

- A) Disulphide bonds
- B) Hydrogen bonds
- C) Hydrophobic interaction
- D) Peptide bonds

**Q.22 Hemoglobin is composed of:**

- A) Two alpha chains
- B) Two beta chains
- C) Two alpha and two beta chains
- D) Four alpha chains

**Q.23 Each alpha chain of hemoglobin consists of:**

- A) 151 amino acids
- B) 146 amino acids
- C) 141 amino acids
- D) 156 amino acids

**Q.24 Each beta chain of hemoglobin consists of:**

- A) 146 amino acids
- B) 156 amino acids
- C) 141 amino acids
- D) 151 amino acids

**Q.25 Number of amino acids incorporated in beta chains of a molecule of hemoglobin is:**

- A) 280
- B) 282
- C) 292
- D) 290

**Q.26 Number of peptide bonds involved in stabilization of primary structure of a molecule of hemoglobin is:**

- A) 574
- B) 570
- C) 572
- D) 573

**Q.27 Number of peptide bonds involved in maintenance of primary structure of shorter chain of insulin is:**

- A) 30
- B) 21
- C) 20
- D) 19

**Q.28 The size of a protein molecule at primary level is determined by:**

- A) Number of amino acids
- B) Type of amino acids
- C) Number and type of amino acids
- D) Number and sequence of amino acids



**Q.29** Proteins in the human body are composed of unique and specific arrangement of:

- A) 25 types of amino acids
- B) 20 types of amino acids
- C) Over 20 types of amino acids
- D) Less than 20 types of amino acids

**Q.30** Due to unique and specific arrangement of same amino acids more than \_\_\_\_\_ different proteins are found in human body:

- A) 10,000
- B) 1000
- C) 10,0000
- D) 100

**Q.31** For proper functioning, a protein should have its amino acids in:

- A) A random arrangement
- B) A specific medium
- C) A specific arrangement
- D) Ascending order

**Q.32** The example of physiological ill effect of changing the amino acid sequence of a protein is:

- A) Uremia
- B) Hypoglycemia
- C) Goiter
- D) Sickle cell anemia

**Q.33** If one amino acid out of 574 amino acids is replaced by another in a hemoglobin molecule it will lose following properties, EXCEPT:

- A) Shape
- B) Functional capacity
- C) Oxygen carrying capacity
- D) Quaternary level

**Q.34** Hypoxia which may lead to death is the ultimate consequence of a change occurred initially at \_\_\_\_\_ level of hemoglobin structure:

- A) Quaternary
- B) Tertiary
- C) Secondary
- D) Primary

**Q.35** The polypeptide chains in a protein molecule usually do not \_\_\_\_\_.

- A) Remain stable
- B) Lie flat
- C) Acquire coiling
- D) Acquire folding

**Q.36** The example of structural protein is:

- A) Hemoglobin
- B) Albumin
- C) Antibodies
- D) Collagen

**Q.37** One of the common secondary structure of protein is:

- A)  $\alpha$ -helix
- B)  $\beta$ -helix
- C)  $\gamma$  helix
- D)  $P_i$  helix

**Q.38** It is a very uniform geometric structure with 3.6 amino acids in each turn of the helix:

- A)  $\alpha$ -helix
- B)  $\beta$ -helix
- C)  $\alpha$ -pleated sheet
- D)  $\beta$ -pleated sheet

**Q.39** The helical structure of secondary protein is kept by the formation of \_\_\_\_\_ among amino acid molecules in successive turns of the spiral:

- A) Ionic bond
- B) Peptide bond
- C) Hydrogen bond
- D) Disulphide bond

**Q.40** It is formed by folding back of the polypeptide chain:

- A)  $\alpha$ -helix
- B)  $\beta$ -helix
- C)  $\alpha$ -pleated sheet
- D)  $\beta$ -pleated sheet

**Q.41** Usually a polypeptide chain bends and folds upon itself forming globular shape to acquire:

- A) Primary configuration
- B) Secondary configuration
- C) Tertiary configuration
- D) Quaternary configuration

**Q.42** This structural level of proteins is maintained by ionic, hydrogen and disulphide bonds:

- A) Primary structure
- B) Secondary structure

- C) Tertiary structure  
D) Quaternary structure
- Q.43 Stabilization of tertiary structure of proteins involve \_\_\_\_\_ chemical bonds.**  
A) One C) Three  
B) Two D) Four
- Q.44 The most stable tertiary configuration is due to:**  
A) Ionic bonds  
B) Hydrogen bonds  
C) Disulphide bonds  
D) Hydrophobic interaction
- Q.45 Pick up the highly complex protein:**  
A) Primary protein  
B) Secondary protein  
C) Tertiary protein  
D) Quaternary protein
- Q.46 Polypeptide tertiary chains are aggregated and held together to give rise to:**  
A) Primary structure  
B) Secondary structure  
C) Tertiary structure  
D) Quaternary structure
- Q.47 Quaternary structure is maintained by:**  
A) Ionic bonds  
B) Hydrophobic interaction  
C) Hydrogen bonds  
D) Ionic bonds, Hydrogen bonds and Hydrophobic interaction
- Q.48 Hemoglobin, the oxygen carrying protein of red blood cells exhibits:**  
A) Primary structure  
B) Secondary structure  
C) Tertiary structure

- D) Quaternary structure
- Q.49 It involves all the four structural levels of proteins:**  
A) Insulin  
B)  $\alpha$ -helix  
C) Alpha chain of hemoglobin  
D) Hemoglobin molecule
- Q.50 Pick up the fibrous protein:**  
A) Keratin C) Enzyme  
B) Hemoglobin D) Antibodies
- Q.51 Pick up the globular protein:**  
A) Keratin C) Collagen  
B) Fibrin D) Hemoglobin
- Q.52 Pick up the globular protein:**  
A) Actin  
B) Myosin  
C) Hormonal proteins  
D) Collagen
- Q.53 In a DNA duplex, ten base pairs cover the length of  $34\text{\AA}$ , what will be distance in between two consecutive base pairs:**  
A)  $3.4\text{\AA}$  C)  $0.34\text{\AA}$   
B)  $34\text{\AA}$  D)  $340\text{\AA}$
- Q.54 The amount of DNA is fixed for a particular species, as it depends upon the:**  
A) Number of individuals  
B) Number of chromosomes  
C) Number of cells  
D) Number of genes
- Q.55 The amount of DNA in \_\_\_\_\_ is one half to that of \_\_\_\_\_:**  
A) Somatic cells, germ cells  
B) Gametocytes, Somatic cells  
C) Germ cells, Somatic cells  
D) Somatic cells, Gametocytes

**Q.56** If kidney cells of carp fish have 3.3 picograms DNA per nucleus, the amount of DNA in sperm cell of carp fish will be:

- A) 1.3 picograms      C) 1.6 picograms  
B) 2.3 picograms      D) 2.4 picograms

**Q.57** In the chromosomes of the bacterium *E. coli*, each of the paired strand of DNA contains about:

- A) 5 million bases      C) 0.5 million bases  
B) 5 billion bases      D) 50 million bases

**Q.58** The *E. coli* genome consists of base pairs:

- A) 4,639,221      C) 4,629,221  
B) 4,639,222      D) 4,638,221

**Q.59** Like DNA \_\_\_\_\_ is a polymer of ribonucleotides.

- A) ATP      C) FAD  
B) NAD      D) RNA

**Q.60** \_\_\_\_\_ is synthesized by \_\_\_\_\_ in a process known as transcription.

- A) RNA, DNA      C) DNA, DNA  
B) RNA, RNA      D) DNA, RNA

**Q.61** RNAs are synthesized in the \_\_\_\_\_ and then are moved out in the \_\_\_\_\_ to perform their specific functions.

- A) Cytoplasm, Nucleus  
B) Nucleus, Cytoplasm  
C) Nucleus, Nucleus  
D) Cytoplasm, Cytoplasm

**Q.62** As the name indicates, it takes the genetic message from the nucleus to the ribosomes, in the cytoplasm to form the particular proteins:

- A) Ribosomal RNA      C) Transfer RNA  
B) Messenger RNA      D) DNA

**Q.63** Transfer RNA comprises about \_\_\_\_\_ % of the cellular RNA.

- A) 3 to 4      C) 80  
B) 5 to 6      D) 10 to 20

**Q.64** It transfers amino acid molecules to the site where peptide chains are being synthesized:

- A) tRNA      C) rRNA  
B) mRNA      D) ScRNA

**Q.65** It may be upto 80% of the total RNA:

- A) tRNA      C) rRNA  
B) mRNA      D) snRNA

**Q.66** It acts as a machinery for synthesis of proteins:

- A) Golgi Apparatus      C) Mitochondria  
B) Ribosomal RNA      D) DNA of a gene

**Q.67** DNA was discovered by:

- A) A French chemist  
B) A German chemist  
C) An English chemist  
D) A Spanish chemist

**Q.68** Who discovered DNA?

- A) Frederick Miescher  
C) Frederick Sanger  
B) Frederick Griffith  
D) Frederick Aldrich

**Q.69** Nucleic acids were first isolated from:

- A) Human pus cells  
B) Fish sperm cells  
C) Human pus cells and fish sperm cells  
D) Human sperm cells and fish pus cells

- Q.70 Nucleic acids were named so due to:**  
 A) Their isolation from nuclei  
 B) Their isolation from pus cells  
 C) Their acidic nature  
 D) Their isolation from nucleus and acidic nature
- Q.71 Mostly occurs in the nuclei of the cells but in lesser amount outside the nucleus as well:**  
 A) RNA C) Nucleic acids  
 B) Proteins D) DNA
- Q.72 It is mostly present in the nucleolus, in the ribosomes in the cytosol and in smaller amounts in other parts of the cell as well:**  
 A) DNA C) Proteins  
 B) RNA D) Nucleic acids
- Q.73 They are polymers of units called nucleotides:**  
 A) Amino acids C) Fatty acids  
 B) Nucleosides D) Nucleic acids
- Q.74 Each nucleotide is made up of:**  
 A) One sub unit C) Three sub units  
 B) Two sub units D) Four sub units
- Q.75 The pentose of DNA is:**  
 A) Ribose C) Deoxyribulose  
 B) Ribulose D) Deoxyribose
- Q.76 The pentose of RNA is:**  
 A) Ribose C) Deoxyribulose  
 B) Ribulose D) Deoxyribose
- Q.77 Single ringed nitrogenous bases are:**  
 A) Purine C) Adenine  
 B) Pyrimides D) Guanine

- Q.78 Pick up the smaller nitrogenous base:**  
 A) Purines C) Cytosine  
 B) Adenine D) Guanine
- Q.79 Purines include:**  
 A) Adenine and cytosine  
 B) Adenine and thymine  
 C) Adenine and guanine  
 D) Adenine and uracil
- Q.80 Pyrimidines found in RNA are:**  
 A) Cytosine and thymine  
 B) Cytosine and uracil  
 C) Cytosine and adenine  
 D) Cytosine and guanine
- Q.81 In a typical nucleotide the nitrogenous base is attached to carbon at:**  
 A) Position 01 of pentose sugar  
 B) Position 05 of pentose sugar  
 C) Position 03 of pentose sugar  
 D) Position 02 of pentose sugar
- Q.82 The compound formed by combination of a base and a pentose sugar is called:**  
 A) Nucleoside C) Nucleic acid  
 B) Nucleotide D) Nuclein
- Q.83 It is an important nucleotide used as an energy currency by the cell:**  
 A) FAD C) ATP  
 B) NAD D) AMP
- Q.84 It controls the properties and potential activities of the cell:**  
 A) DNA C) ATP  
 B) RNA D) AMP
- Q.85 It is the heredity material:**  
 A) RNA C) Proteins  
 B) DNA D) ATP



**Q.86** DNA is made up of \_\_\_\_\_ different types of nucleotides.

- A) Three                      C) Five
- B) Four                      D) Six

**Q.87** Pick up the example of a dinucleotide:

- A) ATP                      C) GTP
- B) ADP                      D) NAD

**Q.88** Ribose plus nitrogenous base plus phosphoric acid is equal to:

- A) Deoxyribonucleotide
- B) Deoxyribonucleoside
- C) Ribonucleotide
- D) Ribonucleoside

**Q.89** Pick up the set of nucleotides not included in the list of deoxyribonucleotide:

- A) AMP, ADP, ATP
- B) UMP, UDP, UTP
- C) CMP, CDP, CTP
- D) TMP, TDP, TTP

**Q.90** Pick up the list carrying four nucleosides of DNA:

- A) Adenosine, Guanosine, Cytidine, Thymidine
- B) Adenosine, Guanosine, Thymidine, uridine
- C) Adenosine, Uridine, Thymidine, Cytidine
- D) Uridine, Guanosine, Thymidine, Cytidine

**Q.91** Data about ratios of different bases present in DNA molecules was provided by:

- A) Maurice Wilkins
- B) Erwin Chargaff
- C) Watson and Crick
- D) Rosalind and Franklin

**Q.92** The data presented by Erwin Chargaff suggested that:

- A) Adenine and guanine are equal
- B) Guanine and thymine are equal
- C) Adenine and cytosine are equal
- D) Adenine and thymine are equal and so are cytosine and guanine

**Q.93** They built a scale model of DNA:

- A) James D. Watson and Francis Crick
- B) Maurice Wilkins and Rosalind Franklin
- C) Maurice Wilkins and Rosalind Franklin
- D) P.A Leneve and T.H Morgan

**ANSWER KEY (Worksheet-8)**

1	A	26	B	51	D	76	A
2	C	27	C	52	C	77	B
3	B	28	C	53	A	78	C
4	D	29	B	54	B	79	C
5	B	30	A	55	A	80	B
6	D	31	C	56	C	81	A
7	A	32	D	57	A	82	A
8	D	33	D	58	A	83	C
9	C	34	D	59	D	84	A
10	B	35	B	60	A	85	B
11	D	36	D	61	B	86	B
12	B	37	A	62	B	87	D
13	B	38	A	63	D	88	C
14	A	39	C	64	A	89	B
15	B	40	D	65	C	90	A
16	B	41	C	66	B	91	B
17	C	42	C	67	B	92	D
18	A	43	C	68	A	93	A
19	A	44	D	69	C		
20	C	45	D	70	D		
21	D	46	D	71	D		
22	C	47	D	72	B		
23	C	48	D	73	D		
24	A	49	D	74	C		
25	C	50	A	75	D		

**EXPLANATION****Q.1 Answer is "Proteins"**

**Explanation:** Proteins being a major structural organic biomolecule at any level of biological organization constitutes more than 50% of the dry weight of organic biomass and maintain the basic fabric of the structure of cells, tissues and organs. Moreover, there are numerous functional proteins as well.

**Q.2 Answer is "Enzymes"**

**Explanation:** Enzymes being biological catalysts catalyze the metabolic processes in living beings. Without enzymes

metabolism will proceed so slowly that life will cease.

**Q.3 Answer is "Proteins"**

**Explanation:** Proteins perform variety of functions in living being. No other biomolecule perform such diverse roles as played by proteins.

**Q.4 Answer is "Hemoglobin"**

**Explanation:** Hemoglobin is a carrier or transport protein which carries the respiratory gases i.e. O<sub>2</sub> and CO<sub>2</sub>.

**Q.5 Answer is "Fibrin"**

**Explanation:** Fibrin is an insoluble plasma protein which seals the ruptured blood vessels after injury and prevents the loss of blood.

**Q.6 Answer is "Proteins"**

**Explanation:** Proteins are synthesized by condensation of amino acid monomers in variable sequence and variable number. Thus amino acid are monomers of proteins and proteins are polymers of amino acids.

**Q.7 Answer is "Carbon, Nitrogen, Oxygen and Hydrogen"**

**Explanation:** Most of the proteins are polymer of twenty amino acids. Out of these twenty amino acids only cysteine and methionine contain sulphur along with carbon, nitrogen, oxygen and hydrogen.

**Q.8 Answer is "CH<sub>3</sub>"**

**Explanation:** Amino acids differ from each other with respect to R group only, rest of the components are constant. CH<sub>3</sub> represents R group for alanine.

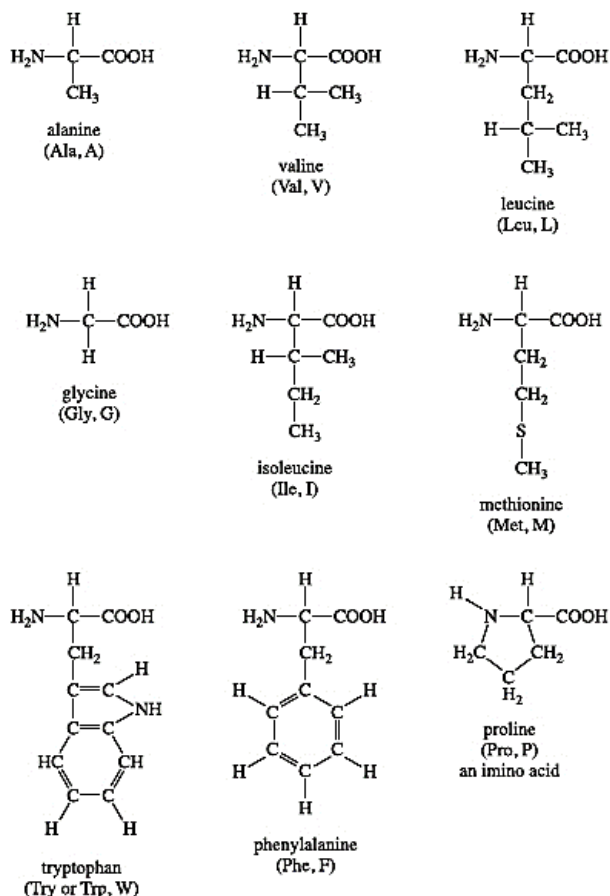
**Q.9 Answer is "Alpha carbon"**

**Explanation:** It is called alpha carbon due to the attachment of functional group to it.

**Q.10 Answer is "R group"**

**Explanation:** Amino acids differ from each other on the basis of R group or side

chain, rest of the components are constant  
e.g. when 'R' is hydrogen it will be glycine  
and if 'R' is methyl it will be alanine.



**Q.11** Answer is “Carboxyl, Amino”

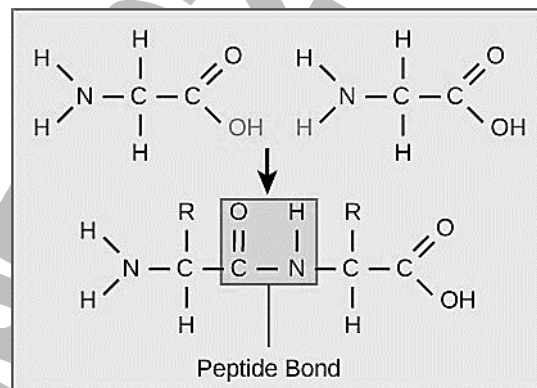
**Explanation:** The hydroxyl (OH) of carboxylic acid of one amino acid combines with the hydrogen (H) of amino group of second amino acid to produce a water molecule. As a result the carbon atom of carboxylic acid of first amino acid makes a bond with the nitrogen atom of amino group of next amino acid. This C – N bond is peptide bond.

**Q.12** Answer is “Glycine”

**Explanation:** Glycine being the simplest amino acid of nature have hydrogen as ‘R’ group.

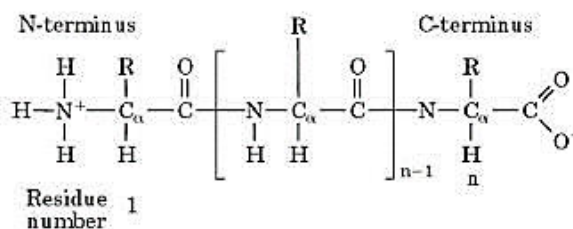
**Q.13** Answer is “C – N bond”

**Explanation:** Peptide bond is a bond between the carbon atom of carboxyl group of one amino acid and nitrogen of amino group of second amino acid.



**Q.14** Answer is “Amino, Carboxyl”

**Explanation:** No matter, how long the peptide chain is, it will have two reactive ends i.e amino (-NH) at one end and carboxylic acid (-COOH) at other end.



**Q.15** Answer is “Glycine and alanine”

**Explanation:** As the name glycylalanine indicates, it is formed by condensation of glycine and alanine amino acids by removal of a water molecule.

**Q.16** Answer is “Number and specific sequence of amino acids”

**Explanation:** At primary structural level any change in the number and sequence of amino acids changes shape and properties of protein as well. Sickle cell hemoglobin is its best example where only glutamic acid have been replaced by valine and as a

consequence its O<sub>2</sub> carrying capacity is affected.

**Q.17 Answer is “Four”**

**Explanation:** Primary, secondary, tertiary and quaternary proteins are four different structural levels of proteins.

**Q.18 Answer is “Primary”**

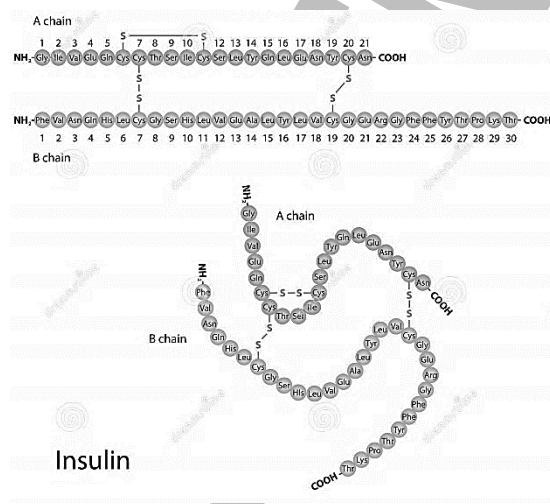
**Explanation:** F. Sanger told us that insulin protein consists of 51 amino acids in two chains i.e. a chain of 21 amino acids attached by means of disulphide bonds with a chain of 30 amino acids. Such straight chains of amino acids represent the primary structure of insulin protein. It was the first ever instance of the determination of number and sequence of amino acids in a protein. However a finished molecule of insulin stands at quaternary level.

**Q.19 Answer is “21, 30”**

**Explanation:** Short chain of insulin consists of 21 amino acids whereas long chain consists of 30 amino acids.

**Q.20 Answer is “Disulphide bonds”**

**Explanation:** Disulphide bonds hold together the two chains of amino acids.



**Q.21 Answer is “Peptide bonds”**

**Explanation:** Primary protein is formed by a linear arrangement of amino acids held together by peptide bonds. Thus the number and sequence of amino acids will matter for a particular type of primary protein.

**Q.22 Answer is “Two alpha and two beta chains”**

**Explanation:** Hemoglobin a carrier protein of our blood is made up of 574 amino acids in four chains of tertiary proteins. Two alpha chains consist of 141 amino acids each, whereas two beta chains consist of 146 amino acids each. A hemoglobin molecule ultimately stands at quaternary level of protein structure, involving primary, secondary and tertiary levels in it.

**Q.23 Answer is “141 amino acids”**

**Explanation:** Each alpha chain of hemoglobin consists of 141 amino acids.

**Q.24 Answer is “146”**

**Explanation:** Each alpha chain of hemoglobin consists of 146 amino acids.

**Q.25 Answer is “292”**

**Explanation:** It is  $146 \times 2 = 292$  amino acids.

**Q.26 Answer is “570”**

**Explanation:** Number of peptide bond in a polypeptide chain is always one less than the total number of amino acids in that chain. In this way each alpha chain will be stabilized by 140 peptide bonds and each beta chain by 145 peptide bonds. Doubling the both numbers ( $140 \times 2 = 280$ ,  $145 \times 2 = 290$ ) and adding them up ( $280 + 290 = 570$ ), we get 570.



Q.27 Answer is “20”

**Explanation:** Shorter chain of insulin consists of 21 amino acids, thus having 20 peptide bonds.

Q.28 Answer is “Number and type of amino acids”

**Explanation:** Number of monomers always decides the size of polymer. As the various amino acids have different size that is why the type of amino acid will also contribute in determining the size of primary protein.

Q.29 Answer is “20 types of amino acids”

**Explanation:** Human proteins which are more than 10,000 types are synthesized by same 20 amino acids by changing their number and sequence.

Q.30 Answer is “10,000”

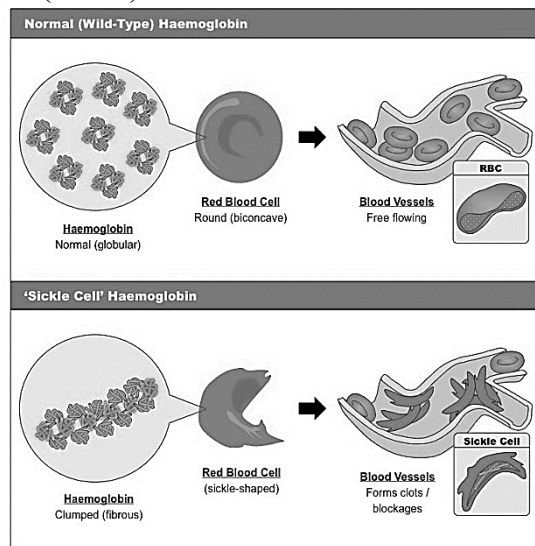
**Explanation:** In human body all the proteins are synthesized from same twenty amino acids however their diversity depends upon number and sequence of amino acids in each protein. More than 10,000 types of proteins have been discovered from human bodies so far.

Q.31 Answer is “A specific arrangement”

**Explanation:** At primary level a protein retains its specific configuration and function by specific arrangement of its amino acids. Sickle cell hemoglobin is best example in this regard.

Q.32 Answer is “Sickle cell anemia”

**Explanation:** Hemoglobin stops carrying oxygen if one amino acid (glutamic acids) in beta chain is replaced by the other (valine).



Q.33 Answer is “Quaternary level”

**Explanation:** By changing sequence of amino acids in a quaternary protein the structure and function of proteins is changed but it will remain a new protein of quaternary level.

Q.34 Answer is “Primary”

**Explanation:** Any change in hemoglobin at primary level changes the overall configuration of hemoglobin and as a result it stops functioning properly.

Q.35 Answer is “Lie flat”

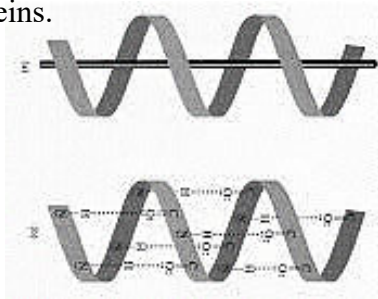
**Explanation:** Most of the primary proteins are folded, refolded and aggregated to acquire secondary, tertiary and quaternary structural levels, respectively.

Q.36 Answer is “Collagen”

**Explanation:** Collagen makes the basic framework of bones and cartilage. Thus it is a structural protein. Rest of the three proteins are functional.

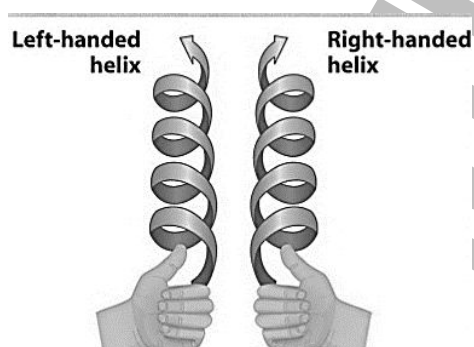
Q.37 Answer is “ $\alpha$  – helix”

**Explanation:** The most common secondary structures in proteins are alpha helices and beta pleated sheets. Particularly the  $\alpha$ -helix is part of many important structural and functional proteins.



Q.38 Answer is “ $\alpha$  – helix”

**Explanation:** Alpha helix is also called a classic Pauling–Corey–Branson  $\alpha$ -helix. The 3.6<sub>13</sub> is also used for this type of helix denoting the average number of residues per helical turn, with 13 atoms being involved in the ring formed by the hydrogen bond.

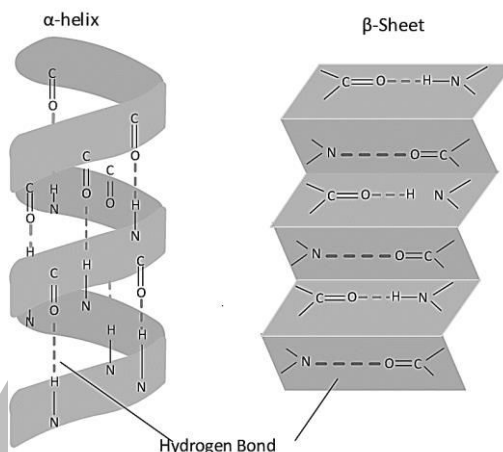


Q.39 Answer is “Hydrogen bonds”

**Explanation:** The coils and folds of secondary structure are stabilized by hydrogen bonds between consecutive folds or turns /coils.

Q.40 Answer is “ $\beta$  – pleated sheet”

**Explanation:** The example of folded secondary protein is  $\beta$  – pleated sheet which is formed by folding back of polypeptide chain.



Q.41 Answer is “Tertiary configuration”

**Explanation:** A globular three-dimensional structure formed by a single polypeptide chain will be a tertiary protein, because quaternary protein is also globular but it requires more than one polypeptide chains.

Q.42 Answer is “Tertiary structure”

**Explanation:** Ionic, hydrogen and disulphide bonds are involved in stabilization of tertiary structure of proteins.

Structural level	Bond/s involved in stabilization
Primary structure	Peptide bond
Secondary structure	Hydrogen bond
Tertiary structure	Ionic, hydrogen and disulphide bond
Quaternary structure	Hydrogen interaction, hydrogen and ionic bonds

Q.43 Answer is “Three”

**Explanation:** Tertiary structure of proteins is maintained by ionic, hydrogen and disulphide bonds.

**Q.44** Answer is “Hydrophobic interaction”

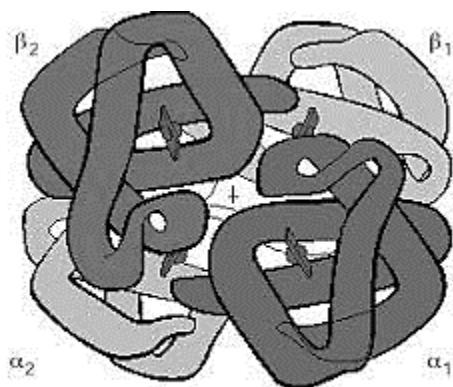
**Explanation:** Hydrophobic amino acids are buried inside while the hydrophilic amino acids are on the surface of the molecule until the aqueous medium remains intact.

**Q.45** Answer is “Quaternary Protein”

**Explanation:** Because it involves primary secondary and tertiary levels as well.

**Q.46** Answer is “Quaternary structure”

**Explanation:** More than one molecules of tertiary proteins are bonded to acquire a stable aggregated configuration called quaternary configuration e.g. hemoglobin.



Quaternary structure of Protein

**Q.47** Answer is “Ionic bond, Hydrogen bond and hydrophobic interaction”

**Explanation:** These bonds are involved in stabilization of quaternary structure, as per textbook.

**Q.48** Answer is “Quaternary structure”

**Explanation:** A hemoglobin molecule stands at quaternary level of proteins. It involves four chain of tertiary level i.e. two alpha chains and two beta chains.

**Q.49** Answer is “Hemoglobin molecule”

**Explanation:** Hemoglobin involves all the four structural levels of proteins i.e. primary, secondary, tertiary and quaternary. Actually four chains of tertiary level are aggregated together to give rise to a hemoglobin molecule acquiring quaternary level.

**Q.50** Answer is “Keratin”

**Explanation:** Keratin is that structural protein which is used to make our hair and nails and all structural proteins including keratin are included in fibrous category of proteins.

**Q.51** Answer is “Hemoglobin”

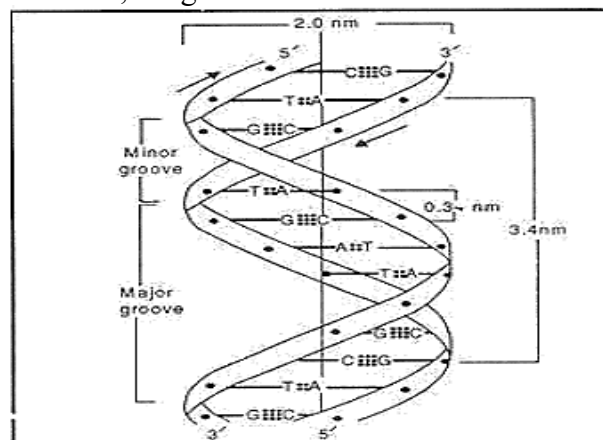
**Explanation:** All functional proteins are globular proteins including hemoglobin.

**Q.52** Answer is “Hormonal proteins”

**Explanation:** Hormonal proteins being functional are globular proteins.

**Q.53** Answer is “ $3.4 \text{ \AA}$ ”

**Explanation:** Dividing  $34 \text{ \AA}$  ( $3.4 \text{ nm}$ ) by 10, we get  $3.4 \text{ \AA}$  or  $0.34 \text{ nm}$ .



**Q.54** Answer is “Number of chromosomes”

**Explanation:** Major amount of DNA is located in chromosomes and number of chromosomes varies from species to

species, thus amount of DNA will also be different from species to species. But in same species it will be same.

**Q.55 Answer is “Germ cells, somatic cells”**

**Explanation:** Germ cells (sperms and ova) are meiotic products, thus contain haploid number of chromosomes, whereas rest of the body cells are mitotic products.

**Q.56 Answer is “1.6 picogram”**

**Explanation:** As kidney cells are diploid (2n) as compared to haploid (n) sperm cells.

**Q.57 Answer is “5 million bases”**

**Explanation:** These are 5 million bases arranged in a particular linear order.

**Q.58 Answer is “4,639,221”**

**Explanation:** The E.coli genome consists of 4,639,221 base pairs which code for at least 4288 proteins.

**Q.59 Answer is “RNA”**

**Explanation:** Ribonucleic acid is a polymer of ribonucleotides.

**Q.60 Answer is “RNA, DNA”**

**Explanation:** RNA is synthesized through the process of transcription by using DNA as a template.

**Q.61 Answer is “Nucleus, cytoplasm”**

**Explanation:** Transcription occurs in nucleus by using chromosomal DNA as template, then mRNA transcript is moved on through nuclear pores to the cytoplasm where transcribed message is translated into appropriate polypeptide proteins by using all three types of RNAs.

**Q.62 Answer is “Messenger RNA”**

**Explanation:** It takes the message encoded on genes to the ribosomes in cytoplasm where it is translated into proteins.

**Q.63 Answer is “10 to 20”**

**Explanation:** It is intermediate in quantity among three types of RNAs.

**Q.64 Answer is “tRNA”**

**Explanation:** It transfers appropriate amino acids to growing polypeptide chain.

**Q.65 Answer is “rRNA”**

**Explanation:** Quantitatively rRNA is the major form of RNA in cell.

**Q.66 Answer is “Ribosomal RNA”**

**Explanation:** It is used to make peptide bonds between amino acids and as a result polypeptide chain is synthesized.

**Q.67 Answer is “A German chemist”**

**Explanation:** It was Frederick Miescher.

**Q.68 Answer is “Frederick Miescher”**

**Explanation:** A German chemist Fredrick Miescher isolated a white substance from the nucleus of human pus cell and fish sperm cell and called it as nucleic. Due to its acidic pH it was renamed as nucleic acid later on.

**Q.69 Answer is “Human pus cells and fish sperm cells”**

**Explanation:** Frederick Miescher isolated a whitish substance from the nuclei of human pus cells and fish sperm cells and called it nuclien.

**Q.70 Answer is “Their isolation from nucleus and acidic nature”**

**Explanation:** Nucleic means isolated from nucleus and acid means having acidic pH.

**Q.71 Answer is “DNA”**

**Explanation:** Being genetic material DNA constitutes chromosomes and genes but small amount of extra chromosomal DNA exists in cytoplasm inside the chloroplast and mitochondria.



**Q.72** Answer is "RNA"

**Explanation:** RNA being associated with protein synthesis mostly occurs in cytoplasm however it is synthesized inside the nucleus from DNA that is why it always occurs in nucleus as well.

**Q.73** Answer is "Nucleic acid"

**Explanation:** Nucleotides are condensed to give rise to nucleic acids i.e. polymer of nucleotides.

**Q.74** Answer is "Three sub units"

**Explanation:** Nucleotide consists of pentose sugar, nitrogenous base and phosphoric acid.

**Q.75** Answer is "Deoxyribose"

**Explanation:** Because DNA is a polymer of deoxyribonucleotides.

**Q.76** Answer is "Ribose"

**Explanation:** As RNA is polymer of ribonucleotides.

**Q.77** Answer is "Pyrimidines"

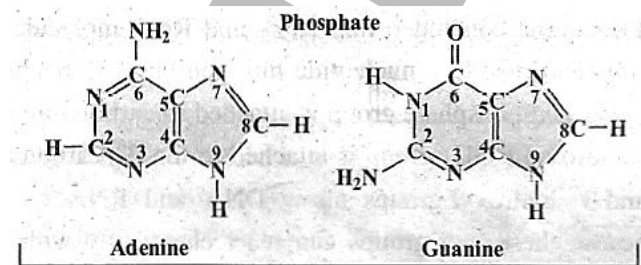
**Explanation:** These are smaller nitrogenous bases and have a single ring.

**Q.78** Answer is "Cytosine"

**Explanation:** Pyrimidines being a group smaller nitrogenous bases includes cytosine, thymine and uracil. But here we have been asked about the smallest base, not group.

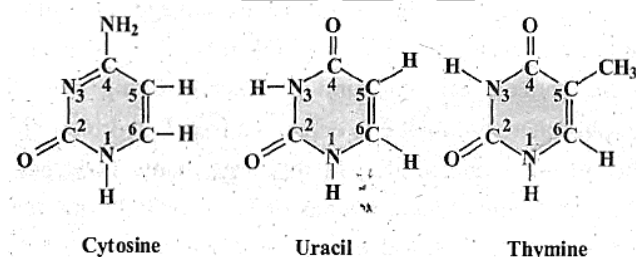
**Q.79** Answer is "Adenine and guanine"

**Explanation:** These are larger nitrogenous bases.



**Q.80** Answer is "Cytosine and Uracil"

**Explanation:** As thymine is replaced by uracil in RNA.



**Q.81** Answer is "Position 01 of pentose sugar"

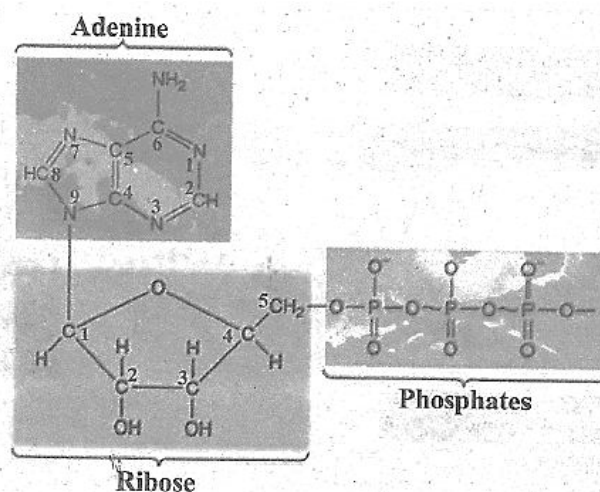
**Explanation:** Position of nitrogenous base is fixed in nucleotides and it is always carbon no.1 of pentose.

**Q.82** Answer is "Nucleoside"

**Explanation:** Nucleotide minus phosphoric acid is equal to nucleoside and nucleoside plus phosphoric acid is equal to nucleotide.

**Q.83** Answer is "ATP"

**Explanation:** Adenosine triphosphate is a nucleotide and it is used as energy currency of the cell having energy rich bonds of phosphate with phosphate.



**Q.84** Answer is "DNA"

**Explanation:** DNA as a hereditary material controls all activities of a cell.

**Q.85** Answer is “DNA”

*Explanation:* DNA is hereditary material.

**Q.86** Answer is “Four”

*Explanation:* The types of nucleotides are decided by the types of nitrogenous bases used in DNA synthesis.

**Q.87** Answer is “NAD”

*Explanation:* Nicotinamide adenine dinucleotide.

**Q.88** Answer is “Ribonucleotide”

*Explanation:* Ribose sugar is part of ribonucleotide.

**Q.89** Answer is “UMP, UDP, UTP”

*Explanation:* Uracil is not part of DNA.

**Q.90** Answer is “Adenosine, Guanosine, Cytidine and Thymidine”

*Explanation:* Four nucleosides on the basis of four nitrogenous bases which are part of DNA.

**Q.91** Answer is “Erwin Chargaff”

*Explanation:* He provided this data.

**Q.92** Answer is “Adenine and thymine are equal and so are the cytosine and guanine”

*Explanation:* As adenine makes a base pair with thymine and vice versa, whereas cytosine makes a base pair with guanine and vice versa.

**Q.93** Answer is “James D. Watson and Francis crick”

*Explanation:* Scale model of DNA was built by these two scientists after X-Ray photographs of DNA made by Franklin.

**Worksheet-9**  
**(Biological Molecules)**

**Q.1 It forms a fluid cushion around organs that helps to protect them from trauma:**

- A) Protein                      C) Vitamin  
B) Lipid                        D) Water

**Q.2 Biological importance of water is/are:**

- A) Polarity  
B) Universal solvent  
C) High specific heat and high heat of vaporization  
D) Polarity, Universal solvent and high specific heat and High heat of vaporization

**Q.3 The heat required to convert one gram of liquid water into vapors at its boiling point is called:**

- A) Heat of condensation  
B) Heat of neutralization  
C) Specific heat  
D) Heat of vaporization

**Q.4 Protoplasm of living cell can survive, if its water contents upto:**

- A) 20%                      C) 70%  
B) 10%                     D) 50%

**Q.5 All are biological importance of water, EXCEPT:**

- A) Polar molecule  
B) Universal solvent  
C) High specific heat and high heat of vaporization  
D) Water expands at high temperature

**Q.6 The amount of heat energy required to raise the temperature of one gram of water by one-degree celsius:**

- A) Heat of neutralization of water  
B) Heat of condensation of water

- C) Heat of vaporization of water  
D) Specific heat of water

**Q.7 It is a process in which large organic molecules are synthesized and water molecule is removed:**

- A) Hydrolysis                C) Hydrogenation  
B) Condensation            D) Decarboxylation

**Q.8 Which one of the following is not correct about water?**

- A) Water has high specific heat  
B) Water has high heat of vaporization  
C) Water is not universal solvent  
D) Water exhibits strong cohesion tension

**Q.9 Ice floats because:**

- A) It is less dense than water  
B) It is more dense than water  
C) It occupies less space than water  
D) It occupies more space than water

**Q.10 Which one of the following is not a property of water?**

- A) Hydrophobic properties  
B) Hydrophilic properties  
C) Very good solvent  
D) Strong surface tension

**Q.11 After taking a shower, you notice that some water droplets are clinging to the shower curtain. This is an example of:**

- A) Adhesion                C) Ionic bonding  
B) Cohesion                D) Surface tension

**Q.12 The formation of a large molecule from two small molecules with the removal of water is called:**

- A) Condensation  
B) Hydrolysis  
C) Dehydration synthesis

- D) Sublimation
- Q.13 Water:**
- A) Is a good solute
  - B) Serves as enzyme
  - C) Is a universal solvent
  - D) Serve as energy currency
- Q.14 Which one of the following is called biological catalysts?**
- A) Clotting factor
  - B) Osmotic protein
  - C) Enzyme
  - D) Vitamin
- Q.15 The active site of enzymes consists of:**
- A) Only few amino acids
  - B) Only a few amino acids
  - C) Bulk of amino acids
  - D) One or two amino acids
- Q.16 \_\_\_\_\_ maintains the globular structure of the enzyme.**
- A) Few amino acids
  - B) A few amino acids
  - C) Many amino acids
  - D) Bulk of the amino acids
- Q.17 Often it contributes directly to the chemical reactions which bring about catalysis:**
- A) Prosthetic group
  - B) Co-factor
  - C) Co-enzymes
  - D) Activator
- Q.18 If non-protein part of enzyme is covalently bonded to the protein part, it is called:**
- A) Holoenzyme
  - B) Co-enzyme
  - C) Prosthetic group
  - D) Apo-enzyme
- Q.19 An activated enzyme consisting of polypeptide chain and a cofactor is known as:**
- A) Apoenzyme
  - B) Holoenzyme
  - C) Co-enzyme
  - D) Pseudo enzyme

- Q.20 Enzymes are sensitive to even a minor change in:**
- A) pH
  - B) Temperature
  - C) Substrate conc.
  - D) pH, temperature and substrate conc.
- Q.21 \_\_\_\_\_ is a powerful protein digesting enzyme and is capable of destroying cell's internal structure and thus produced in inactive \_\_\_\_\_ form by the cell.**
- A) Pepsin, Pepsinogen
  - B) Pepsinogen, Pepsin
  - C) Pepsin, Trypsin
  - D) Trypsin, Pepsin
- Q.22 After the formation of products, it is released unaltered and thus can be used again:**
- A) Substrate
  - B) Enzyme
  - C) Inhibitor
  - D) Hormone
- Q.23  $E + S \rightleftharpoons$  \_\_\_\_\_:**
- A)  $E + P$
  - B)  $ES$
  - C)  $E + S$
  - D)  $EI$
- Q.24 Enzymes involved in some metabolic pathways are normally present together:**
- A) Randomly
  - B) In descending order
  - C) In reverse order
  - D) In precise order
- Q.25 The charge and shape of the active site of the enzyme is formed by \_\_\_\_\_ in the polypeptide chain of the active site of the enzyme.**
- A) Some amino acids
  - B) Many amino acids
  - C) Bulk of amino acids
  - D) One amino acids



**Q.26** The reaction between \_\_\_\_\_ activates the catalytic site of enzyme.

- A) Enzyme and substrate
- B) Active site of enzyme and substrate
- C) Substrate and binding site of enzyme
- D) Enzyme and binding site of enzyme

**Q.27** According to this model enzyme is a rigid structure:

- A) Lock and key model
- B) Induced fit model
- C) Allosteric model
- D) Isoenzyme model

**Q.28** According to \_\_\_\_\_ the active site of enzyme is not a rigid structure.

- A) Lock and key model
- B) Emil Fischer's model
- C) Induced fit model
- D) Allosteric model

**Q.29** The functional specificity of every enzyme is the consequence of its:

- A) Specific chemistry
- B) Specific configuration
- C) Variable chemistry and configuration
- D) Specific chemistry and configuration

**Q.30** The rate of reaction depends directly on the amount of enzyme provided the substrate concentration is:

- A) Unlimited      C) Limited
- B) Low              D) Fixed

**Q.31** By increasing the enzyme molecules \_\_\_\_\_ will convert the substrate molecules into products, in the given period of time.

- A) Less active sites

B) More active sites

- C) The same number of active site
- D) No active site

**Q.32** If the enzyme conc. is kept constant, by increasing the substrate concentration the rate of enzyme action is:

- A) Never increased
- B) Decreased
- C) Increased forever
- D) Increased for specific time

**Q.33** The rate of enzyme-controlled reactions may increase with increase in:

- A) Temperature upto minimum level
- B) Temperature upto maximum level
- C) Temperature upto optimum level
- D) Temperature upto infinite level

**Q.34** Chemical reactions are accelerated at high temperature because:

- A) Heat provides activation energy
- B) Heat lowers the activation energy
- C) Heat lowers the kinetic energy
- D) Heat makes the reactants remain static

**Q.35** When reactants move more quickly and chances of their collision with each other are increased as a result the rate of enzyme-controlled reactions will?

- A) Decrease initially    C) Increase for ever
- B) Increase initially    D) Decrease for ever

**Q.36** Inhibitors can be divided into:

- A) Two basic types    C) Four basic types
- B) Three basic types    D) Five basic types

**Q.37** They alter the structure of the enzyme in such a way that even if genuine substrate binds the active site, catalysis fails to take place temporarily:

- A) Irreversible inhibitors

- B) Reversible inhibitors
- C) Competitive inhibitors
- D) Non-competitive inhibitors

**Q.38 Pick up the product:**

- A) Succinic acid      C) Fumaric acid
- B) Malonic acid      D) Dehydrogenase

**Q.39 Succinic acid dehydrogenase + malonic acid  $\longrightarrow$ ?**

- A) No reaction possible
- B) Fumaric acid
- C) Enzyme is blocked
- D) No reaction possible, Enzyme is blocked

**Q.40 Which one of the following is reused?**

- A) Substrate
- B) Enzyme
- C) Coenzyme
- D) Enzyme and Co-enzyme

**Q.41 Some enzymes are potentially damaging if they are manufactured in their active form e.g.:**

- A) Amylose      C) Pepsinogen
- B) Pepsin      D) Lipase

**Q.42 Which one of the following products will control this pathway through feedback activation?**



- A) B      C) D
- B) C      D) E



**Accumulation of "E" will control the above pathway through:**

- A) Feedback mechanism

- B) Feedback activation
- C) Positive feedback
- D) Feedback inhibition



**Deficiency of "E" will control the above pathway through:**

- A) Feedback mechanism
- B) Feedback activation
- C) Negative feedback
- D) Feedback inhibition

**Q.45 Induce fit model was proposed by:**

- A) Watson      C) Emil Fischer
- B) Koshland      D) F. Miescher

**Q.46 Salivary amylase works best at pH:**

- A) 2.00      C) 6.80
- B) 7.20      D) 8.50

**Q.47 Optimum pH for the action of pancreatic lipase is:**

- A) 2.00      C) 5.00
- B) 7.00      D) 9.00

**Q.48 Malonic acid is competitive inhibitor of:**

- A) Succinic acid
- B) Fumaric acid
- C) Succinic dehydrogenase
- D) Citric acid

**Q.49 It causes denaturation of globular structure of enzyme:**

- A) Slight change in pH
- B) Extreme pH change
- C) Competitive inhibitor
- D) Slight pH change

**Q.50** Any molecule that increases the rate of a chemical reaction without being used up during that reaction is called:

- A) Coenzyme                      C) Apoenzyme
- B) Activator                     D) Catalyst

STEP ENTRY TEST 2020

ANSWER KEY (Worksheet-9)					
1	D	23	B	45	B
2	D	24	D	46	C
3	D	25	A	47	D
4	B	26	C	48	C
5	D	27	A	49	B
6	D	28	C	50	D
7	B	29	D		
8	C	30	A		
9	A	31	B		
10	A	32	D		
11	A	33	C		
12	C	34	A		
13	C	35	B		
14	C	36	A		
15	B	37	D		
16	D	38	C		
17	B	39	D		
18	C	40	D		
19	B	41	B		
20	D	42	D		
21	A	43	D		
22	B	44	B		

**EXPLANATION**

**Q.1** Answer is “Water”

**Explanation:** Water is effective lubricant that provides protection against damage resulting from friction. For example, tears protect the surface of eye from the rubbing of eyelids, water also forms a fluid cushion around organs that helps to protect them from trauma.

**Q.2** Answer is “Polarity, Universal solvent and High specific heat and high heat of vaporization”

**Explanation:** Biological importance of water is essential for life. There is no existence of life without water. All the almighty has created all living organisms from water. Polarity, universal solvent and high specific heat and high heat of

vaporization all are the biological importance of water.

**Q.3** Answer is “Heat of vapourization”

**Explanation:** The heat required to convert one gram of liquid water into vapors at its boiling point is called heat of vapourization.

**Q.4** Answer is “10%”

**Explanation:** It is essential for existence of protoplasm because protoplasm cannot survive if its water content is reduced as low as 10 percent.

**Q.5** Answer is “Water expands at high temperature”

**Explanation:** Water has a unique property, as it expands when temperature falls below 4°C. Water is most heavy at 4°C. therefore ice (solid water) is less dense than liquid water and this is the reason that ice floats in liquid water. Water body freezes on the surface at low temperature. Water has a high surface tension. In living cells this feature of surface tension allows a thin film of water to cover membranes and to keep them moist.

**Q.6** Answer is “Specific heat of water”

**Explanation:** Water has high specific heat. Specific heat is the amount of heat energy required to rise the temperature of one gram of water by one degree celsius.

**Q.7** Answer is “Condensation”

**Explanation:** Condensation is a process in which large organic molecules are synthesized and water molecule is removed.



**Q.8** Answer is “Water is not universal solvent”

**Explanation:** Water is a universal solvent because it can dissolve all polar and ionic substances.

**Q.9** Answer is “It is less than water”

**Explanation:** Water has a unique property, as it expands when temperature falls below 4°C. Water is most heavy at 4°C. Therefore ice (solid water) is less dense than liquid water and this is that ice float is liquid water.

**Q.10** Answer is “Hydrophobic properties”

**Explanation:** Water is polar molecule due to polar nature of water it dissolves almost all type of polar substances.

**Q.11** Answer is “Adhesion”

**Explanation:** Adhesion refers to the tendency of water molecules to be attracted, or “stick”, to other substances. This is a result of the covalent bond between the two hydrogen atoms and the one oxygen atom in the water molecule. Just like a magnet, the poles of water molecule allow it to stick to other polar substances.

**Q.12** Answer is “Dehydration synthesis”

**Explanation:** Because dehydration synthesis is the combination of smaller molecules into the larger molecule with the removal of water.

**Q.13** Answer is “Is a universal solvent”

**Explanation:** Water is a universal solvent. Due to polar nature of water it dissolves almost all type of polar substances and therefore regarded as universal solvent.

**Q.14** Answer is “Enzyme”

**Explanation:** Enzymes being biological catalysts are involved in metabolism going on, in each cell all the time.

**Q.15** Answer is “Only a few amino acids”

**Explanation:** Active site is usually a groove or pocket not a solid compact structure as the rest of the enzyme is, that is why it is made up of only a few amino acids which means some amino acids.

**Q.16** Answer is “Bulk of amino acids”

**Explanation:** Few means “very few” or none at all, however a few is used to indicate “not a large number”. Many amino acids are also not enough to make a three-dimensional globular compact part of enzyme. Thus bulk is true word for it.

**Q.17** Answer is “Co-factor”

**Explanation:** Co-factor which is further sub-categorized into activator, prosthetic group and coenzyme, often contribute directly in enzyme catalysis sometimes it provides a source of chemical energy, helping to drive reactions which would otherwise be difficult or impossible and usually it acts as a bridge between the enzyme and its substrate.

**Q.18** Answer is “Prosthetic group”

**Explanation:** It is organic cofactor which is non-detachable (covalently bonded).

Sr . #	Cofactor	Nature of Bonding	Chemical Composition
1.	Activator	Detachable	Inorganic metallic ions
2.	Prosthetic group	Undetachable/covalent bonded	Organic
3.	Coenzyme	Detachable	Organic derived from vitamins

**Q.19** Answer is “Holoenzyme”

**Explanation:**

Holoenzyme = Apo enzyme + cofactor

Apoenzyme = Holoenzyme – cofactor

Cofactor = Holoenzyme – apoenzyme

**Q.20 Answer is “pH temperature and substrate conc.”**

**Explanation:** Both temperature and pH can change the enzyme configuration, thus changing its action, whereas substrate is that substance which is changed into products with the help of enzyme.

**Q.21 Answer is “Pepsin, Pepsinogen”**

**Explanation:** Pepsin being a proteolytic enzyme is considered among potentially damaging enzymes. Thus it is produced in inactive form called pepsinogen and is activated inside the lumen of stomach and wall of stomach is protected by mucus.

**Q.22 Answer is “Enzyme”**

**Explanation:** Enzyme being biocatalyst speeds up the biochemical reaction but it itself is not consumed in the reaction. Thus, at the end of biochemical reaction enzyme is obtained unaltered, to be used again.

**Q.23 Answer is “ES”**

**Explanation:** When an appropriate enzyme comes together with an appropriate substrate molecule in the same aqueous medium, enzyme substrate complex (ES) is formed.

**Q.24 Answer is “In precise order”**

**Explanation:** In a biochemical pathway specific enzymes catalyze the specific steps, thus they should be at specific position, otherwise pathway will not be accomplished.

**Q.25 Answer is “Some amino acids”**

**Explanation:** In biology, the active site is the region of an enzyme where substrate molecules bind and undergo a chemical reaction. The active site consists of residues that form temporary bonds with the substrate. The active site is usually a

groove or pocket of the enzyme which can be located in a deep funnel within the enzyme or between the interfaces of multimeric enzymes. Being hollow it consists of some amino acids.

**Q.26 Answer is “Substrate and binding site of enzyme”**

**Explanation:** Catalytic site of enzyme is activated when a suitable substrate molecule have been chemically bonded with the binding site of an enzyme.

**Q.27 Answer is “Lock and key model”**

**Explanation:** According to “Lock and Key Model” the active site of an enzyme is a rigid structure. There is no modification or flexibility in the active site, before, during or after the enzyme action and it is used only as a template.

**Q.28 Answer is “Induced Fit Model”**

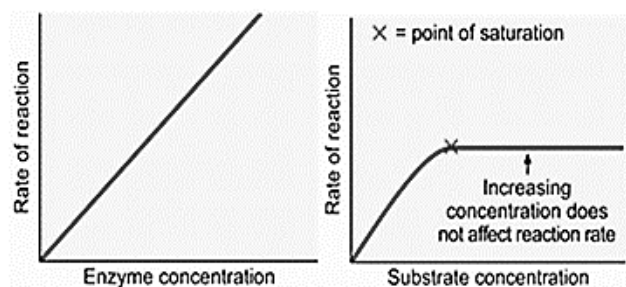
**Explanation:** Koshland’s Induced Fit model recognizes the flexibility in enzyme structure and in this way an appropriate substrate on coming closer to the enzyme may induce certain changes in the active site of that enzyme to become fit with substrate.

**Q.29 Answer is “Specific chemistry and configuration”**

**Explanation:** Any change in chemistry and configuration will change the shape of active site of enzyme and it will become misfit for its substrate.

**Q.30 Answer is “Unlimited”**

**Explanation:** Because substrate is that substance which is transformed into product(s) by the action of enzyme.



**Your STEP Towards A Brighter Future!**

**Q.31 Answer is “More active site”**

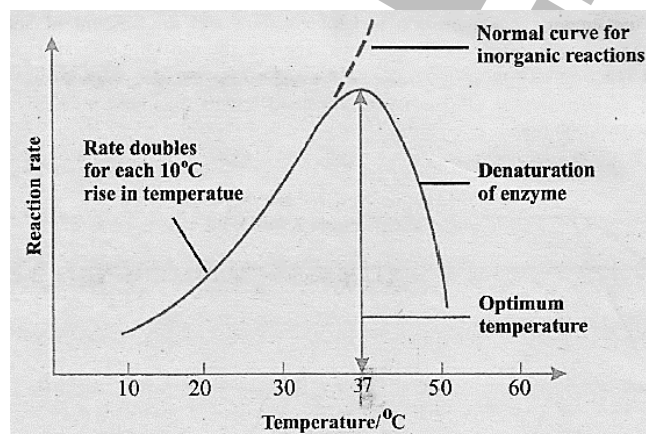
**Explanation:** Active sites are the active parts of enzyme which act upon a substrate. Thus by increasing the number of enzyme molecules more active sites will be available to act upon substrate molecules.

**Q.32 Answer is “Increase for a specific time”**

**Explanation:** Initially the rate will increase as more and more enzyme molecules will be involved in catalysis but soon a saturation stage will come when all the active sites will be occupied. Thus finally the increase in substrate concentration will be of no use without increasing the concentration of enzyme. Please see the graph given in the explanation of question # 23.

**Q.33 Answer is “Temperature upto optimum level”**

**Explanation:** Further increase in temperature beyond optimum temperature will start the denaturation of enzyme molecules and as a result the enzyme action will be slowed down.

**Q.34 Answer is “Heat provides activation energy”**

**Explanation:** Heat increases the kinetic energy of substrate and enzyme molecules which results in an increase in activation energy and as a result rate of enzyme action increases. Please see the graph given in the explanation of question # 26.

**Q.35 Answer is “Increase initially”**

**Explanation:** Initially when temperature is increased from any lower point, the kinetic energy of molecules is increased and as a result the rate of enzyme catalysis also increases. Later on when temperature moves beyond maximum range the movement of molecules will become so violent that they start coming out of the enzyme structure and enzyme denaturation starts consequently.

**Q.36 Answer is “Two basic types”**

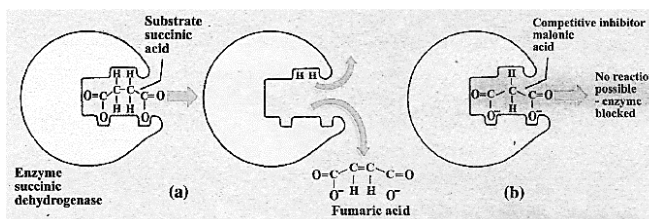
**Explanation:** Reversible and irreversible inhibitors.

**Q.37 Answer is “Non-competitive inhibitors”**

**Explanation:** When change is temporary it is reversible inhibitor and if the inhibitor is changing the enzyme structure as well it cannot compete with substrate for same active site, it is non-competitive inhibitor.

**Q.38 Answer is “Fumaric acid”**

**Explanation:** Fumaric acid is a product which is obtained by removing two hydrogen atoms from succinic acid. The reaction is catalyzed by succinic acid dehydrogenase enzyme.

**Q.39 Answer is “No reaction possible, Enzyme is blocked”**

**Explanation:** Malonic acid is a competitive reversible inhibitor of succinic acid



substrate and it blocks the succinic acid dehydrogenase enzyme.

**Q.40** Answer is “Enzyme and Co-enzyme”

**Explanation:** Both enzyme and co-enzyme are obtained unaltered at the end of reaction and remain available again for use.

**Q.41** Answer is “Pepsin”

**Explanation:** Pepsin being proteolytic enzyme is a potentially damaging enzyme having capability to digest the gut wall as well as to the that cell which is secreting it. Thus it is secreted in inactive form.

**Q.42** Answer is “E”

**Explanation:** The end product of last reaction in a chain of biochemical reactions controls the entire pathway either positively (by feedback activation) or negatively (by feedback inhibition)

**Q.43** Answer is “Feedback inhibition”

**Explanation:** Cell have limited space thus product should be produced according to need. The excess cause storage disorders. Thus upon accumulation of end products, the pathway is inhibited from first step and this is called feedback inhibition and vice versa.

**Q.44** Answer is “Feedback activation”

**Explanation:** In a chain of biochemical reaction, if the end product of last reaction is deficient, the first step in the pathway is activated.

**Q.45** Answer is “Koshland”

**Explanation:** On the basis of new evidences Koshland (1959) proposed its modified form.

**Q.46** Answer is “6.80”

**Explanation:**

Enzyme	Optimum pH
Pepsin	2.00
Sucrase	4.50
Enterokinase	5.50
Salivary amylase	6.80
Catalase	7.60
Chymotrypsin	7.00-8.00
Pancreatic lipase	9.00
Arginase	9.70

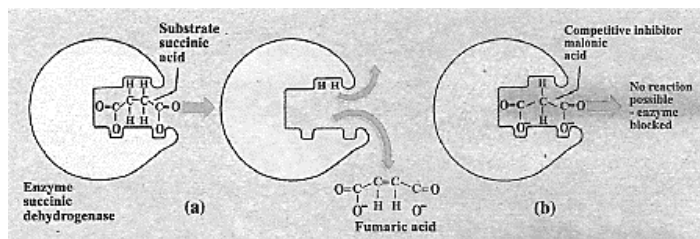
**Q.47** Answer is “9.00”

**Explanation:**

Enzyme	Optimum pH
Pepsin	2.00
Sucrase	4.50
Enterokinase	5.50
Salivary amylase	6.80
Catalase	7.60
Chymotrypsin	7.00-8.00
Pancreatic lipase	9.00
Arginase	9.70

**Q.48** Answer is “Succinic dehydrogenase”

**Explanation:**



**Q.49** Answer is “Extreme pH change”

**Explanation:** Extreme changes in pH cause the bonds in the enzymes to break, resulting in the enzyme denaturation.

**Q.50** Answer is “Catalyst”

**Explanation:** Glossary Page # IV, Book – I.

### Worksheet-10

#### (Chromosomes and DNA)

- Q.1** At the beginning of translation, a tRNA molecule carrying a chemically modified \_\_\_\_\_ binds to the \_\_\_\_\_.  
A) Methionine, Small ribosomal subunit  
B) Methionine, Large ribosomal subunit  
C) Tyrosine, Large ribosomal subunit  
D) Tyrosine, Small ribosomal subunit
- Q.2** The site of ribosome where peptide bond is formed is called:  
A) Aminoacyl site C) Peptidyl site  
B) Exit site D) E site
- Q.3** A site of ribosome where empty tRNAs will leave the ribosome is called:  
A) Aminoacyl site C) Peptidyl site  
B) Exit site D) A-site
- Q.4** In translation, the initiation complex guided by another \_\_\_\_\_ binds to AUG on the RNA.  
A) Elongation factor C) Initiation factor  
B) Release factor D) tRNA synthetase
- Q.5** After initiation complex has formed, the larger ribosomal subunit binds \_\_\_\_\_ molecule with the appropriate \_\_\_\_\_.  
A) mRNA, anticodon C) tRNA, anticodon  
B) mRNA, codon D) tRNA, codon
- Q.6** The protein called elongation factor assists the tRNA in binding to the exposed \_\_\_\_\_ at the \_\_\_\_\_.  
A) mRNA codon, A-site  
B) mRNA codon, P-site  
C) rRNA, A-site  
D) rRNA, P-Site

- Q.7** In translation, methionine is released from its tRNA and is attached instead by a peptide bond to the second amino acid. This is catalyzed by:  
A) Small ribosomal subunit  
B) Initiation factor  
C) Elongation factor  
D) Large ribosomal subunit
- Q.8** The movement of ribosome on mRNA translocates the initial tRNA to the \_\_\_\_\_ site and ejects it from the ribosome.  
A) A C) U  
B) P D) E
- Q.9** \_\_\_\_\_ codons do not bind to tRNA, but they are recognized by release factors.  
A) Initiation C) Non sense  
B) Start D) Anti sense
- Q.10** According to the principle of semi conservative replication the sequence of the original \_\_\_\_\_ is conserved after one round of replication, the \_\_\_\_\_ itself is not.  
A) Duplex, Helix C) Duplex, Duplex  
B) Helix, Duplex D) Helix, Helix
- Q.11** In semi conservative replication, the two strands of duplex separate out, each acting as a \_\_\_\_\_ or \_\_\_\_\_ along which nucleotides are arranged thus giving rise to two new duplexes.  
A) Copy or mould C) Model, mould  
B) Cast or mould D) Model, Copy
- Q.12** In the process of semi-conservative replication:  
A) Primary structure is conserved  
B) Secondary structure is conserved  
C) Primary structure is changed  
D) Primary structure is disrupted
- Q.13** The conservative model of DNA replication stated that the parental double helix would \_\_\_\_\_ and \_\_\_\_\_



- generate DNA copies consisting of entirely new molecules.
- A) Be disrupted  
B) Remain intact  
C) Be opened  
D) Remain partially intact
- Q.14** In this model of DNA replication parental DNA would become completely dispersed and each strand of all the daughter molecules would be a mixture of old and new DNA:
- A) Conservative C) Dispersive  
B) Semi conservative D) Semi-dispersive
- Q.15** The density of DNA containing \_\_\_\_\_ was exactly intermediate to that of the DNA containing \_\_\_\_\_ and \_\_\_\_\_ respectively.
- A)  $N^{15}/N^{14}$ ,  $N^{14}/N^{14}$  and  $N^{15}/N^{15}$   
B)  $N^{14}/N^{14}$ ,  $N^{15}/N^{14}$  and  $N^{15}/N^{15}$   
C)  $N^{15}/N^{15}$ ,  $N^{15}/N^{14}$  and  $N^{14}/N^{14}$   
D)  $N^{15}/N^{14}$ ,  $N^{15}/N^{14}$  and  $N^{14}/N^{14}$
- Q.16** Meselson and Stahl interpreted that after the first round of replication, each daughter DNA duplex was hybrid possessing one of the \_\_\_\_\_ strands of parent molecule and one \_\_\_\_\_ strand.
- A) Heavy, Heavy C) Heavy, Light  
B) Light, Light D) Light, Heavy
- Q.17** In Meselson and Stahl experiments in  $F_1$  generation DNA was:
- A) Heavy  
B) Light  
C) Hybrid  
D) Neither light nor heavy
- Q.18** There are \_\_\_\_\_ DNA polymerases in bacteria.
- A) Two C) Four  
B) Three D) Five
- Q.19** In bacteria, polymerases involved in DNA replication is/are:
- A) I C) III  
B) II D) III and I

- Q.20** The true E. coli replicating enzyme is:
- A) DNA poly – I C) DNA poly - III  
B) DNA poly – II D) DNA poly - IV
- Q.21** This enzyme is a dimer and catalyzes replication of one DNA strand:
- A) DNA poly – I C) DNA poly - III  
B) DNA poly – II D) DNA poly - IV
- Q.22** DNA polymerase cannot:
- A) Carry out DNA replication  
B) Carry out DNA synthesis  
C) Initiate DNA replication  
D) Add nucleotides to a nucleotide chain
- Q.23** Pick up the choice that is incorrect about RNA primer:
- A) Constructed by Primase  
B) A sequence of about 10 RNA nucleotides  
C) Complementary to the parent DNA template  
D) Constructed by RNA polymerase
- Q.24** DNA polymerase III recognizes the \_\_\_\_\_ and adds DNA nucleotides to it to construct DNA strands.
- A) DNA template C) Primase  
B) Primer D) Parental strand
- Q.25** In DNA replication the replacement of RNA nucleotides of primer is catalyzed by:
- A) DNA poly – I C) DNA poly – III  
B) DNA poly – II D) RNA poly
- Q.26** Replication always proceeds in:
- A)  $5' \rightarrow 3'$  direction C)  $3' \rightarrow 3'$  direction  
B)  $3' \rightarrow 5'$  direction D)  $5' \rightarrow 5'$  direction
- Q.27** Because the two parental strands of a DNA are \_\_\_\_\_, the new strands are oriented in \_\_\_\_\_ direction.
- A) Parallel, Parallel  
B) Parallel, Opposite  
C) Antiparallel, Same  
D) Antiparallel, Opposite

**Q.28 Pick up the choice that is not true with respect to DNA replication:**

- A) New strands grow in different directions
- B) Leading strand grows towards replication fork
- C) Leading strand grows continuously
- D) Lagging strand grows continuously

**Q.29 The lagging strand of DNA elongates:**

- A) Towards replications fork
- B) Away from replications fork
- C) Continuously
- D) Discontinuously away from replication fork

**Q.30 The length of Okazaki fragments in eukaryotes is:**

- A) 1000 – 2000 nucleotides
- B) 100 – 200 nucleotides
- C) 10 – 20 nucleotides
- D) 10,000 – 20,000 nucleotides

**Q.31 Vernon Ingram discovered Sickel cell anemia by working at:**

- A) Oxford University
- B) Cambridge University
- C) Tübingen University
- D) California University

**Q.32 Sickel cell hemoglobin occurs due to the immediate replacement of:**

- A) Valine by Glutamic acid
- B) Glutamic acid by valine
- C) Thymine by adenine
- D) Adenine by thymine

**Q.33 The critical changes leading to sickle cell disease is a mutation that replaces a single:**

- A) Adenine with thymine
- B) Thymine with adenine
- C) Guanine with cytosine
- D) Cytosine with guanine

**Q.34 The sequence of nucleotides that determines the amino acid sequence of a protein is called:**

- A) Gene
- B) Allele
- C) Chromosome
- D) Primer

**Q.35 Pick up the  $\beta$  chain of normal hemoglobin:**

- A) Valine – Histidine – Leucine – Threonine – Proline – Glutamic acid
- B) Valine – Glutamic acid – Leucine – Threonine – Proline – Glutamic acid
- C) Valine – Histidine – Leucine – Threonine – Proline – Glutamic acid – Valine
- D) Valine – Histidine – Leucine – Threonine – Proline – Valine – Glutamic acid

**Q.36 Pick up the  $\beta$  chain for sickle cell hemoglobin:**

- A) Valine – Histidine – Leucine – Threonine – Proline – Glutamic
- B) Valine – Glutamic acid – Leucine – Threonine – Proline – Glutamic acid
- C) Valine – Histidine – Leucine – Threonine – Proline – Glutamic acid – Valine
- D) Valine – Histidine – Leucine – Threonine – Proline – Valine – Glutamic acid

**Q.37 The first step of central dogma is the transfer of information from:**

- A) RNA to DNA
- B) DNA to RNA
- C) RNA to proteins
- D) Proteins to RNA

**Q.38 \_\_\_\_\_ is initiated when the enzyme RNA polymerase binds to a particular binding site called a promoter located upstream of a gene.**

- A) Translation
- B) Transcription
- C) Replication
- D) Central Dogma

**Q.39 The second step of the central dogma is the transfer of information from:**

- A) Protein to RNA
- B) RNA to Proteins
- C) Proteins to DNA
- D) DNA to RNA

**Q.40** The nucleotide sequence of the mRNA is translated into an amino acid sequence during:

- A) Transcription      C) Replication  
B) Translation      D) Mutation

**Q.41** Two steps of central dogma provide means of:

- A) Translation      C) Gene expression  
B) Transcription      D) Mutation

**Q.42** \_\_\_\_\_ are long strands of RNA that are transcribed from \_\_\_\_\_ and that travel to the ribosomes to direct precisely which amino acids are assembled into polypeptides.

- A) mRNA, tRNA      C) mRNA, DNA  
B) mRNA, rRNA      D) mRNA, snRNA

**Q.43** Only one of the two strands of DNA is:

- A) Replicated      C) Transcribed  
B) Uncoiled      D) Meaningful

**Q.44** The strand of DNA which is not transcribed is called:

- A) Coding or template strand  
B) Coding or sense strand  
C) Template or antisense strand  
D) Template or sense strand

**Q.45** The RNA polymerase enzyme synthesizes RNA in:

- A) 5' → 5' direction  
B) 5' → 3' direction  
C) 3' → 3' direction  
D) 3' → 5' direction

**Q.46** Transcription starts at the \_\_\_\_\_ on DNA template strand.

- A) RNA polymerase binding site  
B) Promotor site  
C) RNA polymerase binding site called promoter

D) DNA polymerase binding site

**Q.47** Pick up the binding sites within promoter of Prokaryotes:

- A) -35 and -75      C) -35 and -25  
B) -35 and -10      D) -75 and -25

**Q.48** The -10 sequence of prokaryotes reads as:

- A) TATAAT      C) TAGACA  
B) TTGACA      D) GACAAT

**Q.49** In transcription the parental DNA duplex opens up to give rise to:

- A) Transcription fork  
B) Replication fork  
C) Transcription bubble  
D) Replication bubble

**Q.50** The stop sequence at the end of the gene terminates the synthesis of:

- A) mRNA      C) tRNA  
B) DNA      D) rRNA

**Q.51** The newly synthesized mRNA has to travel long distance from inside the nucleus to ribosomes in:

- A) Bacteria      C) Cyanobacteria  
B) Prokaryotes      D) Eukaryotes

**Q.52** To mRNA of eukaryotes \_\_\_\_\_ and \_\_\_\_\_ is added so that the molecule may remain stable during long journey to ribosomes.

- A) Cap, Tail  
B) Initiation codon, termination codon  
C) Start codon, Stop codon  
D) GC hair pins, 7 methyl GTP

**Q.53** The tail of mRNA transcript is in the form of \_\_\_\_\_ linked to \_\_\_\_\_.

- A) Poly A, 3' end of RNA  
B) 7 methyl GTP, 3' end of RNA  
C) 7 methyl GTP, 5' end of RNA  
D) Poly A, 5' end of RNA

**Q.54** UAA, UGA and UAG respectively code for:

- A) Leucine, Alanine, Serine
- B) Leucine, Serine, Alanine
- C) Leucine, Glycine, Alanine
- D) No amino acid, No amino acid, No amino acid

**Q.55** UAA is a \_\_\_\_\_ codon.

- A) Stop
- B) Non sense
- C) Termination
- D) Stop, Non sense or Termination

**Q.56** Every gene starts with:

- A) Initiation codon
- B) Start codon
- C) AUG
- D) Initiation, Start or AUG codon

**Q.57** Transfer of genes from one organism to other and its successful transcription and translation in new host is possible because:

- A) Genetic language is universal
- B) Entire living world follows the central dogma
- C) Mechanism of gene expression is universal
- D) All organisms have similar genes

**Q.58** The most applicable statement about genetic code is that:

- A) It is universal
- B) It is not that universal
- C) It is not quite universal
- D) It is not universal

**Q.59** The mRNA lies on the ribosome in such a way that only \_\_\_\_\_ of its

codons is exposed at the polypeptide site at any time.

- A) 01
- B) 02
- C) 03
- D) 04

**Q.60** A tRNA molecule possessing the complementary three nucleotide sequence of \_\_\_\_\_, binds to the exposed \_\_\_\_\_ in mRNA.

- A) Codon, Codon
- B) Codon, Anticodon
- C) Anticodon, Anticodon
- D) Anticodon, Codon

**Q.61** N-formyl methionine is a:

- A) Chemically modified methionine
- B) Photo reactive methionine
- C) Deaminated methionine
- D) Acetylated of methionine

**Q.62** Genetic code is a combination of:

- A) Two nucleotides
- B) Three nucleotides
- C) Four nucleotides
- D) Five nucleotides

**Q.63** Genetic code is a \_\_\_\_\_ code:

- A) Twin
- B) Quadruplet
- C) Duplet
- D) Triplet

**Q.64** Thread like structures that appear inside the nucleus at the time of cell division are called:

- A) Chromatin fibers
- B) Chromosomes
- C) Spindle fibers
- D) Microtubules

**Q.65** Chromosomes were first observed by:

- A) T. H. Morgan
- B) Carl Correns
- C) W.S. Sutton
- D) Walther Fleming

**Q.66** \_\_\_\_\_ have been found in all eukaryotic cells:

- A) Centrosomes
- C) Mesosomes



- B) Centrioles                      D) Chromosomes
- Q.67 The genes are transported to the daughter cells through vehicles called:**
- A) Nuclei                              C) Chromosomes  
B) Centrioles                      D) Spindle fibers
- Q.68 Missing of a part of or whole of chromosomes leads to:**
- A) Variation                          C) Evolution  
B) Diversification                  D) Mutation
- Q.69 Following are the components of a chromosome, EXCEPT:**
- A) Centromere  
B) Chromatids  
C) Centrosome  
D) Primary constriction
- Q.70 Chromosomes may widely differ in:**
- A) Roles                                  C) Behavior  
B) Composition                      D) Appearance
- Q.71 Chromosomes vary in following features, EXCEPT:**
- A) Size  
B) Arm length  
C) Chemical composition  
D) Centromeric position
- Q.72 Karyotype include following features, EXCEPT:**
- A) Position of constricted regions on chromosome  
B) The relative lengths of two arms  
C) Staining properties  
D) Role performed in cell
- Q.73 The chromosomes with arm length ratio of 1:1 are called:**
- A) Acrocentric                      C) Sub-metacentric  
B) Telocentric                      D) Metacentric

- Q.74 One extremely longer and one extremely shorter arms are found in:**
- A) Telocentric chromosomes  
B) Acrocentric chromosomes  
C) Sub-metacentric chromosomes  
D) Metacentric chromosomes
- Q.75 The chromosomes with single arms are called:**
- A) Acrocentric                      C) Sub-metacentric  
B) Telocentric                      D) Metacentric
- Q.76 Which one of the following chromosomes acquires the shape of English letter 'L' during anaphase of mitosis?**
- A) Acrocentric                      C) Sub-metacentric  
B) Telocentric                      D) Metacentric
- Q.77 Major quantitative chemical component of chromosome is:**
- A) Protein                              C) RNA  
B) DNA                                  D) Lipid
- Q.78 Major functional component of chromosome is:**
- A) DNA                                  C) RNA  
B) Proteins                              D) Nucleic acid
- Q.79 If we gently disrupt a eukaryotic nucleus and examine the DNA with an electron microscope, we find that it resembles a:**
- A) Chromosome                      C) String of beads  
B) Chromatid                          D) Coiled rope
- Q.80 In structural organization of eukaryotic chromosomes supercoils are made up of:**
- A) Coils                                  C) Beaded string  
B) Chromatin fiber                  D) Chromatids

**ANSWER KEY (Worksheet-10)**

1	A	21	C	41	C	61	A
2	C	22	C	42	C	62	B
3	B	23	D	43	C	63	D
4	C	24	B	44	B	64	B
5	C	25	A	45	B	65	D
6	A	26	A	46	C	66	D
7	D	27	D	47	B	67	C
8	D	28	D	48	A	68	D
9	C	29	D	49	C	69	C
10	C	30	B	50	A	70	D
11	C	31	B	51	D	71	C
12	A	32	B	52	A	72	D
13	B	33	B	53	A	73	D
14	C	34	A	54	D	74	B
15	A	35	A	55	D	75	B
16	C	36	D	56	D	76	C
17	C	37	B	57	A	77	A
18	B	38	B	58	A	78	A
19	D	39	B	59	A	79	C
20	C	40	B	60	D	80	A

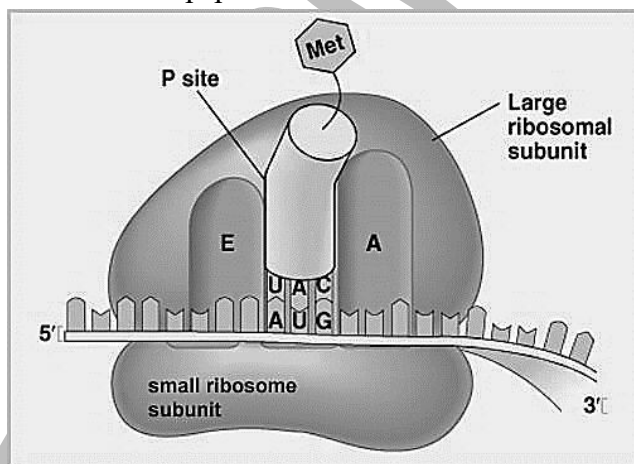
**EXPLANATION**

**Q.1** Answer is “Methionine, small ribosomal subunit”

**Explanation:** In prokaryotes polypeptide synthesis begins with the formation of initiation complex. First the tRNA molecule carrying a chemically modified methionine (called N-formyl methionine) binds to the small ribosomal subunit. Protein called initiation factor positions the tRNA on ribosomal surface at the P site where peptide bond is formed.

**Q.2** Answer is “Peptidyl site”

**Explanation:** ‘P’ site on ribosome is that site where peptide bond is formed.



**Q.3** Answer is “Exit site”

**Explanation:** ‘E’ site is exit site where empty tRNAs will exit the ribosome.

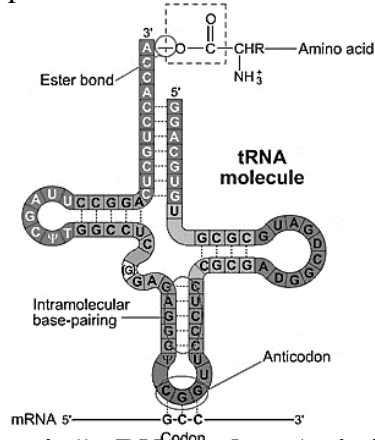
**Q.4** Answer is “Initiation factor”

**Explanation:** Initiation factors are proteins that bind to the small subunit of the ribosome during the initiation of translation, a part of protein synthesis. They are divided into three major groups.

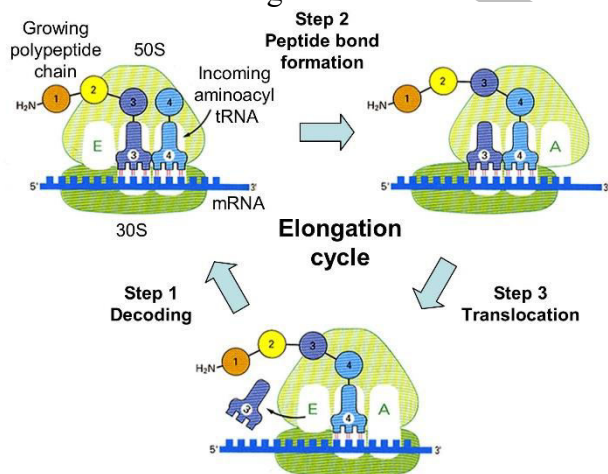
- Prokaryotic initiation factor
- Archael initiation factor
- Eukaryotic initiation factor

**Q.5 Answer is “tRNA, anticodon”**

**Explanation:** After the formation of initiation complex, the large ribosomal subunit binds tRNA molecule with the appropriate anticodon, protein called elongation factors assists in binding it to the exposed mRNA codon at the ‘A’ site.

**Q.6 Answer is “mRNA codon, A-site”**

**Explanation:** Elongation factors are sets of proteins that are used in protein synthesis in the process of cell cycle and elongation in some cells. In the ribosome, they facilitate translational elongation, from the formation of the first peptide bond to the formation of last one. Each time tRNA is guided to enter on site A.

**Q.7 Answer is “Large ribosomal subunit”**

**Explanation:** The two amino acids which lie adjacent to each other undergo a chemical reaction, catalyzed by the large ribosomal subunit, which releases the

initial amino acid from its tRNA and attaches it instead by a peptide bond to the second amino acid.

**Q.8 Answer is “E”**

**Explanation:** The movement of ribosomes along the mRNA molecule in the 5' → 3' direction, translocates the initial tRNA to the E site and ejects it from the ribosome.

**Q.9 Answer is “Non-sense”**

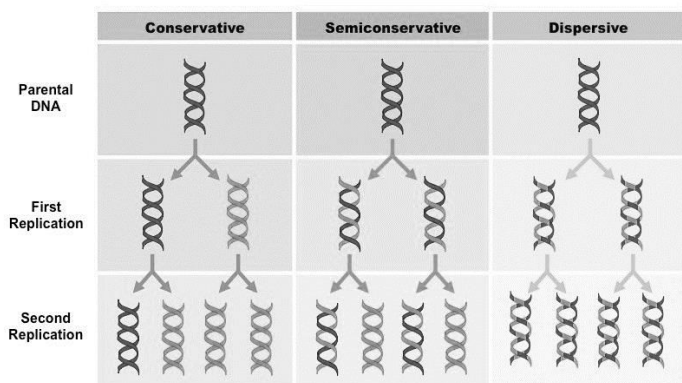
**Explanation:** The non-sense codon also called stop or termination codons, do not encode any genetic information (amino acid), thus they are not recognized by the anticodon of any tRNA. However, they are recognized by the release factor. A release factor is a protein that allows for the termination of translation by recognizing the termination codon or stop codon in an mRNA sequence. UAA, UAG and UGA are stop codons.

**Q.10 Answer is “Duplex , Duplex”**

**Explanation:** The sequence of original duplex is conserved due to semi-conservative replication i.e. both parental strand get separated and start acting as template and two new complementary strands are formed. Thus two new duplexes result in each with same sequence of nucleotides as was held by parental duplex.

**Q.11 Answer is “Model, mould”**

**Explanation:** In semi conservative replication each strand of parental DNA duplex is conserved and it acts as a template for newly formed strand.



**Q.12** Answer is “Primary structure is conserved”

**Explanation:** The nucleotide sequence in each strand of DNA duplex represents the primary structure of DNA which is not affected in semi conservative replication, however the duplex (double helical structure) which represents the secondary structure of DNA duplex is demolished.

**Q.13** Answer is “Remain intact”

**Explanation:** According to conservative replication the entire parental DNA duplex is conserved and a completely new duplex is formed.

**Q.14** Answer is “Dispersive”

**Explanation:** That is why it is called dispersive model of replication as the original DNA is completely broken up into its nucleotides, then new nucleotides are mixed with them to synthesize two duplexes.

**Q.15** Answer is “ $N^{15}/N^{14}$ ,  $N^{14}/N^{14}$  and  $N^{15}/N^{15}$ ”

**Explanation:**  $N^{15}/N^{14}$  being hybrid DNA duplex have density lesser than  $N^{15}/N^{15}$  and more than  $N^{14}/N^{14}$  i.e. it has intermediate density. Thus, it settles in between the pure  $N^{14}/N^{14}$  and pure  $N^{15}/N^{15}$  duplexes.

**Q.16** Answer is “Heavy, light”

**Explanation:** Original DNA was completely heavy  $N^{15}/N^{15}$ , so after semi-conservative replication it should be hybrid, as a single light strand is formed.

**Q.17** Answer is “Hybrid”

**Explanation:** In  $F_1$  generation reused by Meselson and Stahl DNA was hybrid i.e. one strand (parental) was heavy whereas other strand was light.

**Q.18** Answer is “Three”

**Explanation:** There are three DNA polymerase namely I, II and III in bacteria. DNA polymerase I is relatively small enzyme that plays a supporting role in DNA replication. True E.coli replicating enzyme is DNA polymerase III which is 10 times larger and far more complex in structure. The enzyme is a dimer and catalyzes replication of one DNA strand. Polymerase III progressively threads the DNA through the enzyme complex, moving at a rapid rate, some 100 nucleotides per second.

**Q.19** Answer is “III and I”

**Explanation:** DNA poly-II is a DNA repairing enzyme which keeps on carrying out surveillance on DNA and repairs it immediately wherever it is needed.

Type DNA polymerase	Function
DNA poly-I	Converts RNA primer into DNA.
DNA poly-II	It is a DNA repairing enzyme.
DNA poly-III	It is actual polymerase related with replication of DNA.

**Q.20** Answer is “DNA poly-III”

**Explanation:** The actual DNA replication enzyme is DNA polymerase-III DNA poly-I only transforms the RNA primer into DNA fragments.

**Q.21** Answer is “DNA polymerase-III”

**Explanation:** DNA polymerase III is a dimer and catalyzes replication of one DNA strand at a time.

**Q.22** Answer is “Initiate DNA replication”



**Explanation:** It can only elongate the already existing polynucleotide chain. That is why primer is used.

**Q.23 Answer is “Constructed by RNA polymerase”**

**Explanation:** Primase constructs the primer which is a specific type of RNA polymerase that is why it is preferable over mere RNA polymerase.

**Q.24 Answer is “Primer”**

**Explanation:** Primer is a launching pad for DNA polymerase enzyme.

**Q.25 Answer is “DNA poly-I”**

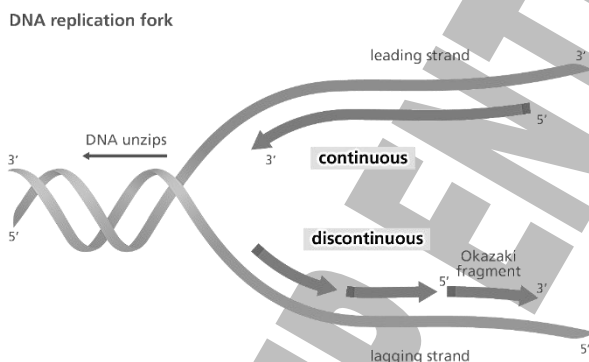
**Explanation:** DNA polymerase-I converts the RNA primer into DNA.

**Q.26 Answer is “5 to 3 direction”**

**Explanation:** As DNA polymerase-III adds new nucleotides at position 3 of polynucleotide chain.

**Q.27 Answer is “Antiparallel, Opposite”**

**Explanation:** As parental DNA strands are antiparallel, thus, construction of new DNA strand against each template strand will also be antiparallel or opposite.



**Q.28 Answer is “Lagging strand grows continuously”**

**Explanation:** Lagging strand grows away from replication fork, thus it is synthesized in fragments called Okazaki fragments and its replication is always discontinuous.

**Q.29 Answer is “Discontinuously away from replication fork”**

**Explanation:** Lagging strand grows away from replication fork, thus it is synthesized

in fragments called Okazaki fragments and its replication is always discontinuous.

**Q.30 Answer is “100 – 200 nucleotides”**

**Explanation:** It is 100 – 200 nucleotides in eukaryotes whereas 1000 – 2000 nucleotides in prokaryotes.

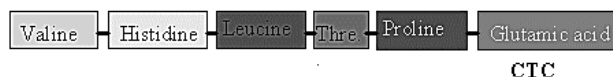
**Q.31 Answer is “Cambridge university”**

**Explanation:** Following Sanger's pioneer work Veron Ingram in 1956 discovered the molecular basis of sickle cell anemia, a protein defect inherited as a Mendelian disorder.

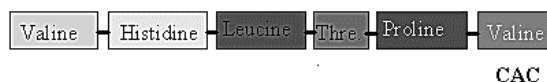
**Q.32 Answer is “Glutamic acid by valine”**

**Explanation:** Its genetic basis or root cause is a mutation involving replacement of a thymine with an adenine, however an immediate cause is replacement of amino acids.

Normal Hemoglobin Beta Chain  
First six amino acids



Hemoglobin S Beta Chain  
First six amino acids



One nucleotide has changed

**Q.33 Answer is “Thymine with adenine”**

**Explanation:** At DNA level a thymine nucleotide is replaced by adenine nucleotide and as result the triplet code encoding glutamic acid is replaced by a triplet code encoding valine. Consequently valine replaces glutamic acid. As amino acid sequence is very important for specific protein. Thus by this change normal hemoglobin protein is transformed into sickle cell hemoglobin and the person suffers from anemia because modified hemoglobin stops carrying gases (O<sub>2</sub> and CO<sub>2</sub>).

**Q.34 Answer is “Gene”**

**Explanation:** Gene is basically a nucleotide sequence which specifies the amino acid sequence in a specific protein.

**Q.35 Answer is “Valine – Histidine – Leucine – Threonine – Proline – Glutamic acid”**

**Explanation:** In  $\beta$  chain of sickle cell hemoglobin glutamic acid at position six is replaced by valine.

**Q.36 Answer is “Valine – Histidine – Leucine – Threonine – Proline – Valine – Glutamic acid”**

**Explanation:** In  $\beta$  chain of sickle cell hemoglobin glutamic acid at position seven have been replaced by valine.

**Q.37 Answer is “DNA to RNA”**

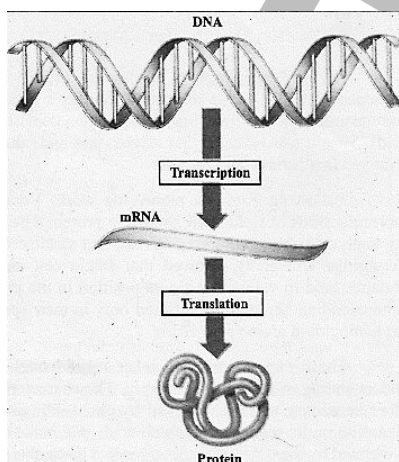
**Explanation:** In central dogma first the DNA is converted into RNA (transcription) and it is in turn converted (translated) into polypeptide proteins.

**Q.38 Answer is “Transcription”**

**Explanation:** RNA polymerase is involved in the formation transcription and starts transcription just behind the RNA primer.

**Q.39 Answer is “RNA to proteins”**

**Explanation:** In translation the RNA transcript is converted into a polypeptide protein.



**Q.40 Answer is “Translation”**

**Explanation:** During translation the transcribed information of mRNA is

translocated into a specific polypeptide protein.

**Q.41 Answer is “Gene expression”**

**Explanation:** As gene encodes information of a particular protein and synthesis of that protein is considered as expression of that encoded information.

**Q.42 Answer is “mRNA, DNA”**

**Explanation:** mRNA is a long chain of nucleotides which is synthesized from DNA template by the process of transcription.

**Q.43 Answer is “Transcribed”**

**Explanation:** It is template strand or antisense strand whereas the other strand not used in transcription is called coding strand or sense strand.

**Q.44 Answer is “Coding or sense strand”**

**Explanation:** It is called so because it is exact replica of mRNA except uracil have been replaced thymine.

**Q.45 Answer is “5 to 3 direction”**

**Explanation:** Just like DNA polymerase, RNA polymerase also adds new nucleotides to position 3 of nucleotide chain.

**Q.46 Answer is “RNA polymerase binding site called promotor”**

**Explanation:** Transcription always starts at promotor site.

**Q.47 Answer is “-35 and -10”**

**Explanation:** -35 means 35 nucleotides down the order and 10 means ten nucleotides down the order.

**Q.48 Answer is “TATAAT”**

**Explanation:** TATAAT is -10 promotor site of prokaryotic cells.

**Q.49 Answer is “Transcription bubble”**

**Explanation:** As genes are mostly located at intercalary positions and DNA is opened in-between the ends so bubble is

formed instead of fork which is formed in replication.

**Q.50 Answer is “mRNA”**

**Explanation:** As stop sequence is an indication for termination of transcription.

**Q.51 Answer is “Eukaryotes”**

**Explanation:** Prokaryotes lack nuclear membrane and their chromosome is directly submerged in cytoplasm, so mRNA after being formed from DNA of chromosome starts being translated. However, in eukaryotes chromosomes are located inside the nucleus where site of translation is cytoplasm, so mRNA have to travel that distance.

**Q.52 Answer is “Cap, tail”**

**Explanation:** As it has to travel a long distance through a hostile environment loaded with nucleases and acid phosphatases.

**Q.53 Answer is “Poly A, 3 end of RNA”**

**Explanation:** Making addition of further nucleotide impossible and inhibiting entrance of any enzyme as well, both tail and head of mRNA transcript are covered in eukaryotes.

**Q.54 Answer is “No amino acid, No amino acid, No amino acid”**

**Explanation:** These are stop, termination or non-sense codons.

**Q.55 Answer is “Stop, non-sense or termination codon”**

**Explanation:** Stop codon is also called termination codon or non-sense codon because it does not encode any amino acid and polypeptide chain is terminated at it.

**Q.56 Answer is “Initiation, start or AUG codon”**

**Explanation:** Initiation codon or start codon is specified to start the polypeptide chain by methionine amino acid.

**Q.57 Answer is “Genetic language is universal”**

**Explanation:** Same genetic code transcribes or encodes same amino acid in chromosomal DNA of any organism.

**Q.58 Answer is “It is universal”**

**Explanation:** As in most of the cases it is same. The only exception is extrachromosomal DNA.

**Q.59 Answer is “01”**

**Explanation:** Three nucleotides or triplet code is exposed at A site of ribosome after initiation.

**Q.60 Answer is “Anticodon, codon”**

**Explanation:** Coded language of mRNA which have been encoded in form of triplet codes is read by anticodons of tRNA and accordingly amino acids are delivered.

**Q.61 Answer is “Chemically modified methionine”**

**Explanation:** N-formyl methionine is a derivative of the amino acid Methionine in which formyl group has been added to amino group. It is specifically used for initiation of protein synthesis in bacterial and organellar genes.

**Q.62 Answer is “Three nucleotides”**

**Explanation:** As it is a triplet code.

**Q.63 Answer is “Triplet”**

**Explanation:** Triplet code means each codon consists of set of three nucleotides.

**Q.64 Answer is “Chromosomes”**

**Explanation:** Chromatin networks which is visible in the nucleus of a non-dividing cell, is transformed into discrete structures called chromosomes by means of coiling and condensation as the nuclear division (karyokinesis) starts.

**Q.65 Answer is “Walther Fleming”**

**Explanation:**

Sr. #	Name of scientist	Contribution
1)	T.H Morgan	Worked on sex determination and sex linkage in <i>Drosophila</i> and got Nobel prize in 1911.
2)	Carl Correns	German geneticist who suggested the role of chromosome in heredity in her papers named "Rediscovery of Mendel's work"
3)	W.S Sutton	Walter Stan Join borough Sutton, An American geneticist formulated chromosomal theory of inheritance.
4)	Walther Fleming	German biologist and founder of cytogenetic observed rapidly dividing cells of a salamander larvae and first observed the chromosomes.

**Q.66 Answer is "Chromosomes"**

**Explanation:** Discrete chromosomes are found in all eukaryotic cells in variable number, however centrosome, along with centrioles are absent in plant cells and mesosomes are found only in prokaryotic/bacterial cells.

**Q.67 Answer is "Chromosomes"**

**Explanation:** Chromosomes are carriers of genes. Each of them contains hundreds or thousands of genes that play important roles in determining how persons body develops and functions. That is why the possession of all chromosomes is essential for survival. The sites of chromosome where genes are located are called loci (pl.), locus (sing.).

**Q.68 Answer is "Mutation"**

**Explanation:** Recombination, crossing over and reshuffling of genetic material during sexual reproduction are sources of variation, diversification and evolution. However, loss of part or whole chromosome is called chromosomal aberration of number which is a type of mutation and have serious consequences in form of physical or physiological retardation and usually becomes lethal as well.

**Q.69 Answer is "Centrosome"**

**Explanation:** Typically a chromosome is made of chromatids, centromere (also called primary constriction) and secondary constriction. However, centrosome is an organelle found in animal cells containing a pair of centrioles located at right angle to each other. Centrosome is located on the exterior surface of nucleus.

**Q.70 Answer is "Appearance"**

**Explanation:** All eukaryotic chromosomes are carriers of genes having same role in heredity. Their behavior in various stages of cell cycle is also same. However, their appearance and morphology differs with changing position of centromere, relative length, thickness and staining behavior.

**Q.71 Answer is "Chemical composition"**

**Explanation:** Chromosomes vary in size, staining properties, the location of centromere, the relative lengths of the two arms on either side of centromere and position of constricted regions along the arms. However, their chemical composition is same i.e. nucleoproteins. Similarly, all chromosomes carry genes and have same role in inheritance.

**Q.72 Answer is "Role performed in cell"**

**Explanation:** Chromosomes vary in size, staining properties, the location of



centromere, the relative lengths of the two arms on either side of centromere and position of constricted regions along the arms. However, their chemical composition is same i.e. nucleoproteins. Similarly, all chromosomes carry genes and have same role in inheritance.

**Q.73 Answer is “Metacentric”**

*Explanation:*

Sr. #	Type of chromosome	Description
1)	Telocentric	Chromosomes having centromere at one end. There will be only one arm. It acquires the shape of English letter ‘i’ during anaphase of mitosis.
2)	Acrocentric	Chromosomes having centromere located slightly below one end, with extremely shorter arm. The arm ratio is like 2 : 10. It acquires the shape of English letter ‘j’ during anaphase of mitosis.
3)	Sub-metacentric	Chromosomes having centromere located slightly away from the centre with a slightly longer and slightly shorter arm. The arm ratio will be like 6 : 8. It acquires the shape of English letter ‘L’ during anaphase of mitosis.
4)	Metacentric	Such chromosomes have centromere exactly in the centre with equal arm length on both side. The arm ratio will be like 5 : 5. It acquires the shape of English letter ‘v’ during anaphase of mitosis

**Q.74 Answer is “Acrocentric chromosomes”**

*Explanation:* See explanation of Q # 73.

**Q.75 Answer is “Telocentric”**

*Explanation:* See explanation of Q # 73.

**Q.76 Answer is “Sub-metacentric”**

*Explanation:* See explanation of Q # 73.

**Q.77 Answer is “Protein”**

*Explanation:*

Protein : 60%

DNA : 40%

**Q.78 Answer is “DNA”**

*Explanation:* Function of chromosomes is to carry genes which are physical units of heredity and genes are made up of DNA having coded information in form of nucleotide sequence. Through chromosomes have 60% proteins but proteins have no direct link with inheritance.

**Q.79 Answer is “String of beads”**

*Explanation:* When DNA of a non-dividing cell (a cell with intact nucleus) is observed under electron microscope it look like beaded string because histone octamers are wrapped in DNA ribbon to form nucleosomes and nucleosomes are linked together by ribbon of linker DNA.

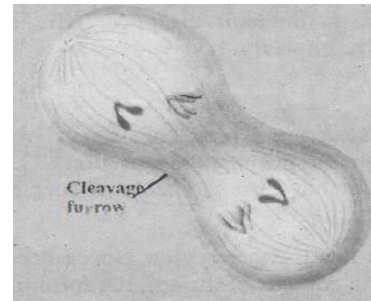
**Q.80 Answer is “Coils”**

*Explanation:* DNA ribbon wraps the histone octamers to form a beaded string which coils and condenses to give rise to the chromatin fiber and chromatin fiber gives rise to coils, coils form supercoils which form chromatids and chromatids form chromosomes.

**Worksheet-11**  
**(Cell Division)**

- Q.1** The cell undergoes a sequence of changes which involves all of the following, EXCEPT:  
A) Period of growth  
B) Replication of DNA  
C) Followed by cell division  
D) Followed by nuclear mitosis
- Q.2** Pick up the phase of cell cycle with non-apparent division \_\_\_\_\_ phase:  
A) Inter  
B) Mitotic  
C) Meiotic  
D) Post mitotic
- Q.3** It is the period of great biochemical activity:  
A) Interphase  
B) Mitotic phase  
C) Meiotic phase  
D) Post mitotic phase
- Q.4** \_\_\_\_\_ is the period of extensive metabolic activity:  
A) G<sub>1</sub>  
B) G<sub>2</sub>  
C) S  
D) G<sub>0</sub>
- Q.5** Which one of the following is misleadingly called resting phase?  
A) Interphase  
B) Mitotic phase  
C) G<sub>1</sub> phase  
D) S phase
- Q.6** The phase of cell cycle in which specific enzymes are synthesized and DNA base units are accumulated for the DNA synthesis:  
A) G<sub>1</sub> phase  
B) G<sub>2</sub> phase  
C) G<sub>0</sub> phase  
D) S phase
- Q.7** The phase of cell cycle during which the DNA is synthesized is called:  
A) G<sub>1</sub>  
B) S  
C) G<sub>2</sub>  
D) G<sub>0</sub>

- Q.8** Length of cell cycle in case of human is about:  
A) 24 hours  
B) 1.5 hours  
C) 12 hours  
D) 5 hours
- Q.9** Length of cell cycle in yeast cell is about of \_\_\_\_\_ minutes:  
A) 30  
B) 60  
C) 90  
D) 150
- Q.10** Spindle fibers attach on to:  
A) Centromere of the chromosome  
B) Kinetochore of the chromosome  
C) Telomere of the chromosome  
D) Tip of the chromosome
- Q.11** During meiosis I, the chromosomes start pairing in:  
A) Zygotene  
B) Diplotene  
C) Pachytene  
D) Leptotene
- Q.12** Identify the stage of mitosis in the given below figure:

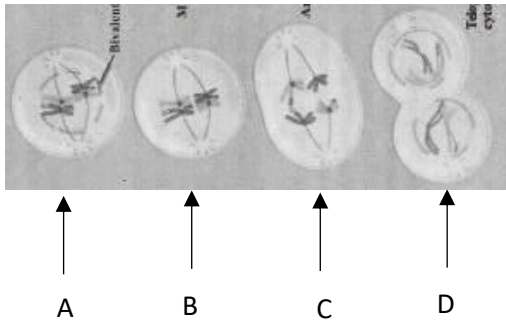


- A) Late prophase  
B) Metaphase  
C) Anaphase  
D) Telophase
- Q.13** Identify the stage of meiosis in the given below figure:



- A) Prophase  
B) Metaphase  
C) Anaphase  
D) Telophase

**Q.14 Identify the anaphase I of meiosis I:**



**Q.15 Microtubules are composed of a protein \_\_\_\_\_ and traces of \_\_\_\_\_:**

- A) Tubulin, RNA      C) Myosin, RNA  
B) Actin, RNA      D) Tubulin, DNA

**Q.16 The centromere has special area, the \_\_\_\_\_:**

- A) Telomere  
B) Kinetochore  
C) Primary constriction  
D) Secondary constriction

**Q.17 Which one of the following is the most critical phase of mitosis?**

- A) Prophase      C) Anaphase  
B) Metaphase      D) Telophase

**Q.18 The phase of mitosis which ensures the equal distribution of chromatids in the daughter cells:**

- A) Prophase      C) Anaphase  
B) Metaphase      D) Telophase

**Q.19 Reaching of the chromosomes at opposite poles terminates \_\_\_\_\_ and start \_\_\_\_\_:**

- A) Prophase, Metaphase  
B) Anaphase, Telophase  
C) Metaphase, Anaphase  
D) Prophase, Telophase

**Q.20 Tissue culture and cloning seek help through:**

- A) Crossing over      C) Meiosis  
B) Mitosis      D) Binary fission

**Q.21 Regeneration, healing of wounds and replacement of older cells all are the gifts of:**

- A) Crossing over      C) Meiosis  
B) Mitosis      D) Binary fission

**Q.22 An exchange of segments between non-sister chromatids of homologous chromosomes during meiosis is called:**

- A) Chiasmata      C) Crossing over  
B) Recombination      D) Mutation

**Q.23 Disc-shaped protein structure within the centromere to which the spindle fibres attached during mitosis or meiosis called:**

- A) Telomere  
B) Kinetochore  
C) Primary constriction  
D) Secondary constriction

**Q.24 Homologous chromosomes, each having sister chromatids, that are joined by a nucleoprotein lattice during meiosis called:**

- A) Monovalent      C) Tetravalent  
B) Bivalent      D) Pentavalent

**Q.25 During which phase of meiosis, the kinetochore fibers contract and the spindle or pole fibers elongate:**

- A) Prophase I      C) Anaphase I  
B) Metaphase I      D) Telophase I

**Q.26 Meiosis usual takes place in all of the following, EXCEPT:**

- A) Spore formation in plants  
B) Sex cell formation  
C) Healing of wounds  
D) Gametes formation in animals

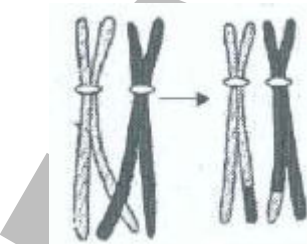
**Q.27 First essential phenomenon of meiosis i.e., pairing of homologous chromosomes called:**

- A) Recombinant      C) Tetrad  
B) Synapsis starts      D) Bivalent

- Q.28** During meiosis I, the chromosomes start pairing at:  
A) Zygotene C) Pachytene  
B) Diplotene D) Leptotene
- Q.29** During the metaphase stage of mitosis, spindle fibres attach to chromosomes at:  
A) Kinetochore  
B) Both centromere and kinetochore  
C) Centromere, kinetochore and areas adjoining centromere  
D) Centromere
- Q.30** A stage of mitosis is shown in the diagram. Pickup the stage along with its characteristics:



- A) Metaphase –centromeres split and chromatids separate  
B) Metaphase – Chromosomes moved to spindle equator  
C) Anaphase – Centromeres split and chromatids separate and start moving away  
D) Telophase – Chromosomes move to spindle equator
- Q.31** The given diagram is the representation of a particular stage of a type of cell division. Identify this stage?



- A) Prophase I during meiosis  
B) Prophase II during meiosis  
C) Prophase of mitosis  
D) Telophase of mitosis

- Q.32** At metaphase, chromosomes are attached to the spindle fibres by their:  
A) Primary constrictions  
B) Secondary constrictions  
C) Kinetochores  
D) Centromeres
- Q.33** Spindle fibre unit with which structure of chromosomes?  
A) Chromocentre C) Kinetochore  
B) Chromomere D) Centriole
- Q.34** Microtubule is involved in which of the following?  
A) Muscle contraction  
B) Membrane architecture  
C) Cell division  
D) DNA recognition
- Q.35** Number of mitotic divisions are required to make 128 cells?  
A) 28 C) 7  
B) 32 D) 14
- Q.36** When paternal and maternal chromosomes changes their materials with each other in cell division this event is called:  
A) Bivalent forming C) Synapsis  
B) Tetard D) Crossing over
- Q.37** Meiosis II performs:  
A) Separation of sex chromosomes  
B) Synthesis of DNA and centromere  
C) Separation of homologous chromosomes  
D) Separation of chromatids
- Q.38** Each kinetochore gets \_\_\_\_\_ fibers in mitosis:  
A) 2 C) 4  
B) 3 D) 6
- Q.39** Pick up the most critical phase of mitosis:  
A) Prophase C) Anaphase  
B) Metaphase D) Telophase
- Q.40** Which one of the following is reverse of prophase?  
A) Interphase C) Metaphase  
B) Anaphase D) Telophase
- Q.41** Spread of tumor cells and establishment of secondary areas of growth is called:  
A) Benign tumors C) Cancer  
B) Metastasis D) Apoptosis



- Q.42 Pick up the longest phase of meiosis I:**  
A) Metaphase I                      C) Anaphase II  
B) Prophase I                        D) Telophase I
- Q.43 \_\_\_\_\_ may lasts for days, weeks or even years:**  
A) Zygotene                          C) Pachytene  
B) Leptotene                        D) Diplotene
- Q.44 Cytokinesis refers to division of:**  
A) Nucleus                          C) Cytoplasm  
B) Whole cell                        D) Mitochondria
- Q.45 S-phase in case of human cell cycle is:**  
A) 30 minutes                        C) 9 hours  
B) 10 hours                          D) 4.5 hours
- Q.46 Which one of the following is absent in animal cell?**  
A) Spindle                          C) Centriole  
B) Chromatids                      D) Phragmoplast
- Q.47 The spindle fibers are composed of RNA and protein called:**  
A) Myoglobin                        C) Tubulin  
B) Actin                              D) Myosin
- Q.48 The condensation of chromosomes reaches to its maximum at:**  
A) Leptotene                        C) Zygotene  
B) Pachytene                        D) Diakinesis
- Q.49 Separation of homologous chromosomes occurs during:**  
A) Prophase                        C) Metaphase  
B) Anaphase                        D) Telophase
- Q.50 The stage of mitosis or meiosis during which the microtubules become organized into a spindle and the chromosomes come to lie in the spindles equatorial plane is called:**  
A) Prophase                        C) Anaphase  
B) Metaphase                        D) Telophase

**ANSWER KEY (Worksheet-11)**

1	D	21	B	41	B
2	A	22	C	42	B
3	A	23	B	43	C
4	A	24	B	44	B
5	A	25	C	45	B
6	A	26	C	46	D
7	B	27	B	47	C
8	A	28	A	48	D
9	C	29	A	49	B
10	B	30	B	50	B
11	A	31	A		
12	C	32	C		
13	B	33	C		
14	C	34	C		
15	A	35	C		
16	B	36	D		
17	C	37	D		
18	C	38	A		
19	B	39	C		
20	B	40	D		

**EXPLANATION**

**Q.1** Answer is "Followed by nuclear mitosis"

**Explanation:** The cell undergoes a sequence of changes, which involves period of growth, replication of DNA, followed by cell division. This sequence of changes of called cell cycle.

**Q.2** Answer is "Inter"

**Explanation:** It comprises two phases viz., interphase which is the period of non-apparent division and the period of division also known as mitotic phase. Each phase is further subdivided into different sub-phases.

**Q.3** Answer is "Interphase"

**Explanation:** The period of life cycle of cell (cell cycle) between two consecutive divisions is termed as the interphase or misleadingly called resting phase. It is the period of great biochemical activity and can further be divided into G<sub>1</sub>-phase, S-phase and G<sub>2</sub>-phase.

**Q.4** Answer is "G<sub>1</sub>"

**Explanation:** G<sub>1</sub> (Gap 1) is the period of extensive metabolic activity, in which cell normally grows in size, specific enzymes, are synthesized and DNA base units are accumulated for the DNA synthesis.

**Q.5** Answer is "Interphase"

**Explanation:** The period of life cycle of cell (cell cycle) between two consecutive division is termed as the interphase or misleadingly called resting phase.

**Q.6** Answer is "G<sub>1</sub> phase"

**Explanation:** G<sub>1</sub> (Gap 1) is the period of extensive metabolic activity, in which cell normally grows in size, specific enzymes, are synthesized and DNA base units are accumulated for the DNA synthesis.

**Q.7** Answer is "S"

**Explanation:** The phase of cell cycle during which the DNA is synthesized is called synthesizes phase.

**Q.8** Answer is "24 hours"

**Explanation:** Length of each phase is variable. In the case of human cell, average cell cycle is about 24 hours, mitosis takes 30 minutes.

**Q.9** Answer is "90"

**Explanation:** Whereas full cycle in yeast cells is only 90 minutes.

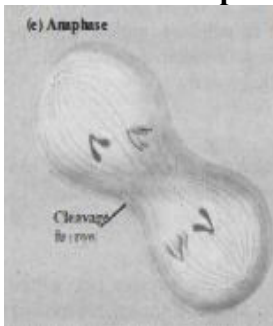
**Q.10** Answer is "Kinetochore of the chromosome"

**Explanation:** Spindle fibers attach on to kinetochore of the chromosome.

**Q.11** Answer is "Zygote"

**Explanation:** First essential phenomenon of meiosis i.e. pairing of homologous chromosomes called synapsis starts. This pairing is highly specific and exactly pointed but with no definite starting points. Each paired but not fused, complex structure is called bivalent or tetrad.

**Q.12 Answer is “Anaphase”**



**Q.13 Answer is “Metaphase”**



**Q.14 Answer is “C”**



**Q.15 Answer is “Tubulin, RNA”**

**Explanation:** Microtubules are composed of a protein tubulin and traces of RNA.

**Q.16 Answer is “Kinetochore”**

**Explanation:** The centromere has special area known as kinetochore which is formed a special protein.

**Q.17 Answer is “Anaphase”**

**Explanation:** Anaphase is the most critical phase of mitosis.

**Q.18 Answer is “Anaphase”**

**Explanation:** The phase of mitosis which ensures the equal distribution of chromatids in the daughter cells is called anaphase.

**Q.19 Answer is “Anaphase, Telophase”**

**Explanation:** Reaching of the chromosomes at opposite poles terminates anaphase and start telophase.

**Q.20 Answer is “Mitosis”**

**Explanation:** Tissue culture and cloning seek help through mitosis.

**Q.21 Answer is “Mitosis”**

**Explanation:** Regeneration, healing of wounds and replacement of older cells all are the gifts of mitosis.

**Q.22 Answer is “Crossing over”**

**Explanation:** An exchange of segments between non-sister chromatids of homologous chromosomes during meiosis is called crossing over.

**Q.23 Answer is “Kinetochore”**

**Explanation:** Disc-shaped protein structure within the centromere to which the spindle fibres attached during mitosis or meiosis called kinetochore.

**Q.24 Answer is “Bivalent”**

**Explanation:** First essential phenomenon of meiosis i.e. pairing of homologous chromosomes called synapsis starts. This pairing is highly specific and exactly pointed but with no definite starting points. Each paired but not fused, complex structure is called bivalent or tetrad.

**Q.25 Answer is “Anaphase I”**

**Explanation:** The kinetochore fibers contract and the spindle or pole fibers elongate, which pull the individual chromosome (each having two chromatids) towards their respective poles.

**Q.26 Answer is “Healing of wounds”**

**Explanation:** Some organisms, both plants and animals, undergo asexual reproduction. Regeneration, healing of wounds and replacement of older cells all are the gifts of mitosis.

**Q.27 Answer is “Synapsis starts”**

**Explanation:** First essential phenomenon of meiosis i.e. pairing of homologous chromosomes called synapsis starts. This pairing is highly specific and exactly pointed but with no definite starting points. Each paired but not fused, complex structure is called bivalent or tetrad.

**Q.28 Answer is “Zygotene”**

**Explanation:**

During zygotene or zygonema of meiotic prophase I the chromosomes become shorter and thicker. homologous chromosomes come to lie side-by-side in pairs. This pairing of homologous chromosomes is known as synapsis, or syndesis. A pair of homologous chromosomes lying together is called a bivalent.

**Q.29 Answer is “Kinetochore”**

**Explanation:**

In metaphase, chromosomes consisting of two sister chromatids get arranged at equator. Discontinuous fibres radiate out from two spindle poles and get connected to the disc shaped structure at the surface of the centromere called kinetochores. These are known as chromosome fibres or tractile fibrils. A kinetochore is a complex protein structure that is analogous to a ring for the microtubule hook; it is the point where microtubules attach themselves to the chromosome.

**Q.30 Answer is “Metaphase – Chromosomes moved to spindle equator”**

**Explanation:**



**Q.31 Answer is “Prophase I during meiosis”**

**Explanation:** The given figure shows crossing over i.e., exchange of segments between two homologous chromosomes. Crossing over is characteristic of meiosis and occurs during pachytene stage of prophase I.

**Q.32 Answer is “Kinetochores”**

**Explanation:**

The key feature of metaphase is the attachment of spindle fibres to

kinetochores of chromosomes. Kinetochores are disc-shaped structures at the surface of the centromeres. These structures serve as the sites of attachment of spindle fibres to the chromosomes that are moved into position.

**Q.33 Answer is “Kinetochore”**

**Explanation:**

Spindle is microtubular apparatus that appears in many eukaryotic cells at the beginning of nuclear division and is responsible for the ordered separation of the chromosomes, chromosomes being attached to the spindle fibres by their centromeres. Two types of spindle fibres can be distinguished as the interpolar fibre, which stretches continuously from pole to pole of the spindle; the kinetochore fibre, which stretches from the pole to the centromere (kinetochore) of an individual chromosome. The mechanism by which the chromosomes move and the spindle fibres contract remains unclear. Cells of animals and lower plants possess centrioles, which act as organizer regions for spindle microtubule formation, but centrioles are absent from the cells of higher plants.

**Q.34 Answer is “Cell division”**

**Explanation:**

Microtubules are unbranched hollow submicroscopic tubules of protein tubulin which develop on specific nucleating regions and can undergo quick growth or dissolution at their ends by assembly or disassembly of monomers. Microtubules form spindle during cell division. Centrioles help in cell division by forming spindle poles or microtubules. In animal cells, microfilament collect in the middle region of the cell below the cell membrane. They induce the cell membrane to invaginate.

In plant cells, cell plate is formed to separate the two daughter cells. Some of the spindle fibres called interzonal



microtubules are deposited around phragmoplast. Vesicles from Golgi apparatus are deposited and coalesce on the phragmoplast to form a cell plate.

**Q.35 Answer is “7”**

**Explanation:** Mitosis is an equational division where after division each cell produces two daughter cells, therefore after 7 divisions one cell will give 128 cells in case of mitosis.

$1 \xrightarrow{1} 2 \xrightarrow{2} 4 \xrightarrow{3} 8 \xrightarrow{4} 16 \xrightarrow{5} 32 \xrightarrow{6} 64 \xrightarrow{7} 128$

**Q.36 Answer is “Crossing over”**

**Explanation:** Crossing over is responsible for inducing variability. It involves an exchange of equal segments of non-sister chromatids belonging to two different but homologous chromosomes. Crossing over takes place at four stranded stage. Only two of the four chromatids take part in crossing over. The other two are called non crossovers. Zygotene is characterized by pairing of homologous chromosomes which is called synapsis. The first meiotic division which is completed at first telophase may be followed by cytokinesis giving rise to a dyad.

**Q.37 Answer is “Separation of chromatids”**

**Explanation:** Meiosis II is shorter than the typical mitotic division because of the shortening of prophase of this division. The division maintains the number of chromosomes produce at the end of reduction division. Hence, it is called homotypic or equational division, though it is similar to mitosis. The main function of homotypic division or meiosis II is to separate the chromatids of univalent chromosomes which differ from each other in their linkage groups due to crossing over.

**Q.38 Answer is “2”**

**Explanation:**

Each kinetochore gets 2 fibers in mitosis.

**Q.39 Answer is “Anaphase”**

**Explanation:** It is the most critical phase of the mitosis, which ensures equal distribution of chromatids in the daughter cells.

**Q.40 Answer is “Telophase”**

**Explanation:** Telophase is reverse of prophase.

**Q.41 Answer is “Metastasis”**

**Explanation:** Spread of tumor cells and establishment of secondary areas of growth is called metastasis.

**Q.42 Answer is “Prophase I”**

**Explanation:** This is very prolonged phase, and differs from the prophase of mitosis, because in this chromosomes behave as homologous pairs.

**Q.43 Answer is “Pachytene”**

**Explanation:** Pachytene may lasts for days, weeks or even years, whereas leptotene and zygotene can last only for few hours.

**Q.44 Answer is “Whole cell”**

**Explanation:** Karyokinesis, which involves the division of nucleus and cytokinesis that refers to the division of the whole cell.

**Q.45 Answer is “10 hours”**

**Explanation:** In the case of human cell, average cell cycle is about 24 hours, mitosis takes 30 minutes,  $G_1$  9 hours, the S-phase 10 hours, and  $G_2$  4.5 hours, where full cycle in yeast cells is only 90 minutes.

**Q.46 Answer is “Phragmoplast”**

**Explanation:** Phragmoplast is absent in animal cell and present in plant cell.

**Q.47 Answer is “Tubulin”**

**Explanation:** The spindle fibers are composed of RNA and protein called Tubulin.

**Q.48 Answer is “Diakinesis”**

**Explanation:** During this phase the condensation of chromosomes reaches to its maximum. At the same time separation of the homologous chromosomes (started during diplotene) is completed, but still they are united at one point, more often at ends, Nucleoli disappear.

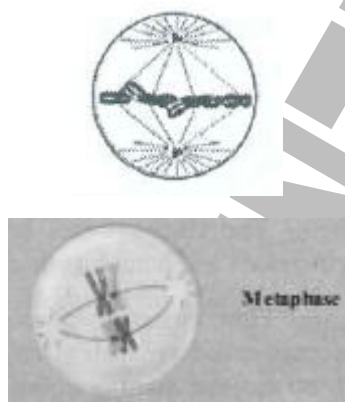
**Q.49 Answer is “Anaphase”**

**Explanation:** Separation of homologous chromosomes occurs during anaphase.



**Q.50 Answer is “Metaphase”**

**Explanation:** The stage of mitosis or meiosis during which the microtubules become organized into a spindle and the chromosomes come to lie in the spindle's equatorial plane is called metaphase.



**Worksheet-12**  
**(Variety of Life)**

**Q.1 Reverse transcriptase can convert:**

- A) Single stranded RNA genome into single stranded DNA
- B) Single stranded RNA genome into double stranded DNA
- C) Double stranded DNA genome into single stranded RNA
- D) Double stranded DNA genome into double stranded RNA

**Q.2 In case of HIV, only \_\_\_\_\_ can infect host cells.**

- A) Single stranded RNA
- B) Double stranded DNA
- C) Double stranded RNA
- D) Single stranded DNA

**Q.3 The double stranded viral DNA can be incorporated into host T<sub>4</sub> genome as a:**

- A) Prophage
- B) Provirus
- C) Bacteriophage
- D) Phage virus

**Q.4 Some retroviruses can convert:**

- A) Cancer cells into normal cells
- B) Cancer cells into germ line cells
- C) Cancer cells into degenerated cells
- D) Normal cells into cancer cells

**Q.5 The AIDS was reported by some physicians in early 1980's in young homosexual males. They showed following symptoms, EXCEPT:**

- A) Severe pneumonia and a rare vascular cancer
- B) Rare pneumonia and a severe vascular cancer
- C) Sudden weight loss and swollen lymph nodes

D) Swollen lymph nodes and general loss of immune functions

**Q.6 Soon after the initial victims of AIDS, the disease was discovered in \_\_\_\_\_ patients, who were given blood products.**

- A) Homosexuals
- B) Females
- C) Non-homosexuals
- D) Transsexuals

**Q.7 The agent causing the AIDS was identified by research teams from:**

- A) Pasteur institute in USA
- B) National institute of health in France
- C) Pasteur Institute in USA and National Institute of health in France
- D) Pasteur Institute in France and National Institute of health in USA

**Q.8 Human immunodeficiency virus causes:**

- A) Severe combined immunodeficiency syndrome
- B) Acquired immunodeficiency syndrome
- C) Non-Hodgkin's lymphoma
- D) Bubble boy disease

**Q.9 Recent studies on HIV reveal that the virus infects and multiplies in \_\_\_\_\_ but does not cause disease in them.**

- A) Heterosexual males
- B) Young homosexual males
- C) Monkeys
- D) Young homosexual females

**Q.10 Following are the means of transmission of AIDS, EXCEPT:**

- A) Intimate sexual contact and breast feeding
- B) Use of common syringes and surgical instruments
- C) Blood transfusion without screening
- D) Human immunodeficiency virus

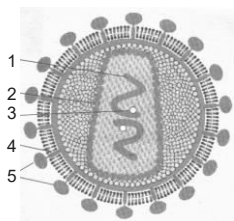
**Q.11** The most important measure to prevent AIDS and HIV is:

- A) Avoiding intravenous drugs
- B) Avoiding intracellular drugs
- C) Avoiding use of syringes
- D) Avoiding the direct contact with HIV

**Q.12** Now vaccine against \_\_\_\_\_ have been synthesized and its experimental administration in humans started in South Africa.

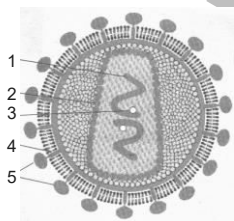
- A) Hepatitis – C
- B) HIV
- C) Hepatitis – A
- D) Hepatitis – B

**Q.13** Which of the following are of viral origin?



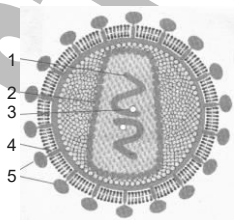
- A) 1,2,3,4
- B) 1,2,3,5
- C) 2,3,4,5
- D) 1,2,4,5

**Q.14** Which one of the following is not of viral origin?



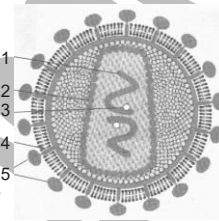
- A) 2
- B) 3
- C) 4
- D) 5

**Q.15** Which of the following is viral envelope?



- A) 2
- B) 3
- C) 4
- D) 5

**Q.16** Pick up the reverse transcriptase:



- A) 2
- B) 3
- C) 4
- D) 5

**Q.17** HIV is uncoated:

- A) Outside the cytoplasm
- B) At the surface of the host cell
- C) Inside the cytoplasm
- D) Inside the nucleus of the host cell

**Q.18** How many molecules of RNA are found in HIV:

- A) 2
- B) 3
- C) 4
- D) 5

**Q.19** How many molecules of reverse transcriptase are found in HIV:

- A) 2
- B) 3
- C) 4
- D) 5

**Q.20** In infection cycle of HIV RNA is converted into DNA duplex by:

- A) Replication
- B) Transcription
- C) Reverse transcription
- D) Translation

**Q.21** In infection cycle of HIV after attachment there comes:

- A) Entry
- B) Uncoiling
- C) Reverse transcription
- D) Integration



**Q.22** Cd<sub>4</sub> receptor bearing T Lymphocyte is infected by:

- A) HIV C) HCV  
B) HBV D) HAV

**Q.23** T<sub>4</sub> phage consists of:

- A) Head C) Nucleocapsid  
B) Tail D) Head and tail

**Q.24** Following are true about head of T<sub>4</sub> phage EXCEPT:

- A) Hexagonal structure  
B) Pyramidal structure  
C) Prism shaped structure  
D) An oval structure

**Q.25** "Two triangular structures with common base" is the description of the structure of \_\_\_\_\_ of T<sub>4</sub> phage.

- A) Tail C) Head  
B) Collar D) Base plate

**Q.26** Within the head of T<sub>4</sub> phage \_\_\_\_\_ molecule is present.

- A) Single Stranded DNA  
B) Double stranded DNA  
C) Single Stranded RNA  
D) Double stranded RNA

**Q.27** The structure of phage \_\_\_\_\_ is more complex than \_\_\_\_\_.

- A) Head, Tail  
B) Tail, Head  
C) Collar, Base plate  
D) Head, Base plate

**Q.28** About tail of T<sub>4</sub> phage which one is not true:

- A) Core or tube is made up of distinct protein  
B) Core or tube is enclosed in sheath

C) Core and sheath are made of same type of protein

D) Sheath is made of another type of protein

**Q.29** The volume of T<sub>4</sub> phage is about \_\_\_\_\_ times shorter than that of host:

- A) 01 C) 100  
B) 10 D) 1000

**Q.30** The bacteriophage is adsorbed to host cell at \_\_\_\_\_ of bacterium.

- A) Receptor site C) Cell membrane  
B) Cell wall D) Capsule

**Q.31** A bacteriophage is attached to the receptor site on the host cells:

- A) Slime C) Cell membrane  
B) Cell wall D) Envelope

**Q.32** In Rhizopus zygote is formed by fusion of hyphae of:

- A) Minus mating strains  
B) Minus mating and plus mating strain  
C) Plus mating strain  
D) Same fungus

**Q.33** In life cycle of Rhizopus, the hyphal tips after coming in contact with each are transformed into:

- A) Sporangia C) Sporangiohores  
B) Conidiophores D) Gametangia

**Q.34** In life cycle of Black bread mold, gametangia after plasmogamy and karyogamy give rise to:

- A) Zygospor C) Basidiospores  
B) Ascospores D) Conidiophore

**Q.35** In the life cycle of Rhizopus diploid spores are produced in:

- A) Asexual reproduction only  
B) Sexual reproduction only  
C) Both in sexual and asexual reproduction

- D) Both in fragmentation and budding
- Q.36 Pick up the true choice with respect to the life cycle of Rhizopus:**
- A) Haploid Zygosporangia  $\xrightarrow{\text{mitosis}}$  Haploid spores
- B) Diploid Zygosporangia  $\xrightarrow{\text{mitosis}}$  Diploid spores
- C) Diploid Zygosporangia  $\xrightarrow{\text{meiosis}}$  Haploid spores
- D) Diploid Zygosporangia  $\xrightarrow{\text{meiosis}}$  Diploid spores
- Q.37 Which one of the following phases of life cycle of Rhizopus is delayed?**
- A) Dikaryotic C) Diploid
- B) Heterokaryotic D) Meiosis
- Q.38 Without the activity of \_\_\_\_\_ along with \_\_\_\_\_ all the essential nutrients would soon become locked up in the mounds of dead animals and plants:**
- A) Fungi, Saprobic bacteria
- B) Algae, Saprobic bacteria
- C) Fungi, Parasitic bacteria
- D) Algae, Parasitic bacteria
- Q.39 Mycorrhizal fungi improves the growth of \_\_\_\_\_ of all kinds of vascular plants through its association:**
- A) 95% C) 85%
- B) 90% D) 80%
- Q.40 \_\_\_\_\_ growing on rocks breaks them, setting stage for other organisms during the course of ecological succession.**
- A) Ectomycorrhizae C) Bacteria
- B) Endomycorrhizae D) Lichen
- Q.41 \_\_\_\_\_ are very good bioindicators of air quality as they are very sensitive to pollution.**
- A) Lichens C) Rhizopus
- B) Mycorrhizae D) Penicillium
- Q.42 Some fungi are also used for:**

- A) Bioabsorption
- B) Environmental degradation
- C) Bioremediation
- D) Biological control
- Q.43 Bioremediation means:**
- A) Degrading pollutants
- B) Removing pollutants
- C) Degrading or removing environmental poisons
- D) Degrading or removing environmental poisons or pollutants by organisms
- Q.44 Give example of edible fungi:**
- A) *Agaricus sp.*
- B) *Tuber sp.*
- C) *Morchella esculenta*
- D) *Agaricus sp.*, *Morchella esculenta* and *Tuber sp.*
- Q.45 Give example of poisonous mushrooms:**
- A) Death cap/death angel
- B) *Saccharomyces cerevisiae*
- C) Jack – O Lantern
- D) Death cap/death angel and Jack – O Lantern
- Q.46 Reindeers moss is used as food for reindeers and some other large animals in:**
- A) Arctic regions
- B) Boreal regions
- C) Sub-arctic regions
- D) Arctic, Sub-arctic and boreal regions
- Q.47 Because of its fermenting ability it is used in the production of bread and liquor:**
- A) *Saccharomyces cerevisiae*
- B) *Neurospora*
- C) *Penicillium notatum*
- D) *Asperillus fumigatus*
- Q.48 Yeasts are heavily used in genetic/molecular biological research, because of the:**
- A) Rapid generation

- B) Rapid increasing pool of genetic information  
C) Rapidly increasing pool of biochemical information  
D) Rapid generation and rapidly increasing pool of genetic and biochemical information
- Q.49 Some species of \_\_\_\_\_ are used for producing soya sauce and soya paste from soya beans.**  
A) *Penicillium* C) *Yeast*  
B) *Aspergillus* D) *Neurospora*
- Q.50 *Penicillin* is dominated from:**  
A) *Saccharomyces cerevisiae*  
B) *Penicillium griseofulvum*  
C) *Penicillium notatum*  
D) *Neurospora crassa*
- Q.51 It is used in organ transplantation in preventing transplant rejection:**  
A) Lovastatin C) *Penicillium*  
B) Cyclosporine D) Griseofulvin
- Q.52 Lovastatin is used for:**  
A) Lowering blood cholesterol  
B) Relief in migraine  
C) Preventing transplant rejection  
D) Inhibiting fungal growth
- Q.53 Griseofulvin is used for:**  
A) Lowering blood cholesterol  
B) Relief in migraine  
C) Preventing transplant rejection  
D) Inhibiting fungal growth
- Q.54 It is used to relieve one kind of headache called migraine:**  
A) Lovastatin C) Ergotine  
B) Cyclosporine D) Griseofulvin
- Q.55 Antibiotics are synthesized by:**  
A) Actinomycetes  
B) Fungi  
C) Bacteria  
D) Actinomycetes, Bacteria and Fungi

- Q.56 Some antibiotics are synthesized in:**  
A) Bacteria C) Fungi  
B) Actinomycetes D) Laboratory
- Q.57 Massive quantities of antibiotics are being prepared and used, which are followed by the widespread problems of:**  
A) Drug resistance in microorganisms  
B) Drug addiction in microorganisms  
C) Drug sensitivity in microorganisms  
D) Intoxication in human being
- Q.58 These are the first eukaryotes to be used by genetic engineers:**  
A) Lichen C) Mycorrhizae  
B) Yeast D) Rhizopus
- Q.59 A functional artificial chromosome was made in:**  
A) *Aspergillus fumigatus*  
B) *Saccharomyces cerevisiae*  
C) *Penicillium notatum*  
D) *Penicillium griseofulvin*
- Q.60 \_\_\_\_\_ has also been used for genetic research.**  
A) Pink bread mold  
B) Blue bread mold  
C) Black bread mold  
D) Pink bread mold called *Neurospora*
- Q.61 Fungi are responsible for many serious plant diseases because they produce several enzymes that can break down the following substances, EXCEPT:**  
A) Cellulose C) Lignin  
B) Cutin D) Chitin
- Q.62 Extensive damage due to \_\_\_\_\_ and \_\_\_\_\_ diseases of wheat, corn and**

rice prompted mass displacement and starvation to death many people.

- A) Rusts, Smuts
- B) Ergot of eye, red rot of sugarcane
- C) Brown rot of plums and apricots
- D) Cotton seed rot and apple scab

**Q.63 Rust and smut cause extensive damage to following crops:**

- A) Wheat, corn, rice
- B) Peaches, Plums, Apricots
- C) Sugarcane, Potato, Cotton
- D) Cotton, Apple, Rye

**Q.64 Fungus causes:**

- A) Root rot in cotton
- B) Scab in cotton
- C) Brown rot in cotton
- D) Ergot in cotton

**Q.65 Fungus causes:**

- A) Ergot in potato
- B) Wilts in potato
- C) Scab in potato
- D) Brown rot in apple

**Q.66 Ringworm and athlete's foot are superficial fungal infections caused by certain:**

- A) Club fungi
- B) Sac fungi
- C) Conjugating fungi
- D) Imperfect fungi

**Q.67 *Candida albicans* cause:**

- A) Oral thrush
- B) Vaginal thrush
- C) Oral and vaginal thrush
- D) Ringworm

**Q.68 Histoplasmosis becomes fatal:**

- A) Usually
- B) Always

- C) Never
- D) Very occasionally

**Q.69 Aspergillosis is caused by:**

- A) *Aspergillus fumigatus*
- B) *Aspergillus albicans*
- C) *Aspergillus notatum*
- D) *Penicillium notatum*

**Q.70 Histoplasmosis can be serious and fatal if it spreads in:**

- A) Blood stream
- B) Nervous system
- C) Organs other than lungs
- D) Blood stream and then to other organs

**Q.71 Pick up the correct sequence:**

- A) Aspergillus → Aspergillosis → AIDS → Death
- B) Aspergillosis → Aspergillus → AIDS → Death
- C) AIDS → Aspergillosis → Aspergillus → Death
- D) AIDS → Aspergillus → Aspergillosis → Death

**Q.72 Improperly stored grains such as peanuts and corn etc. are contaminated by:**

- A) *Aspergillus*
- B) *Candida*
- C) *Neurospora*
- D) *Agaricus*

**Q.73 It is caused by eating bread made from purple ergot contaminated rye flour:**

- A) Histoplasmosis
- B) Ergotism
- C) Ringworm
- D) Aspergillosis

**Q.74 Which one of the following is wood rotting fungi:**

- A) Bracket fungi or shelf fungi
- B) Truffles or morels
- C) Mushrooms or truffles
- D) Black bread mold or pink bread mold

**Q.75 Viruses that infect bacteria are called:**

- A) Prophage
- C) Bacteriophage



- B) Provirus                      D) Virions
- Q.76 Who used the term bacteriophage for the first time?**  
A) Twort  
B) D'Herelle  
C) Louis Pasteur  
D) Charles chamberland
- Q.77 In Charles Chamberland's experiment which one of the following represented filterable viruses:**  
A) Bacteria                      C) TMV  
B) Rabies virus                D) HIV
- Q.78 The virus that was first ever obtained in purified form was:**  
A) TMV                          C) Pox virus  
B) Rabies virus                D) Polio virus
- Q.79 The transmittable nature of TMV was first observed by:**  
A) W.M Stanley                C) Chamberland  
B) Ivanowsky                  D) Twort
- Q.80 The size of the largest virus is:**  
A) 250 nm                      C) 150 nm  
B) 20 nm                        D) 200 nm
- Q.81 What gives definite shape to a virion?**  
A) Tail                          C) Capsid  
B) Base plate                  D) Genome
- Q.82 Pick up the one which is absent in viruses:**  
A) DNA  
B) RNA  
C) Enzymes  
D) Metabolic machinery
- Q.83 The protein subunits which make the protein coat of viruses are called:**

- A) Capsids                      C) Monomers  
B) Capsomeres                D) Amino acids
- Q.84 The capsid of herpes virus and that of adenovirus differ from each other with respect to:**  
A) Chemical nature  
B) Type of subunits  
C) Number of subunits  
D) Role in life cycle
- Q.85 How many additional capsomeres are found in adenovirus, as compared to those in herpes virus:**  
A) 70                              C) 90  
B) 80                              D) 100
- Q.86 Which one of the following characters, does not belong to fungi?**  
A) Absorptive heterotrophic mode  
B) Eukaryotic organization  
C) Centrioles present  
D) Nuclear mitosis
- Q.87 The body of a fungus is called:**  
A) Hypha                        C) Mycelium  
B) Fruiting body                D) Coenocyte
- Q.88 Non-hyphal unicellular fungi are called:**  
A) Yeast                        C) Toadstools  
B) Mushrooms                D) Fruiting bodies
- Q.89 The only exception with respect to sexual reproduction in fungi is that of:**  
A) Conjugation fungi        C) Sac fungi  
B) Imperfect fungi          D) Club fungi
- Q.90 Conidia are also called as:**  
A) Naked spores                C) Zoospores  
B) Zygosporangia                D) sexual spores
- Q.91 Heterokaryotic hyphae/cell contains:**

- A) Two nuclei of same types  
B) Two nuclei of different types  
C) Many nuclei of same types  
D) Many nuclei of different types
- Q.92 The word virus was generally referred to as a poison associated with disease and death at the time of:**  
A) Louis Pasteur and Charles Chamber land  
B) Louis Pasteur and Ivanowski  
C) Louis Pasteur and W. M Stanley  
D) Louis Pasteur and Robert Koch
- Q.93 A particle of nucleic acid wrapped in a protein coat is recognized as a:**  
A) Cell C) Virus  
B) Bacterium D) Prion
- Q.94 Study of nucleocapsids is carried out in:**  
A) Microbiology C) Virology  
B) Mycology D) Cell biology
- Q.95 For the synthesis of their proteins, a virus uses:**  
A) Its own metabolism  
B) Metabolism of its host organism  
C) Metabolism of its host cell  
D) Metabolism of its host cell
- Q.96 Which one of the following organisms can pass through the porcelain filter?**  
A) Virus C) Fungi  
B) Bacteria D) Protozoans
- Q.97 Who determined that, viruses are smaller than bacteria?**  
A) Ivanovsky  
B) Edward Jenner  
C) Charles Chamberland  
D) W. M. Stanley
- Q.98 Pick up the notorious fungus:**  
A) Mushrooms C) Smuts  
B) Morels D) Truffles
- Q.99 Taxonomically fungi was a:**

- A) Kingdom  
B) Group of plant kingdom  
C) Group of animal kingdom  
D) Group of protist kingdom
- Q.100 Unlike plants and like animals, fungi lack:**  
A) Cell wall C) Chitin  
B) Cellulose D) Definite nucleus
- Q.101 Fungi resembles to the arthropods unlike to the rest of the animals with respect to:**  
A) Heterotrophic mode of nutrition  
B) Absence of chloroplast  
C) Presence of exoskeleton  
D) The chemical found in external covering of the body
- Q.102 It have been estimated by mycologists that fungi and animals probably arose from:**  
A) Different ancestors  
B) Common ancestors  
C) Ingestive heterotrophs  
D) Absorptive heterotrophs
- Q.103 Fungi have been assigned to a separate kingdom because they are distinct from:**  
A) Plants  
B) Animals  
C) Protists  
D) Rest of the eukaryotes
- Q.104 Mention some unique characteristic of the fungi:**  
A) Absorptive heterotrophic mode of nutrition  
B) Occurrence of chitin  
C) Capability of reproduction  
D) Nuclear mitosis
- Q.105 The body of fungus consists of:**  
A) Mycelium  
B) Hyphae

- C) Fruiting body  
D) Rhizoids
- Q.106 It is more resistant to decay than cellulose and lignin:**  
A) Glycogen C) Chitin  
B) Amylose D) Amylopectin
- Q.107 Which one of the following statement about spores of fungi is wrong?**  
A) These are produced by sexual process  
B) These are produced by asexual process  
C) These are haploid  
D) These are motile and flagellate
- Q.108 Resting spore of fungi is called:**  
A) Ascospore C) Conidium  
B) Basidiospore D) Zygospor
- Q.109 Non-motile asexual spores produced uncovered on hyphal tips are called:**  
A) Teliospores C) Zygospor  
B) Basidiospores D) Conidia
- Q.110 Appearance of mold on Jams and jellies indicate the fungal resistance against:**  
A) Extreme pH  
B) Immense osmotic pressure  
C) Decomposition  
D) Desiccation
- Q.111 The fruiting body of mushroom is called:**  
A) Ascocarp C) Mycelium  
B) Basidiocarp D) Thalamus
- Q.112 Formation of ascospores or basidiospores is the consequence of:**  
A) Karyogamy C) Diploidization  
B) Dikaryotization D) Meiosis
- Q.113 Formation of a resistant structure in Rhizopus is consequence of:**  
A) Plasmogammy  
B) Karyogammy  
C) Heterokaryotization  
D) Dikaryotization

- Q.114 \_\_\_\_\_ species of animals are known:**  
A) One million  
B) Over one million  
C) One and a half million  
D) Over one and a half million
- Q.115 \_\_\_\_\_ species of plants are known:**  
A) One million  
B) Half million  
C) Over one million  
D) Over a half million
- Q.116 The smallest taxon in plant nomenclature is:**  
A) Order C) Phylum  
B) Species D) Class
- Q.117 Two individuals organisms belong to same species if they can:**  
A) Interbreed  
B) Reproduce  
C) Produce sterile offspring  
D) Produce fertile offspring
- Q.118 Each kingdom divided into smaller taxon, called:**  
A) Phylum C) Family  
B) Classes D) Order
- Q.119 Classes are further sub-divided into:**  
A) Families C) Genera  
B) Orders D) Species
- Q.120 The family of corn is:**  
A) Poales C) Poaceae  
B) Plantae D) Angiospermae
- Q.121 Following names are used for onion in different regions of Pakistan, EXCEPT:**  
A) Bassal C) Ganda  
B) Argavad D) Piyaz
- Q.122 Pick up the odd one:**  
A) Golden shower C) Purging cassia  
B) Brinjal D) Gurmala
- Q.123 To biologist a fish is a:**  
A) Cray fish C) Jelly fish  
B) Vertebrate D) Starfish
- Q.124 Different classification systems recognize:**  
A) Two to six kingdoms  
B) Two to five kingdoms  
C) Two to three kingdoms  
D) Two to four kingdoms

- Q.125** Which one of the following organisms have both plant like and animal like characters?
- A) Yeast                      C) Paramecium  
B) Trichonympha        D) Euglena
- Q.126** Five kingdom classification system was modified by:
- A) Robert Whittaker  
B) Margulis and Schwartz  
C) Carlous Linnaeus  
D) Ernst Haeckel

STEP ENTRY TEST 2020



## ANSWER KEY (Worksheet-12)

1	B	21	A	41	A	61	D	81	C	101	D
2	B	22	A	42	C	62	A	82	D	102	B
3	B	23	D	43	D	63	A	83	B	103	D
4	D	24	D	44	D	64	A	84	C	104	D
5	B	25	C	45	D	65	B	85	C	105	B
6	C	26	B	46	D	66	D	86	C	106	C
7	D	27	B	47	A	67	C	87	C	107	D
8	B	28	C	48	D	68	D	88	A	108	D
9	C	29	D	49	B	69	A	89	B	109	D
10	D	30	A	50	C	70	D	90	A	110	B
11	D	31	B	51	B	71	D	91	B	111	B
12	B	32	B	52	A	72	A	92	D	112	D
13	B	33	D	53	D	73	B	93	C	113	B
14	C	34	A	54	C	74	A	94	C	114	C
15	C	35	B	55	D	75	C	95	C	115	B
16	B	36	C	56	D	76	B	96	A	116	B
17	C	37	D	57	A	77	B	97	C	117	D
18	A	38	A	58	B	78	A	98	C	118	A
19	A	39	A	59	B	79	B	99	B	119	B
20	C	40	D	60	D	80	A	100	B	120	C
										121	B
										122	B
										123	B
										124	A
										125	D
										126	B

## EXPLANATION

Q.1 Answer is "A single stranded RNA genome into a double stranded DNA"

**Explanation:** Reverse transcription is a process in which an RNA acts as a template for synthesis of RNA-DNA hybrid. Then that DNA is replicated to get double stranded DNA. The enzyme involved in this process is called reverse transcriptase because this process is reverse of transcription.

Q.2 Answer is "Double stranded DNA"

**Explanation:** The host of HIV is a lymphocyte T4 containing DNA as a

genetic material that is why the viral genome should also be converted into DNA by reverse transcription.

Q.3 Answer is "Provirus"

**Explanation:** A viral DNA incorporated into the DNA of host animal cell is called provirus which means before becoming virus.

Q.4 Answer is "Normal cells into cancer cells"

**Explanation:** Such retroviruses are called oncoviruses (cancer causing viruses).

Q.5 Answer is "Rare pneumonia and a severe vascular cancer"

**Explanation:** Actually it is severe pneumonia and a rare vascular cancer.

Q.6 Answer is "Non-homosexuals"

**Explanation:** As the infection was initially discovered in homosexuals but later on it was transmitted to heterosexuals from infected homosexuals.

Q.7 Answer is "Pasture institute in France and National institute of Health in USA"

**Explanation:** HIV, the agent causing the AIDS was discovered at Pasteur Institute of France and National institute of Health in USA in 1984.

Q.8 Answer is "Acquired immunodeficiency syndrome"

**Explanation:** It is abbreviated as AIDS.

Q.9 Answer is "Monkeys"

**Explanation:** Recent studies of HIV reveal that the virus infects and multiplies in monkey but does not cause disease in them which means that HIV is host specific.

Q.10 Answer is "Human immunodeficiency virus"

**Explanation:** Human Immunodeficiency Virus (HIV) is the causal agent not vector or transmitter.

**Q.11** Answer is “Avoiding the direct contact with HIV”

**Explanation:** All sources of transmission become effective by contact with HIV, which should be avoided for the prevention of AIDS. Actually the body fluids of the HIV positive person should not come in contact with the body fluids of any healthy person.

**Q.12** Answer is “HIV”

**Explanation:** It have been claimed in 2001 that a vaccine against HIV have been developed and after successful trials it will be in the market for consumers.

**Q.13** Answer is “1,2,3,5”

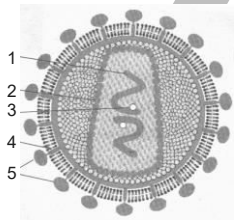
**Explanation:** Other than envelop which have been derived from the cell membrane of host cell, rest of the all parts of virus are genetically encoded on viral (HIV) genome.

**Q.14** Answer is “4”

**Explanation:** Envelope have been labeled by 4. It is part of the plasma membrane of host cell and its genetic information is not located on the viral genome.

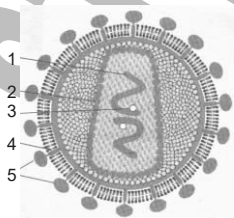
**Q.15** Answer is “4”

**Explanation:**



**Q.16** Answer is “03”

**Explanation:**



**Q.17** Answer is “Inside the cytoplasm”

**Explanation:** HIV is uncoated inside the cytoplasm of host cell.

**Q.18** Answer is “2”

**Explanation:** There are two molecules of reverse transcriptase i.e. one molecule is associated with each RNA.

**Q.19** Answer is “2”

**Explanation:** HIV have two identical strands of RNA, each having its own reverse transcriptase molecule.

**Q.20** Answer is “Reverse Transcription”

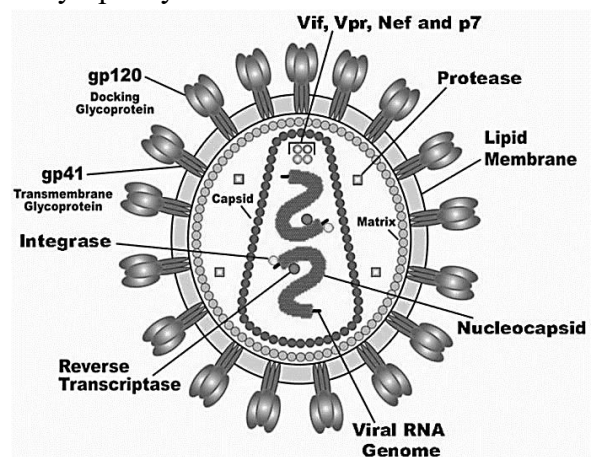
**Explanation:** RNA is converted into DNA by a process called reverse transcription. It is controlled by reverse transcriptase enzyme.

**Q.21** Answer is “Entry”

**Explanation:** In infection cycle of HIV after attachment of virus to host cell, there comes entry which is followed by uncoiling.

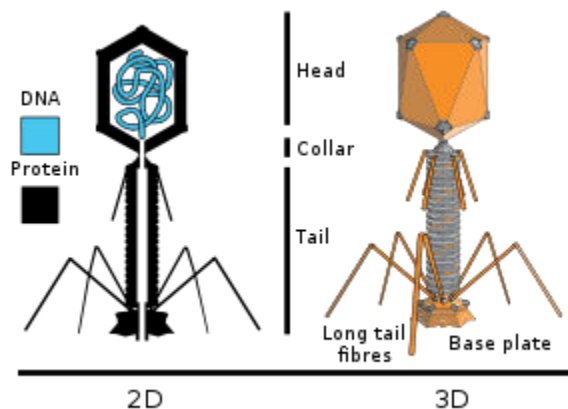
**Q.22** Answer is “HIV”

**Explanation:** Viruses are intracellular obligate parasites and they require a specific receptor site for their adsorption. The receptor site required by HIV is called Cd4 receptor site (cluster of differentiation 4). It is a cluster of specific glycoproteins which develops on the surface of T4 lymphocyte.



**Q.23** Answer is “Head and tail”

**Explanation:** It is tadpole shaped with a head consisting up of nucleocapsid and a tail attached with head.



**Q.24** Answer is “An oval structure”

**Explanation:** The head of bacteriophage is an elongated, pyramidal, hexagonal, prism shaped structure, to which straight tail is attached.

**Q.25** Answer is “Head”

**Explanation:** Head of T<sub>4</sub> phage Pyramidal

**Q.26** Answer is “Double stranded DNA molecule”

**Explanation:** T<sub>4</sub> phage have double stranded DNA molecules.

**Q.27** Answer is “Tail, Head”

**Explanation:** Tail contains two types of proteins whereas head contains only one type of protein.

**Q.28** Answer is “Core and sheath are made of same type of protein”

**Explanation:** Core of tail is made up of a rigid and inflexible protein whereas sheath is made up of flexible and contractile protein.

**Q.29** Answer is “1000”

**Explanation:** The volume of the phage is about 1/1000<sup>th</sup> of the host.

**Q.30** Answer is “Receptor site”

**Explanation:** Being obligate parasite viruses require receptor site on host surface for attachment.

**Q.31** Answer is “Cell Wall”

**Explanation:** The receptor site develops on cell wall of host bacterium.

**Q.32** Answer is “Minus Mating strain and plus mating strain”

**Explanation:** In fungi due to homothallic body the terms of male and female cannot be used.

**Q.33** Answer is “Gametangia”

**Explanation:** Means bodies containing gametes.

**Q.34** Answer is “Zygospore”

**Explanation:** It is a diploid resistant body which comes into being by fusion of two haploid nuclei of different strains.

**Q.35** Answer is “Sexual reproduction only”

**Explanation:** Somatic body of fungus is haploid and it divides by mitosis to produce asexual spores.

**Q.36** Answer is “Diploid zygospore → Haploid spores”

**Explanation:** Diploid zygospore undergoes meiosis to produce four haploid spores, two of plus strain and two of minus strain.

**Q.37** Answer is “Meiosis”

**Explanation:** Zygospore is a resistant dormant body which waits for arrival of favorable conditions and meiosis is delayed.

**Q.38** Answer is “Fungi, saprobic bacteria”

**Explanation:** Both of them are decomposers and recycler of nature.

**Q.39** Answer is “95%”

**Explanation:** Symbiotic association is common in vascular plants.

**Q.40** Answer is “Lichen”

- Explanation:** Lichens are hardy invaders which act as pioneers in xeroseres.
- Q.41 Answer is “Lichens”**  
**Explanation:** They are sensitive to air pollution particularly to SO<sub>2</sub> and start dieing immediately if air becomes polluted.
- Q.42 Answer is “Bioremediation”**  
**Explanation:** They eradicate the pollutant from nature.
- Q.43 Answer is “Degrading or removing environmental poisons/pollutants by organisms”**  
**Explanation:** Degrading or removing environmental poisons/pollutants by organisms is called bioremediation.
- Q.44 Answer is “*Agaricus sp.*, *Morchella esculenta* and *Tuber sp.*”**  
**Explanation:** All of them are edible.
- Q.45 Answer is “Death cap / death angel and Jack O Lantern”**  
**Explanation:** These are poisonous fungi having strong neurotoxins.
- Q.46 Answer is “Arctic, subarctic and boreal regions”**  
**Explanation:** Reindeers are found in these areas and consume the fruticose lichen (*Cladonia rangiferina*) as fodder.
- Q.47 Answer is “*Saccharomyces cerevisiae*”**  
**Explanation:** It is the scientific name of baker’s or brewer’s yeast which acts as fermenting agent in bakeries and breweries.
- Q.48 Answer is “Rapid generation and rapidly increasing pool of genetic and biochemical information”**  
**Explanation:** It has short generation time and budding enables it to multiply rapidly.
- Q.49 Answer is “*Aspergillus*”**  
**Explanation:** It produces some highly proteolytic enzymes which breakdown the grain proteins.

- Q.50 Answer is “*Penicillium notatum*”**  
**Explanation:** Historically it happened so.
- Q.51 Answer is “Cyclosporine”**  
**Explanation:** It is an immunosuppressent.
- Q.52 Answer is “Lowering blood cholesterol”**  
**Explanation:** It is an inhibitor of that enzyme which is associated with cholesterol anabolism.
- Q.53 Answer is “Inhibiting fungal growth”**  
**Explanation:** It makes the cells resistant to fungal infections.
- Q.54 Answer is “Ergotine”**  
**Explanation:** It is also called ergotamine. It have structural similarity with neurotransmitters such as serotonin, dopamine and epinephrine. It induces the constriction of the intracranial extra cerebral blood vessels to relieve migraine.
- Q.55 Answer is “Actinomycetes, bacteria and fungi”**  
**Explanation:** Biological antibiotics are produced by certain fungi actinomycetes and bacteria, whereas synthetic antibiotics are usually derived from dyes.
- Q.56 Answer is “Laboratory”**  
**Explanation:** Synthetic antibiotics.
- Q.57 Answer is “Drug resistance in microorganisms”**  
**Explanation:** Widespread use of antibiotics and easy availability are causes of increased microbial resistance against antibiotics.
- Q.58 Answer is “Yeast”**  
**Explanation:** Various yeast species have been genetically engineered to produce various drugs; *Saccharomyces cerevisiae* is a simple eukaryotic cell, serving as a model for all eukaryotes. It is easy to genetically engineer. Its physiology, metabolism and genetics are amendable for use in harsh industrial conditions. A wide variety of chemicals of different



classes can be produced by engineered yeast, including phenolics, isoprenoids, alkaloids and polyketides. About 20% biopharmaceuticals are produced by *Saccharomyces cerevisiae*, including insulin, vaccine for hepatitis and human serum albumin.

**Q.59 Answer is “Saccharomyces cerevisiae”**

**Explanation:** Yeast artificial chromosomes (YACs) are genetically engineered chromosomes derived from the DNA of the yeast *Saccharomyces cerevisiae*, which is then ligated into a bacterial plasmid.

**Q.60 Answer is “Pink bread mold called Neurospora”**

**Explanation:** *Neurospora Crassa* is a model organism because it is easy to grow and have haploid life cycle that makes genetic analysis simple since recessive traits will be shown in the offspring. For example, it was used by Beadle and Tatum in their experiments

**Q.61 Answer is “Chitin”**

**Explanation:** Fungi have battery of enzymes to decompose cellulose, lignin and cutin but chitin cannot be broken down by it.

**Q.62 Answer is “Rusts, Smuts”**

**Explanation:** The most devastating parasitic fungi for cereal crops.

**Q.63 Answer is “Wheat, Corn, Rice”**

**Explanation:** These are obligate parasites of cereal crops i.e. members of family poaceae.

**Q.64 Answer is “Root rot in cotton”**

**Explanation:**

Fungal Diseases	Affected Plants
Root rot	Cotton
Brown rot	Peaches, Plums Apricots and Cherries
Scab	Apple
Ergot	Rye

Red rot	Sugar cane
Rust, smut	Wheat, Corn, Barley, Rice, Oat, Sugar cane etc.
Powdery mildews	Grapes, Rose, Wheat, etc
Wilts	Potato

**Q.65 Answer is “Wilts in potato”**

**Explanation:**

Fungal Diseases	Affected Plants
Root rot	Cotton
Brown rot	Peaches, Plums Apricots and Cherries
Scab	Apple
Ergot	Rye
Red rot	Sugar cane
Rust, smut	Wheat, Corn, Barley, Rice, Oat, Sugar cane etc.
Powdery mildews	Grapes, Rose, Wheat, etc
Wilts	Potato

**Q.66 Answer is “Imperfect Fungi”**

**Explanation:**

Fungal Diseases	Causal Agent
Ringworm	Imperfect fungi (Deuteromycota)
Athlete's foot	Imperfect fungi (Deuteromycota)
Vaginal thrush (Candidiasis)	<i>Candida albicans</i>
Histoplasmosis	<i>Histoplasma capsulatum</i> (grows)
Aspergillosis	<i>Aspergillus fumigatus</i>
Cancer	<i>Aspergillus sp.</i>

**Q.67 Answer is “Oral or vaginal thrush”**

**Explanation:** *Candida albicans*, a yeast causes oral and vaginal thrush commonly called candidacies or candidiasis.

**Q.68 Answer is “Very occasionally”**

**Explanation:** If person's immune system is weak, then it becomes fatal.

**Q.69 Answer is “Aspergillus fumigatus”**

**Explanation:** As the name indicates

**Q.70 Answer is “Blood stream and then to other organs”**



**Explanation:** Because systemic fungus is difficult to be controlled and eradicated.

**Q.71 Answer is “AIDS – Aspergillus – Aspergillosis – Death”**

**Explanation:** Aspergillosis occurs in those persons who suffers from any type of immune deficiency e.g. AIDS

**Q.72 Answer is “Aspergillus”**

**Explanation:** It is decomposer and saprobic fungus.

**Q.73 Answer is “Ergotism”**

**Explanation:** Ergot fungi refers to a group of fungi of genus *Claviceps*. The most prominent member in *Claviceps purpurea*. This fungus grows on rye and related plants and produces alkaloids that can cause ergotism in humans and other mammals who consume grains contaminated with its fruiting structure called ergot sclerotium.

**Q.74 Answer is “Bracket fungi or shelf fungi”**

**Explanation:** Wood rotting fungi destroy not only living trees but also structural timber. Bracket fungi/shelf fungi cause lot of damage to stored cut lumber as well as stands of timber of living trees.

**Q.75 Answer is “Bacteriophages”**

**Explanation:** A virus that attacks on bacteria are called bacterial viruses, bacteriophages or phage viruses.

**Q.76 Answer is “D’ Herelle”**

**Explanation:** As far as discovery is concerned, Twort discovered the bacterial viruses earlier than D’Herelle, however the term bacteriophage was used by D’Herelle for the first time. Bacteriophage means bacteria eater.

**Q.77 Answer is “Rabies virus”**

**Explanation:** Those days word virus was generally used for any poisonous fluid which caused any disease or death. That is why Chamberland used the term filterable

viruses for rabies causing agents as they passed through the filter.

**Q.78 Answer is “TMV”**

**Explanation:** TMV was crystallized by W. M Stanley.

**Q.79 Answer is “Ivanowsky”**

**Explanation:** Ivanowsky took bacteria free extract from infected tobacco leaves and sprinkled it over healthy plants which suffered from TMV later on.

**Q.80 Answer is “250nm”**

**Explanation:** Pox virus is the largest virus with 250 nm size.

**Q.81 Answer is “Capsid”**

**Explanation:** Capsid gives definite shape to the virions.

**Q.82 Answer is “Metabolic machinery”**

**Explanation:** Viruses are acellular entities and lack biosynthetic machinery for their replication.

**Q.83 Answer is “Capsomeres”**

**Explanation:** Capsomeres are those protein subunits whereas capsid is entire protein coat.

**Q.84 Answer is “Number of subunits”**

**Explanation:** Herpes virus have 162 capsomeres, whereas adenovirus have 252 capsomeres. Net difference is that of 90 capsomeres.

**Q.85 Answer is “90”**

**Explanation:** Herpes virus have 162 capsomeres, whereas adenovirus have 252 capsomeres. Net difference is that of 90 capsomeres

**Q.86 Answer is “Centriole present”**

**Explanation:** Fungi like plants lack centrioles.

**Q.87 Answer is “Mycelium”**

**Explanation:** The body of fungus, called mycelium, consists of long, slender, branched tubular thread like filaments called the hyphae.

**Q.88 Answer is “Yeast”**

*Explanation:* Yeast are non-hyphal unicellular fungi.

**Q.89 Answer is “Imperfect fungi”**

*Explanation:* Perfect stage is sexual stage which is absent in Deuteromycota. That is why it is called imperfect fungi or fungi imperfecti.

**Q.90 Answer is “Naked spores”**

*Explanation:* Conidia being produced on conidrophore, without any covering like sporangial wall are called naked spores. These are haploid and asexual spores.

**Q.91 Answer is “Two nuclei of different types”**

*Explanation:* Heterokaryotic hyphae/cells also called dikaryotic hyphae/cells contain two nuclei of different genetic types or mating types.

**Q.92 Answer is “Louis Pasteur and Robert Koch”**

*Explanation:* as microscopic techniques were not well developed at the time of Louis Pasteur and Robert Koch, the study about virus was very limited and the only thing that is known about it was that it is a poison associated with disease and death.

**Q.93 Answer is “Virus”**

*Explanation:* Viruses are actually particles of nucleoproteins i.e. a nucleic acid core (DNA or RNA) have been coated in a protein coat called capsid.

**Q.94 Answer is “Virology”**

*Explanation:* That branch of biology which deals with the study of viruses is called virology and as structurally viruses are nucleocapsids so it may be study of nucleocapsids as well.

**Q.95 Answer is “Metabolism of its host cell”**

*Explanation:* Viruses are acellular entities having no cellular/metabolic machinery. Thus they have to rely upon the

biosynthetic machinery of host for this purpose.

**Q.96 Answer is “Virus”**

*Explanation:* Viruses having smaller size as compared to bacteria can pass through the porcelain filter and it was first proved by Charles Chamberland by filtering rabies virus through porcelain filter.

**Q.97 Answer is “Charles Chamberland”**

*Explanation:* Charles Chamberlandt called the filtrate as filterable viruses and residue as non-filterable viruses.

**Q.98 Answer is “Smuts”**

*Explanation:* Smuts are such fungi which are pathogenic to cereal crops particularly to wheat, barley, oat, maize etc.

**Q.99 Answer is “Group of plant kingdom”**

*Explanation:* Fungi was included in Kingdom plantae due to the presence of cell wall and absence of centrioles. However, later on due to its heterotrophic mode of nutrition it was excluded from plants and given the status of an independent kingdom.

**Q.100 Answer is “Cellulose”**

*Explanation:* Cellulose is found in the cell wall of plants and algae, fungi have chitinous cell wall. Animals cell lack cellulose as a structure component

**Q.101 Answer is “The chemical found in external covering of the body”**

*Explanation:* Fungi have chitinous cell wall as external covering and insects have chitinous exoskeleton as external covering.

**Q.102 Answer is “Common ancestors”**

*Explanation:* As both animals and fungi are heterotrophs and both have chitin as a structural component.

**Q.103 Answer is “Rest of the eukaryotes”**

**Explanation:** With respect to nuclear mitosis and molecular data fungi resemble none of the other eukaryote.

**Q.104 Answer is “Nuclear mitosis”**

**Explanation:** Nuclear mitosis is a unique feature of fungi as no other group of organisms carries out nuclear mitosis.

**Q.105 Answer is “Hyphae”**

**Explanation:** Hyphae are the structural units of fungi except yeast.

**Q.106 Answer is “Chitin”**

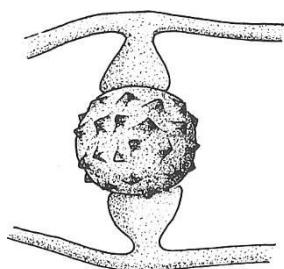
**Explanation:** Chitin is more resistant to decay than cellulose and lignin.

**Q.107 Answer is “These are motile and flagellate”**

**Explanation:** Fungi produces non-motile spores which lack flagella.

**Q.108 Answer is “Zygospore”**

**Explanation:** Zygospore formed in zygomycota is a resistant body which can withstand the unfavorable conditions and upon arrival of favorable conditions starts germination.



**Q.109 Answer is “Conidia”**

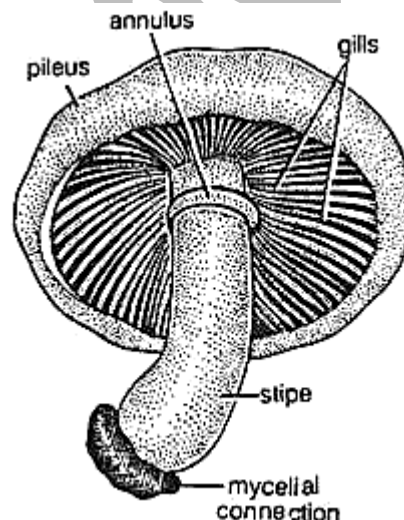
**Explanation:** Conidia are also called naked spores as they lack any sporangial cover.

**Q.110 Answer is “Immense osmotic pressure”**

**Explanation:** Jams and jellies are hyperosmotic media with saturation level of sugar and to grow in such medium requires immense osmotic resistance.

**Q.111 Answer is “Basidiocarp”**

**Explanation:** As mushroom (Agaricus) belongs to basidiomycota its fruiting body is called basidiocarp which bear basidia and basidiospores.



**Q.112 Answer is “Meiosis”**

**Explanation:** Both basidiospores and ascospores are haploid spores formed from diploid nucleus by reduction division or meiosis.

**Q.113 Answer is “Karyogamy”**

**Explanation:** After karyogamy or diploidization, the diploid nucleus produces a resistant cyst around it and becomes resistant zygospore.

**Q.114 Answer is “Over one million”**


**Explanation:** According to the verified figures of biodiversity, over one and half million species of animals and over a half million species of plants are known.

**Q.115 Answer is “Over a half million”**

**Explanation:** According to the verified figures of biodiversity, over one and half million species of animals and over a half million species of plants are known.

Q.116 Answer is "Species"

**Explanation:**

1	Kingdom	As we move from species to kingdom the number of individuals per taxon increases but similarity among individuals decreases
2	Division	
3	Class	
4	Order	
5	Family	
6	Genus	
7	Species	As we move from kingdom to species the number of individuals per taxon decreases but similarity among individuals increases

Q.117 Answer is "Species"

**Explanation:** A species is a group of natural population which can interbreed freely among themselves and produce fertile offspring, but are reproductively isolated from all other such groups in nature. So mere interbreeding and reproduction is not enough to be a species as occurs in horse and donkey, both belong to different species but they can interbreed and produce mule.

Q.118 Answer is "Phyla"

**Explanation:** See explanation of Q # 116.

Q.119 Answer is "Orders"

**Explanation:** See explanation of Q # 116.

Q.120 Answer is "Poaceae"

**Explanation:** Botanical classification of corn, Zea mays.

Kingdom	Plantae
Division (Phylum)	Anthophyta (Tracheophyta)
Class	Angiospermae
Order	Poales
Family	Poaceae
Genus	<i>Zea</i>
Species	<i>Mays</i>

Q.121 Answer is "Argavad"

**Explanation:**

Sr. #	Plant	Common names
1)	Onion	Bassal, Vassal, Ganda, Piyaz
2)	Cassia	Amaltas, Argavad, Golden shower, Purging Cassia

Q.122 Answer is "Brinjal"

**Explanation:** See explanation of Q # 121.

Q.123 Answer is "Vertebrate"

**Explanation:** A silver fish (*Lepisma saccharina*) is small primitive wingless insect. Crayfish are fresh water crustaceans resembling small lobsters. Starfish is an echinoderm. However, dogfish (*Squalis acanthias*) belongs to squalidae family of sharks.

Q.124 Answer is "Two to six kingdoms"

**Explanation:** Earliest classification was two Kingdom (Animals and plants) classification. However not due to the contribution of Ernst Haeckel, E. Chatton, Robert Whittaker, Lynn Margulis and Schwartz it have been extended upto 5 kingdoms.

Q.125 Answer is "Euglena"

**Explanation:** Euglenoids have at various times been classified in the plant kingdom (with algae) and in animal kingdom (in protozoa).



**Q.126** Answer is “Margulis and Schwartz”

*Explanation:* Five kingdom system was presented by Robert Whittaker but later on it was modified by Lynn Margulis and Carlene Schwartz.

STEP ENTRY TEST 2020

**Worksheet-13(i)**

**(Bioenergetics)**

**Q.1** Inside the stroma of chloroplast there is a suspended:

- A) Membrane system
- B) Set of enzymes
- C) Membrane system and set of enzymes
- D) Chlorophyll

**Q.2** Chlorophyll molecules are found embedded in:

- A) Thylakoid membranes
- B) Outer chloroplast membrane
- C) Lamellar membranes
- D) Inner chloroplast membrane

**Q.3** Electron acceptors of photosynthetic electron transport chain are parts of:

- A) Thylakoid membranes
- B) Outer chloroplast membrane
- C) Lamellar membranes
- D) Inner chloroplast membrane

**Q.4** Chlorophyll and other pigments absorb light energy which is converted into chemical energy of:

- A) NADH and NADPH
- B) ATP and NADPH
- C) ATP and NADH
- D) FADH and NADPH

**Q.5** The substances that absorb visible light are called:

- A) Radioactive substances
- B) Bioluminescent substances
- C) Pigments
- D) Fluorescent substances

**Q.6** Different pigments absorb light of:

- A) Same wavelength
- B) 380 – 750 nm wavelengths
- C) Different wavelengths
- D) 280 – 750 nm wavelengths

**Q.7** An instrument used to measure relative abilities of different pigments to absorb different wavelengths of light is called:

- A) Photometer
- B) Light meter
- C) Spectrometer
- D) Spectrophotometer

**Q.8** Thylakoid membranes contain:

- A) Several kinds of pigments
- B) Only chlorophylls
- C) Only carotenoids
- D) Only xanthophylls

**Q.9** Carotenes are mostly:

- A) Red to orange
- B) Yellow and red to orange
- C) Yellow to orange
- D) Orange and red to yellow

**Q.10** These broaden the absorption and utilization of light:

- A) Yellow pigments
- B) Orange pigments
- C) Red pigments
- D) Yellow and red to orange pigments

**Q.11** Chlorophylls found in photosynthetic bacteria are called:

- A) Chlorophyll a and b
- B) Chlorophyll c and d
- C) Chlorophyll b and c
- D) Bacteriochlorophylls

**Q.12** Green, yellow and indigo wavelengths of light are least absorbed by:

- A) Carotenes
- B) Xanthophylls
- C) Chlorophylls
- D) Carotenoids

- Q.13 Plants appear green, because:**  
 A) Green wavelength is reflected  
 B) Green wavelength is transmitted  
 C) Darker green color masks over the yellow color  
 D) Green wavelength is reflected and transmitted
- Q.14 The light absorbing hydrophilic part of chlorophyll is:**  
 A) Flat  
 B) Long and anchoring  
 C) Square shaped  
 D) Flat and square shaped
- Q.15 Porphyrin ring represents the:**  
 A) Hydrophobic head of chlorophyll  
 B) Hydrophilic tail of chlorophyll  
 C) Hydrophobic tail of chlorophyll  
 D) Hydrophilic head of chlorophyll
- Q.16 Chlorophyll head is made up of:**  
 A) Four joined porphyrin rings  
 B) Four Joined tetrapyrrole rings  
 C) Four joined pyrrole rings  
 D) Two joined pyrrole rings
- Q.17 In chlorophyll head an atom of magnesium is coordinated with the:**  
 A) Carbon of each pyrrole ring  
 B) Hydrogen of each pyrrole ring  
 C) Nitrogen of each pyrrole ring  
 D) Methyl of each pyrrole ring
- Q.18 \_\_\_\_\_ of haemoglobin is also a porphyrin ring.**  
 A)  $\alpha$  – chain                      C) Haem group  
 B)  $\beta$  – chain                      D) Protein

- Q.19 Haem group of hemoglobin differs from porphyrin of chlorophyll in having:**  
 A) Iron as central atom  
 B) Magnesium as central atom  
 C) Four pyrrole rings  
 D) Central atom coordinated with nitrogen of each pyrrole ring
- Q.20 Long tail of chlorophyll which is attached to one of the pyrrole is:**  
 A) Hydrocarbon tail  
 B) Phytol  
 C) Phytol or hydrocarbon tail  
 D) Hydrophilic tail
- Q.21 The chlorophyll molecule is embedded in the hydrophobic core of:**  
 A) Thylakoid membrane by its head  
 B) Lamellar membrane by its head  
 C) Thylakoid membrane by its tail  
 D) Lamellar membrane by its tail
- Q.22 Chlorophyll a and Chlorophyll b differ from each other in only one of the:**  
 A) Atoms                              C) Functional groups  
 B) Elements                          D) Carbon atoms
- Q.23 Chlorophyll a and chlorophyll b differ from each other with respect to the number of:**  
 A) Carbon atoms  
 B) Oxygen atoms  
 C) Hydrogen atoms  
 D) Hydrogen and oxygen atoms
- Q.24 As compared to chlorophyll a, chlorophyll b have:**  
 A) Two more hydrogen atoms  
 B) One less oxygen atom  
 C) Two less hydrogen atoms and one more oxygen atom  
 D) Two more hydrogen atom and one less oxygen atom

**Q.25** As compared to chlorophyll b, chlorophyll a have:

- A) Two more hydrogen atoms
- B) One less oxygen atom
- C) Two less hydrogen atoms
- D) Two more hydrogen atom and one less oxygen atom

**Q.26** Chlorophyll a can be converted into chlorophyll b by replacing:

- A) Carbonyl group with methyl group
- B) Magnesium with ferrous
- C) Methyl group with carbonyl group
- D) Ferrous with magnesium

**Q.27** Chlorophyll b can be converted into chlorophyll a by replacing:

- A) Carbonyl group with methyl group
- B) Magnesium with ferrous
- C) Methyl group with carbonyl group
- D) Ferrous with magnesium

**Q.28** Some wavelengths \_\_\_\_\_ by chlorophyll a are \_\_\_\_\_ by chlorophyll b.

- A) Absorbed, absorbed
- B) Not absorbed, weakly absorbed
- C) Not absorbed, not absorbed
- D) Not absorbed, very effectively absorbed

**Q.29** Due to slight difference in their \_\_\_\_\_, the chlorophyll a and chlorophyll b show slightly different \_\_\_\_\_.

- A) Structure, absorption spectra
- B) Structure, molecular formula
- C) Absorption spectra, structure
- D) Absorption spectra, molecular formula

**Q.30** Difference in structure of different pigments:

- A) Increase the range of light wavelengths being absorbed
- B) Decrease the range of light wavelengths being absorbed
- C) Have no effect on range of light wavelengths being absorbed
- D) Have no effects on the color of pigment

**Q.31** Chlorophyll a is:

- A) Yellow – Green
- B) Blue – Green
- C) Blue – Yellow
- D) Yellow – Blue

**Q.32** Chlorophyll b is:

- A) Yellow – Green
- B) Blue – Green
- C) Blue – Yellow
- D) Yellow – Blue

**Q.33** The most important photosynthetic pigment is:

- A) Chlorophyll – b
- B) Chlorophyll - a
- C) Bacteriochlorophyll
- D) Carotenoids

**Q.34** It takes part directly in the light dependent reactions:

- A) Chlorophyll – b
- B) Chlorophyll – a
- C) Bacteriochlorophyll
- D) Carotenoids

**Q.35** The conversion of solar energy into chemical energy is carried out directly in:

- A) Chlorophyll – b
- B) Chlorophyll – a
- C) Bacteriochlorophyll
- D) Carotenoids

**Q.36** Chlorophyll a itself exists in:

- A) Two forms
- B) One forms
- C) Several forms
- D) Three forms



**Q.37 Chlorophyll b is found along with chlorophyll a in:**

- A) Few green plants and all algae
- B) All green plants and all algae
- C) All green plants and few algae
- D) Few green plants and green algae

**Q.38 Chlorophylls are soluble in:**

- A) Carbon tetrachloride
- B) Alcohol
- C) Carbon tetrachloride and alcohol
- D) Water

**Q.39 Pick up the one(s) called as accessory pigments:**

- A) Carotenes
- B) Chlorophylls
- C) Xanthophylls
- D) Carotenoids and xanthophylls

**Q.40 They absorb light and transfer the energy to chlorophyll a via chlorophyll b:**

- A) Chlorophylls – a    C) Carotenoids
- B) Chlorophylls – b    D) Xanthophylls

**Q.41 The order of transfer of energy is:**

- A) Carotenoids → chlorophyll a → chlorophyll b
- B) Chlorophyll b → chlorophyll a → carotenoids
- C) Carotenoids → Chlorophyll b → Chlorophyll a
- D) Chlorophyll a → Chlorophyll b → Carotenoids

**Q.42 Some carotenoids protect chlorophyll from intense light by:**

- A) Absorbing excessive light energy
- B) Dissipating excessive light energy
- C) Transferring excessive light energy to chlorophyll a

D) Absorbing and dissipating excessive light energy

**Q.43 Protection against intense light is provided by carotenoids to:**

- A) Chlorophyll – a
- B) Human eyes
- C) Chlorophyll – b
- D) Chlorophyll a and human eyes

**Q.44 Absorption spectrum for chlorophyll indicates that absorption is maximum in:**

- A) Blue part of spectrum
- B) Blue and Red parts of spectrum
- C) Red part of spectrum
- D) Violet – blue and orange – red part of spectrum

**Q.45 An absorption spectrum of chlorophylls have:**

- A) Two peaks
- B) Two peaks, one valley
- C) Two valleys
- D) One peaks, two valleys

**Q.46 Pick up the one having broadest valley:**

- A) Absorption spectrum of chlorophyll a
- B) Absorption spectrum of carotenoids
- C) Absorption spectrum of chlorophyll b
- D) Action spectrum of chlorophyll a

**Q.47 The absorptive peaks in the absorption spectrum of chlorophyll b are at the wave length of:**

- A) 430 – 670 nm    C) 440 – 480 nm
- B) 460 – 640 nm    D) 420 – 610 nm

**Q.48 Photosynthesis is a process in which:**

- A) Oxidation of CO<sub>2</sub> occurs
- B) Oxidation of H<sub>2</sub>O occurs
- C) Reduction of CO<sub>2</sub> occurs
- D) Reduction of CO<sub>2</sub> and oxidation of H<sub>2</sub>O occurs

**Q.49 The reactions of photosynthesis consists of:**

- A) Two phases                      C) Four phases  
B) Three phases                  D) Many phases

**Q.50 In photosynthesis reducing power and assimilatory power is synthesized during:**

- A) Dark reaction  
B) Light reaction  
C) Calvin cycle  
D) Oxidation phosphorylation

**Q.51 For synthesis of sugar by reducing CO<sub>2</sub>, NADPH<sub>2</sub> provides:**

- A) Chemical energy  
B) Co-enzymes  
C) Energized electrons  
D) Enzymes

**Q.52 The phase of photosynthesis in which sugar is synthesized by reducing CO<sub>2</sub> is also called as dark reaction because:**

- A) It requires darkness  
B) It does not require light  
C) It requires night period  
D) It cannot proceed in light

**Q.53 Photosynthetic pigments are organized into clusters called:**

- A) Antenna pigments  
B) Reaction centre  
C) Photosynthetic system  
D) Photosystems

**Q.54 Each photosystem consists of a light gathering:**

- A) Antenna complex  
B) Reaction complex  
C) Antenna complex and a reaction centre  
D) Primary electron acceptor

**Q.55 The reaction centre of photosystem have:**

- A) One molecule of chlorophyll a and primary electron acceptor  
B) Many molecule of chlorophyll a and primary electron acceptor

C) One or more molecules of chlorophyll a and primary electron acceptor

D) Chlorophyll a, chlorophyll b and primary electron acceptor

**Q.56 There are two photosystems associated with photosynthesis which have been named in order of their discovery as:**

- A) P680 and P700                  C) PS-I and PS-II  
B) PS-II and PS-I                  D) P700 and P680

**Q.57 Photosystem – I has a form of chlorophyll a which absorbs best the light of:**

- A) 700 nm                              C) 730 nm  
B) 680 nm                              D) 660 nm

**Q.58 Associated nearby each reaction centre of a photosystem, there is a specialized molecule called:**

- A) Primary electron acceptor  
B) Chlorophyll b  
C) Accessory pigments  
D) Carotenoids

**Q.59 Pick up the photosynthetic electron transport which is predominant:**

- A) Non – cyclic electron flow  
B) Z – scheme  
C) Cyclic electron flow  
D) Non-cyclic electron flow or Z – scheme

**Q.60 The photosynthetic electron transport which involved only photosystem – I is called:**

- A) Non-cyclic electron flow  
B) Z – scheme  
C) Cyclic electron flow  
D) Non-cyclic electron flow or Z – scheme

**Q.61 The formation of ATP during non-cyclic electron flow is called:**

- A) Z – scheme  
B) Light reaction  
C) Non-cyclic phosphorylation  
D) Synthesis of ATP and NADPH<sub>2</sub>

**Q.62 Formation of ATP during cyclic electron flow is called:**

- A) Cyclic phosphorylation
- B) Photophosphorylation
- C) Oxidative phosphorylation
- D) Z – scheme

**Q.63 The splitting up of water molecule into two hydrogen ions and an oxygen atom, by light is called:**

- A) Electrolysis of water
- B) Ionization of water
- C) Photolysis of water
- D) Autolysis of water

**Q.64 The correct sequence of electron carriers which receive the electrons from primary electron acceptor of PS-II and pass it to PS-I:**

- A) PS → Cytochrome complex → PQ
- B) PQ → PC → Cytochrome complex
- C) Cytochrome complex → PQ → PC
- D) PQ → Cytochrome complex → PC

**Q.65 Pick up the one not involved in cyclic electron flow of light reaction of photosynthesis:**

- A) PQ
- B) PC
- C) Cytochrome complex
- D) Fd

**Q.66 As electrons move down the photosynthetic electron transport chain their energy goes on decreasing and is used by thylakoid membrane to produce:**

- A) ATP
- B) Oxygen
- C) Water
- D) NADH<sub>2</sub>

**Q.67 The chemical energy for the synthesis of sugar during the Calvin cycle, is provided by the:**

- A) ATPs generated by light reactions
- B) NADH<sub>2</sub> generated by light reactions
- C) FADH<sub>2</sub> generated by light reactions
- D) Oxygen generated by light reactions

**Q.68 Pick up the correct flow of electrons in second electron transport chain of non-cyclic photophosphorylation:**

- A) NADP → Primary electron acceptor of PS-I → NADP → PS-I
- B) PS-I → Fd → Primary acceptor of PS-I → NADP
- C) PS-I → Primary acceptor of PS-I → NADP → Fd
- D) PS-I → Primary acceptor of PS-I → Fd → NADP

**Q.69 This pathway uses the photosystem-I, but not photosystem-II:**

- A) Non-cyclic photophosphorylation
- B) Cyclic electron flow
- C) Z-scheme
- D) Non-cyclic electron flow

**Q.70 During cyclic photophosphorylation ATP is generated by the:**

- A) Coupling of ETC by chemiosmosis
- B) Involvement of chemiosmosis
- C) Involvement of ETC
- D) Oxidative phosphorylation

**Q.71 The mechanism for ATP synthesis is chemiosmosis in:**

- A) Cyclic photophosphorylation
- B) Non-cyclic photophosphorylation
- C) Both cyclic and non-cyclic photophosphorylation
- D) Z-scheme

**Q.72** The details of path of carbon in dark reaction of photosynthesis were discovered by Melvin, Calvin and his colleagues at:

- A) Oxford university
- B) University of California
- C) Cambridge university
- D) Tübingen university

**Q.73** The cyclic series of reactions, by which the carbon is fixed and reduced resulting in the synthesis of sugar is called:

- A) Cyclic phosphorylation
- B) Calvin cycle
- C) Non-cyclic phosphorylation
- D) Z-scheme

**Q.74** First phase of Calvin cycle is:

- A) Reduction of CO<sub>2</sub>
- B) Regeneration of CO<sub>2</sub> acceptor
- C) Fixation of CO<sub>2</sub>
- D) Regeneration of RuBP

**Q.75** The Calvin cycle begins when a molecule of CO<sub>2</sub> reacts with a highly reactive phosphorylated five carbon sugar named:

- A) Ribulose biphosphate
- B) Ribulose diphosphate
- C) Ribulose biphosphate
- D) Ribose biphosphate

**Q.76** During the first step of reduction phase of Calvin cycle following change occurs:

- A)  $3\text{PGA} \xrightarrow{\text{ATP} \rightarrow \text{ADP}} 1, 3 \text{ BPGA}$
- B)  $\text{G.3.P} \longrightarrow \text{RuBP}$
- C)  $1, 3 \text{ BPGA} \xrightarrow{\text{NAD} \longrightarrow \text{NADH}} \text{G.3.P}$
- D)  $\text{G.3.P} \longrightarrow \text{Starch}$

**Q.77** The assimilatory and reducing powers synthesized in light reaction of photosynthesis are utilized in:

- A) Fixation phase of Calvin cycle
- B) Regeneration phase of Calvin cycle

- C) Reduction phase of Calvin cycle
- D) Condensation phase of Calvin cycle

**Q.78** The phase of Calvin cycle in which less ATPs of light reaction are used is:

- A) Fixation
- B) Regeneration
- C) Reduction
- D) Reduction and Regeneration

**Q.79** The number of CO<sub>2</sub>, NADPH and ATP molecules respectively required for one Calvin cycle are:

- A) 3, 6, 9
- B) 6, 12, 18
- C) 12, 24, 36
- D) 24, 48, 72

**Q.80** The number of CO<sub>2</sub>, NADPH<sub>2</sub> and ATP molecules required to synthesize one maltose molecule from the output of Calvin cycle is respectively:

- A) 3, 6, 9
- B) 6, 12, 18
- C) 12, 24, 36
- D) 24, 48, 72

**Q.81** The ratio of CO<sub>2</sub>, NADPH<sub>2</sub> and ATP molecules required to synthesize one glucose molecule from the output of C<sub>3</sub> pathway is respectively:

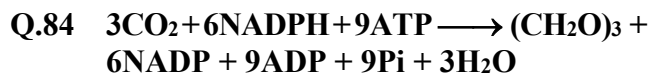
- A) 1, 2, 3
- B) 3, 6, 9
- C) 6, 12, 18
- D) 12, 24, 36

**Q.82** The ratio of CO<sub>2</sub>, NADPH<sub>2</sub> and ATP molecules required for one calvin cycle is:

- A) 1, 2, 3
- B) 3, 6, 9
- C) 6, 12, 18
- D) 12, 24, 36

**Q.83** The ratio of CO<sub>2</sub>, NADPH<sub>2</sub> and ATP molecules required to synthesize starch from the output of Calvin cycle is:

- A) 1, 2, 3
- B) 3, 6, 9
- C) 6, 12, 18
- D) 12, 24, 36



It is summary equation of:

- A) Light reactions of photosynthesis
- B) Photosynthesis
- C) Dark reactions of photosynthesis
- D) Respiration

STEP ENTRY TEST 2020



**ANSWER KEY (Worksheet-13(i))**

1	C	23	D	45	B	67	A
2	A	24	C	46	A	68	D
3	A	25	D	47	B	69	B
4	B	26	C	48	D	70	A
5	C	27	A	49	A	71	C
6	C	28	D	50	B	72	B
7	D	29	A	51	C	73	B
8	A	30	A	52	B	74	C
9	A	31	B	53	D	75	A
10	D	32	A	54	C	76	A
11	D	33	B	55	C	77	C
12	C	34	B	56	C	78	B
13	C	35	B	57	A	79	A
14	D	36	C	58	A	80	C
15	D	37	C	59	D	81	A
16	C	38	C	60	C	82	A
17	C	39	D	61	C	83	A
18	C	40	C	62	A	84	C
19	A	41	C	63	C		
20	C	42	D	64	D		
21	C	43	D	65	A		
22	C	44	B	66	A		

**EXPLANATION**

**Q.1** Answer is “Membrane system and set of enzymes”

**Explanation:** Thylakoid membranes making grana and enzymes associated with photosynthesis, attached to these membranes, are suspended in stroma of chloroplast.

**Q.2** Answer is “Thylakoid membranes”

**Explanation:** Each chlorophyll molecule is anchored in thylakoid membrane by means of its tail and head lies inside the lumen of thylakoids.

**Q.3** Answer is “Thylakoid membranes”

**Explanation:** Thylakoid membranes sites for cyclic and non-cyclic photophosphorylation.

**Q.4** Answer is “ATP and NADPH”

**Explanation:** It is assimilatory power (ATP) and reducing power (NADPH) respectively required for dark reaction.

**Q.5** Answer is “Pigments”

**Explanation:** Pigments are such colored substances which absorb light.

**Q.6** Answer is “Different wavelengths”

**Explanation:** As absorption spectra of pigments vary, they absorb light of different wavelengths.

**Q.7** Answer is “Spectrophotometer”

**Explanation:** A spectrophotometer is used to measure relative abilities of different pigments to absorb different wavelengths of light.

**Q.8** Answer is “Several kinds of pigments”

**Explanation:** Chlorophyll and other photosynthetic pigments like carotenes, xanthophylls, phycobilins are found embedded in the thylakoid membranes.

**Q.9** Answer is “Red to orange”

**Explanation:** According to their absorption spectra carotenes are red to orange pigments.

**Q.10** Answer is “Yellow and red to orange pigments”

**Explanation:** These are carotenoids i.e. carotenes and xanthophylls and they work as accessory pigments or antenna pigments to broaden the absorption and utilization of light by plants.

**Q.11** Answer is “Bacteriochlorophyll”

**Explanation:** It is different from that of eukaryotic and even cyanobacterial chlorophyll.

**Q.12** Answer is “Chlorophylls”

**Explanation:** Chlorophyll absorb blue and red wave lengths of light only.

**Q.13** Answer is “Darker green color masks over the yellow color”

*Explanation:* Carotenoids are yellow and red to orange pigments which are masked over by green colored chlorophylls.

**Q.14** Answer is “Flat and square shaped”

*Explanation:* It is porphyrin head made up of tetrapyrrole rings.

**Q.15** Answer is “Hydrophilic head of chlorophyll”

*Explanation:* The head of chlorophyll is hydrophilic but tail of chlorophyll is hydrophobic. Head consists of four pyrrole rings.

**Q.16** Answer is “Four joined pyrrole rings”

*Explanation:* It is tetrapyrrole means four pyrrole rings, however collectively four pyrrole rings constitute a porphyrin.

**Q.17** Answer is “Nitrogen of each pyrrole ring”

*Explanation:* An atom of magnesium is present in the centre of porphyrin ring and is coordinated with the nitrogen of each pyrrole ring.

**Q.18** Answer is “Haem group”

*Explanation:* This is homology between hemoglobin and chlorophyll.

**Q.19** Answer is “Iron as central atom”

*Explanation:* Haem have iron as central atom whereas porphyrin of chlorophyll have magnesium as central atom.

**Q.20** Answer is “Phytol or hydrocarbon tail”

*Explanation:* It is a hydrocarbon tail also called phytol.

**Q.21** Answer is “Thylakoid membrane by its tail”

*Explanation:* The chlorophyll molecule is embedded in hydrophobic core of thylakoid membrane, by its tail.

**Q.22** Answer is “Functional group”

*Explanation:* It is methyl ( $\text{CH}_3$ ) for chl. a and carbonyl ( $\text{CHO}$ ) for chl. b.

**Q.23** Answer is “Hydrogen and oxygen atoms”

*Explanation:* chl. a have two additional hydrogen atoms but one oxygen less, whereas chl. b have one additional oxygen atom but two hydrogen atoms less.

**Q.24** Answer is “Two less hydrogen atoms and one more  $\text{O}_2$  atom”

*Explanation:* Chlorophyll a and chlorophyll b differ from each other in only one of the functional groups bonded to the porphyrin; the methyl group ( $-\text{CH}_3$ ) in chlorophyll a is replaced by a terminal carbonyl group ( $-\text{CHO}$ ) in chlorophyll b.

**Q.25** Answer is “Two more hydrogen atoms and one less oxygen atom”

*Explanation:* Chlorophyll a have methyl group ( $-\text{CH}_3$ ) whereas chlorophyll b have carbonyl group ( $-\text{CHO}$ ). Thus, chlorophyll a have two more hydrogen atoms and one less oxygen atom.

**Q.26** Answer is “Methyl group with carbonyl group”

*Explanation:* Chlorophyll a have methyl group ( $-\text{CH}_3$ ) whereas chlorophyll b have carbonyl group ( $-\text{CHO}$ ). Thus chlorophyll a have two more hydrogen atoms and one less oxygen atom.

**Q.27** Answer is “Carbonyl group with methyl group”

*Explanation:* Chlorophyll a have methyl group ( $-\text{CH}_3$ ) whereas chlorophyll b have carbonyl group ( $-\text{CHO}$ ). Thus both can be converted into each other by changing functional groups.

**Q.28** Answer is “Not absorbed, very effectively absorbed”

*Explanation:* Due to slight difference in their structure, the two chlorophylls shows slightly different colors. Some wavelengths not absorbed by chlorophyll a are very effectively absorbed by chlorophyll b and vice versa.

**Q.29** Answer is “Structure, absorption spectra”

*Explanation:* Due to slight difference in their structure, the two chlorophylls show slightly different colors. Some wavelengths not absorbed by chlorophyll a are very effectively absorbed by chlorophyll b and vice versa.

**Q.30** Answer is “Increase the range of wavelength being absorbed”

*Explanation:* Structural change changes the absorption spectrum.

**Q.31** Answer is “Blue green”

*Explanation:* It is dark green.

**Q.32** Answer is “Yellow – green”

*Explanation:* It is light green.

**Q.33** Answer is “Chlorophyll – a”

*Explanation:* As reaction centre for light reaction of photosynthesis lies in it.

**Q.34** Answer is “Chlorophyll – a”

*Explanation:* Chlorophyll a having primary reaction centre of light reaction of photosynthesis is directly involved in light reaction.

**Q.35** Answer is “Chlorophyll – a”

*Explanation:* As the reaction centre of light reaction lies in chlorophyll a, so it is involved in conversion of solar energy into chemical energy.

**Q.36** Answer is “Several forms”

*Explanation:* With respect to red absorbing peaks it may be at 670,680,690 and 700 nm.

**Q.37** Answer is “All green plants and few algae”

*Explanation:* Chlorophyll b occurs in all green plants right from bryophytes to angiosperms but it is found only in euglenoids and chlorophyta as far as algae is concerned, however chlorophyll a is present in all photoautotrophs except bacteria.

**Q.38** Answer is “Carbon tetrachloride and alcohol”

*Explanation:* As they are soluble in organic solvents.

**Q.39** Answer is “Carotenoids & xanthophyll”

*Explanation:* As they absorb lights of different wavelengths other than that absorbed by chlorophyll – a and finally transfer it to chlorophyll a by bringing that into its absorptive range.

**Q.40** Answer is “Carotenoids”

*Explanation:* It is as under;  
Carotenoids → Chl. b → Chl. a

**Q.41** Answer is “Carotenoids → Chlorophyll-b → Chlorophyll – a”

*Explanation:* Carotenoids and chlorophyll-b being antenna pigments transfer the light energy to chlorophyll-a where reaction centre lies.

**Q.42** Answer is “Absorbing and dissipating excessive light energy”

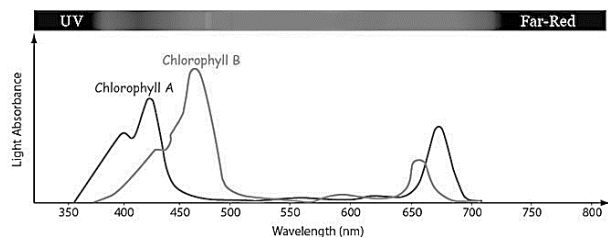
*Explanation:* This protection is provided to human eyes as well.

**Q.43** Answer is “Chlorophyll a and human eyes”

*Explanation:* Carotenoids provide protection against intense light to chlorophyll-a and human eyes.

**Q.44** Answer is “Blue and red parts of spectrum”

*Explanation:* Chlorophyll absorbs in these ranges maximum.



**Q.45 Answer is “Two peaks one valley”**

**Explanation:** One peak at blue and other at red wavelengths.

**Q.46 Answer is “Absorption spectrum of chlorophyll a”**

**Explanation:** One peak is near 430nm whereas other peak is near 670nm.

**Q.47 Answer is “460-640”**

**Explanation:** It is visible in the absorption spectrum of chlorophyll given in textbook of biology at page 212.

**Q.48 Answer is “reduction of CO<sub>2</sub> and oxidation of water occurs”**

**Explanation:** CO<sub>2</sub> is reduced to synthesize carbohydrate and hydrogen is removed from water which is used in reduction of CO<sub>2</sub>.

**Q.49 Answer is “Two phases”**

**Explanation:** Light reaction and dark reaction.

**Q.50 Answer is “Light reaction”**

**Explanation:** It is ATP and NADPH respectively. ATP is assimilatory power and NADPH is reducing power.

**Q.51 Answer is “Energized electrons”**

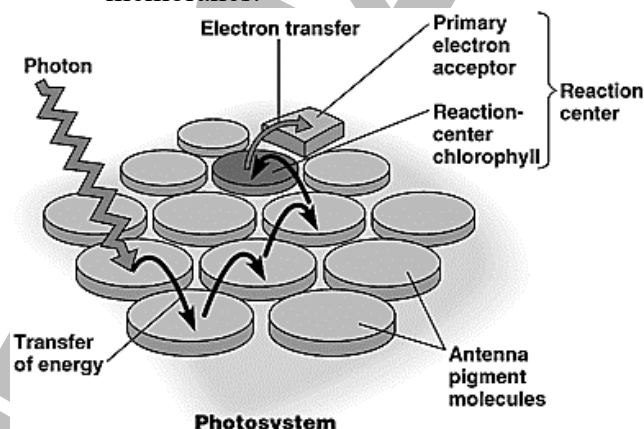
**Explanation:** These energized electrons are used as a source of energy in synthesis of sugar.

**Q.52 Answer is “It does not requires light”**

**Explanation:** It is dark reaction which uses the assimilatory power and reducing power synthesized in light reaction in reducing CO<sub>2</sub> to synthesize carbohydrates. It may occur in light as well as in dark.

**Q.53 Answer is “Photosystems”**

**Explanation:** Photosynthetic pigments are organized into clusters, called photosystems, for efficient absorption and utilization of solar energy in thylakoid membranes.



**Q.54 Answer is “Antenna complex and a reaction centre”**

**Explanation:** Each photosystem consists of a light gathering antenna complex and a reaction center. The antenna complex has many molecules of chlorophyll-a, chlorophyll-b and carotenoids, most of them channeling the energy to reaction center.

**Q.55 Answer is “One or more molecules of chlorophyll a and primary electron acceptor”**

**Explanation:** Reaction center of photosynthesis lies in chlorophyll a. It consists of one or more molecules of chlorophyll a along with a primary electron acceptor and associated electron carrier of electron transport system. Chlorophyll a molecules of reaction center and associated proteins are closely linked to the nearby electron transport system.

**Q.56 Answer is “Answer PS-I and PS-II”**

**Explanation:** PS-I was discovered earlier than PS-II.



**Q.57** Answer is “700nm”

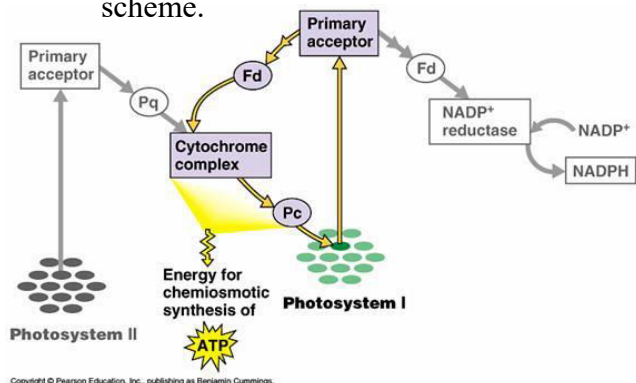
**Explanation:** This is absorptive range photosystem-I.

**Q.58** Answer is “Primary electron acceptor”

**Explanation:** Chlorophyll a molecules of reaction center and associated proteins are closely linked to the nearby electron transport system.

**Q.59** Answer is “Non-cyclic electron flow or Z-scheme”

**Explanation:** It is non-cyclic photophosphorylation also called Z-scheme.



**Q.60** Answer is “Cyclic electron flow”

**Explanation:** It yields only ATPs

**Q.61** Answer is “Non-cyclic phosphorylation”

**Explanation:** As same electrons are not cycled back again and again.

**Q.62** Answer is “Cyclic phosphorylation”

**Explanation:** Same electrons are again and again cycled back and each time yield one ATP.

**Q.63** Answer is “Photolysis of water”

**Explanation:** Photo means light and lysis means splitting up. So splitting up of water by light is called photolysis of water.

**Q.64** Answer is “PQ → Cytochrome complex → PC”

**Explanation:** It is photosynthetic electron transport chain involved in non-cyclic phosphorylation.

**Q.65** Answer is “PQ”

**Explanation:** Cyclic phosphorylation involves PS-I, primary electron acceptor of PS-I, Fd, cytochrome complex and PC.

**Q.66** Answer is “ATP”

**Explanation:** It occurs through chemiosmosis in cytochrome complex.

**Q.67** Answer is “ATPs generated by light reactions”

**Explanation:** ATP (assimilatory power) is synthesized in light reaction which is used later on in dark reaction to synthesize sugar.

**Q.68** Answer is “PS-I → Primary acceptor of PS-I → Fd → NADP”

**Explanation:** It starts from PS-I and ends at formation of reducing power.

**Q.69** Answer is “Cyclic electron flow”

**Explanation:** In cyclic phosphorylation only PS-I is involved.

**Q.70** Answer is “Coupling of ETC by chemiosmosis”

**Explanation:** In both cyclic and non-cyclic photophosphorylation, the mechanism for ATP synthesis is chemiosmosis, the process that uses membranes to couple redox reactions to ATP production.

**Q.71** Answer is “Both cyclic and non-cyclic photophosphorylation”

**Explanation:** Chemiosmosis is involved in both types of photophosphorylation.



**Q.72** Answer is “University of California”

*Explanation:* Melvin Calvin and his colleagues at The University of California discovered the details of path of carbon in these reactions. He was awarded Nobel prize in 1961.

**Q.73** Answer is “Calvin cycle”

*Explanation:* As discovered by Melvin Calvin. So it is called Calvin cycle

**Q.74** Answer is “Fixation of CO<sub>2</sub>”

*Explanation:* In first phase CO<sub>2</sub> is condensed with RuBP in presence of Rubisco. It is called fixation of CO<sub>2</sub>.

**Q.75** Answer is “Ribulose Bisphosphate”

*Explanation:* It is Ribulose 1, 5 bisphosphate.

**Q.76** Answer is 3PGA  $\xrightarrow[\text{ADP}]{\text{ATP}}$  1, 3 BPGA”

*Explanation:* In first stage of reduction phase assimilatory power is utilized and 3PGA is converted into 1,3 BPGA.

**Q.77** Answer is “Reduction phase of Calvin cycle”

*Explanation:* However additional assimilatory power (ATPs) are also used in regeneration phase.

**Q.78** Answer is “Regeneration”

*Explanation:* Only 3ATPs are used to regenerate 3RuBP from 5 G.3.P.

**Q.79** Answer is “3,6,9”

*Explanation:* Observe the Calvin cycle.

**Q.80** Answer is “12,24,36”

*Explanation:* As synthesis of glucose requires 6, 12, 18 molecules of CO<sub>2</sub>, NADPH and ATPs respectively, maltose consists of two glucose molecules.

**Q.81** Answer is “1,2,3”

*Explanation:* Ratio remains same.

**Q.82** Answer is “1,2,3”

*Explanation:* It is 3:6:9 actually.

**Q.83** Answer is “1,2,3”

*Explanation:* Ratio of input of Calvin Cycle will remain same.

**Q.84** Answer is “Dark reaction of photosynthesis”

*Explanation:* Evident from inputs and outputs.

**Worksheet-13(ii)**  
**(Bioenergetics)**

**Q.1**  $C_6H_{12}O_6 \longrightarrow 2C_3H_4O_3 + \text{Energy}$ . The given equation represents the:

- A) Oxidation of pyruvate
- B) Glycolysis
- C) Krebs's cycle
- D) TCA cycle

**Q.2** Biologists believe that in the first cell that was organized on earth, a reaction may have occurred which was identical to:

- A) Oxidation of pyruvate
- B) Glycolysis
- C) Krebs's cycle
- D) TCA cycle

**Q.3** Cellular respiration depending upon the type of the cell and prevailing conditions varies from the step after:

- A) Oxidation of pyruvate
- B) Citric acid cycle
- C) Glycolysis
- D) Oxidative phosphorylation

**Q.4** Pyruvate, the end product of glycolysis, follows different catabolic pathways depending on the:

- A) Organism
- B) Metabolic conditions
- C) Size of organism
- D) Organism and metabolic conditions

**Q.5** Alcoholic fermentation, lactic acid fermentation and aerobic respiration are the three ways for the processing of:

- A) Pyruvate in the cell
- B) Glucose in the cell
- C) Acetate in the cell
- D) Organic food in cell

**Q.6** What occurs in the absence of oxygen:

- A) Alcoholic fermentation
- B) Respiratory electron transport chain
- C) Lactic acid fermentation
- D) Alcoholic and lactic acid fermentation

**Q.7** Pick up the one which is anaerobic:

- A) Fermentation
- B) Oxidative phosphorylation
- C) Respiratory chain
- D) Krebs cycle

**Q.8** Glucose is completely broken down only in the:

- A) Aerobic respiration
- B) Cellular respiration
- C) Internal respiration
- D) External respiration

**Q.9** During aerobic respiration glucose is oxidized to:

- A)  $CO_2$
- B)  $H_2O$
- C)  $CO_2$  and water
- D)  $CO_2$  and energy

**Q.10** During aerobic respiration glucose is oxidized to carbon dioxide and water and:

- A) Energy is consumed
- B) Light is consumed
- C) Energy is released
- D) Light is produced

**Q.11** This form of anaerobic respiration occurs in muscle cells of humans and other animals during extreme physical activities, such as sprinting:

- A) Alcoholic fermentation
- B) Aerobic respiration
- C) Anaerobic respiration
- D) Lactic acid fermentation

**Q.12 Cristae are part of:**

- A) Chloroplast
- B) Endoplasmic reticulum
- C) Mitochondrion
- D) Golgi apparatus

**Q.13 A large “battery” of \_\_\_\_\_ slowly release energy from the glucose molecules.**

- A) Organelles
- B) Coenzymes
- C) Enzymes
- D) Enzyme and coenzymes

**Q.14 A compound found in every living cell and is one of the essential chemicals of life. It plays a key role in most biological energy transformations. It is:**

- A) NADH
- B) FADH
- C) ATP
- D) Glucose

**Q.15 Conventionally, ‘P’ stands for the:**

- A) Phosphorus atom
- B) Entire phosphate group
- C) Phosphorus element
- D) Phosphorus acid

**Q.16 A far more free energy is released when bond of \_\_\_\_\_ phosphate of ATP is broken by hydrolysis:**

- A) First
- B) Second
- C) Third
- D) Second and third

**Q.17 What enables the cell to accumulate a great quantity of energy in very small space and keeps it ready for use as soon as it is needed:**

- A) High energy ‘P’ bond
- B) High energy bonds of organic food
- C) High energy bonds of glucose
- D) High energy bonds of lipids

**Q.18 The maintenance of a living system requires a:**

- A) Continuous supply of free energy
- B) Continual supply of free energy
- C) Continuously increasing supply of free energy
- D) Continuously decreasing supply of free energy

**Q.19 Cellular respiration is essentially:**

- A) Oxidation process
- B) Redox process
- C) A reduction process
- D) Decarboxylation process

**Q.20 Cellular respiration is also called as:**

- A) Internal respiration
- B) Biological oxidation
- C) Organismic respiration
- D) Internal respiration and biological oxidation

**Q.21 The breakdown of glucose in cell yields pyruvate in the:**

- A) Presence of oxygen
- B) Absence of oxygen
- C) Presence or absence of oxygen
- D) High Conc. of oxygen

**Q.22 Following are the requirements for glycolysis to occur in the cytoplasm EXCEPT:**

- A) Glucose
- B) ATP
- C) Enzymes and Coenzymes
- D) FAD

**Q.23 The first step of glycolysis is the transfer of a phosphate group from:**

- A) ATP to glucose
- B) ATP to fructose
- C) G.3.P to ATP
- D) ATP to G.3.P

**Q.24 The product of second step of glycolysis:**

- A) Glucose 6-phosphate

- B) Fructose 1, 6 Bisphosphate  
C) Fructose 6-phosphate  
D) Glucose
- Q.25** The second ATP is consumed in \_\_\_\_\_ step of glycolysis.  
A) First C) Third  
B) Second D) Fourth
- Q.26** The product of third step of glycolysis is:  
A) Glucose  
B) Fructose 6-phosphate  
C) Glucose 6-phosphate  
D) Fructose 1, 6-biphosphate
- Q.27** The product(s) of fourth step of glycolysis is:  
A) G.3.P  
B) 3PGAL  
C) Dihydroxyacetone phosphate  
D) G.3.P/3PGAL and Dihydroxyacetone phosphate
- Q.28** Pick up the energy yielding process of glycolysis:  
A) Oxidation of PGAL  
B) Reduction of PGAL  
C) Phosphorylation of PGAL  
D) Reduction of 3-PG
- Q.29** The step of glycolysis in which removal of a water molecule is carried out is:  
A) 3PG → 2PG C) PEP → Pyruvate  
B) 2PG → PEP D) 1,3 BPG → 3PG
- Q.30** What is equivalent to half glucose molecule that has been oxidized to the extent of losing two electrons as hydrogen atoms:  
A) G.3.P C) 3PGAL  
B) 3-PG D) Pyruvate

- Q.31** During aerobic respiration, the chemical substance that enters the mitochondrion to start Krebs cycle is:  
A) Pyruvic acid C) Acetic acid  
B) Acetyl CO-A D) Citric acid
- Q.32** Before start of Krebs cycle, following changes occur, EXCEPT:  
A) Formation of acetyl-Co-A  
B) Oxidation of acetate  
C) Reduction of NAD  
D) Decarboxylation of pyruvate
- Q.33** Krebs cycle is a cyclic series of chemical reactions during which:  
A) Oxidation process is completed  
B) Decarboxylation process is completed  
C) Reduction process is completed  
D) Energy consuming process is completed
- Q.34** In first step of Krebs cycle following changes occur, EXCEPT:  
A) Formation of citrate  
B) Condensation of oxaloacetate and acetyl Co-A  
C) Hydration and decondensation of Co-A  
D) Decarboxylation and condensation of Co-A
- Q.35** In Kreb's cycle, for formation of α-ketoglutarate, following changes occur, EXCEPT:  
A) NAD – mediated oxidation  
B) Formation of NADH  
C) Decarboxylation  
D) Hydration
- Q.36** FAD is reduced to get FADH<sub>2</sub> in a step of Krebs cycle which involves conversion of:  
A) Succinate to fumarate  
B) Malate to oxaloacetate  
C) Fumarate to malate  
D) α-ketoglutarate to succinate

**Q.37** Succinate is converted into fumarate by removal of:

- A) A hydrogen atom
- B) A CO<sub>2</sub> atom
- C) Two hydrogen atoms
- D) A water molecule

**Q.38** Rearrangement followed by a second ATP phosphorylation involves step no. \_\_\_\_\_ of glycolysis.

- A) 1
- B) 2
- C) 3
- D) 2, 3

**Q.39** In glycolysis, the six-carbon molecule is split into G-3-P and DAP, then DAP is also converted into G-3-P in step no. \_\_\_\_\_.

- A) 2 & 3
- B) 3 & 4
- C) 4 & 5
- D) 5 & 6

**Q.40** In glycolysis, oxidation followed by phosphorylation produces two NADH molecules and two molecules of BPG, in step no.

- A) 4
- B) 5
- C) 6
- D) 7

**Q.41** The step of glycolysis that involves removal of high energy phosphate by two ADP molecules to get two ATP molecules and two 3PGA molecules is:

- A) Step – 4
- B) Step – 5
- C) Step – 6
- D) Step – 7

**Q.42** Removal of high energy phosphate by two ADP molecules produces two ATP molecules and two pyruvate molecules in step no. \_\_\_\_\_ of glycolysis.

- A) 7
- B) 8
- C) 9
- D) 10

**Q.43** The oxidation – reduction substances which take part in respiratory chain are following EXCEPT:

- A) Coenzyme Q
- B) Molecular oxygen
- C) Cytochromes b, c, a and a<sub>3</sub>
- D) Cytochrome f

**Q.44** In respiratory electron transport chain the first ATP is formed from ADP and inorganic phosphate, utilizing the free energy obtained by oxidation of :

- A) NADH
- B) FADH
- C) Coenzyme Q
- D) Cytochrome C

**Q.45** In respiratory electron transport chain coenzyme – Q is reduced by:

- A) NADH
- B) FADH
- C) Cytochrome - C
- D) Cytochrome - a

**Q.46** In respiratory electron transport chain cytochrome – b is reduced by:

- A) NADH
- B) FADH
- C) Cytochrome - C
- D) Coenzyme - Q

**Q.47** In respiratory electron transport chain cytochrome – a is reduced by oxidation of:

- A) NADH
- B) FADH
- C) Cytochrome - C
- D) Coenzyme - Q

**Q.48** In respiratory electron transport chain the third ATP is produced by the oxidation of:

- A) NADH
- B) Cytochrome - b
- C) Cytochrome - c
- D) Cytochrome - a<sub>3</sub>

**Q.49** Normally oxidative phosphorylation is coupled with the:

- A) Photosynthetic electron transport chain
- B) Non-cyclic electron transport chain
- C) Respiratory electron transport chain
- D) Cyclic electron transport chain



**Q.50**  $\text{NADH} + \text{H}^+ + 3\text{ADP} + 3\text{Pi} + \frac{1}{2} \text{O}_2 \longrightarrow 3\text{NAD}^+ + \text{H}_2\text{O} + 3\text{ATP}$ . The equation has summarized:

- A) Glycolysis
- B) Respiratory chain
- C) Kreb's cycle
- D) Photosynthetic electron transport chain

**Q.51** Pumping of protons ( $\text{H}^+$ ) across the inner membrane of mitochondrion folded into cristae, between matrix of mitochondrion and mitochondrion's intermembrane space occur for chemiosmosis of:

- A) Oxidative phosphorylation
- B) Cyclic phosphorylation
- C) Photophosphorylation
- D) Non-cyclic phosphorylation

**Q.52** Accumulation of NADH inhibits the Krebs cycle by inhibiting:

- A) Phosphoglucokinase
- B) Pyruvate decarboxylase
- C) Phosphofructokinase
- D) Pyruvate dehydrogenase

**Q.53** Glycolysis is inhibited by inhibition of phosphofructokinase through feedback mechanism by accumulation of \_\_\_\_\_ in mitochondrion.

- A) Citrate
- B) Oxaloacetate
- C) Succinate
- D) Adenosine triphosphate

**Q.54** The final phase of cellular respiration in which the compounds NADH and  $\text{FADH}_2$  are oxidized and their electrons pass along a chain of oxidation reduction steps is called:

- A) Electron transport chain
- B) Non-cyclic photophosphorylation

C) Cyclic photophosphorylation

D) Z – scheme

**Q.55** The first of the two distinctive sets of reactions in photosynthesis in which light energy is required to oxidize water and  $\text{O}_2$  is released, is called:

- A) Light independent reaction
- B) Light reaction
- C) Calvin cycle
- D) Dark reaction

**Q.56** The second stage of photosynthesis, in which carbon dioxide is reduced to carbohydrate and which occurs whether light is present or not, is called:

- A) Light reaction
- B) Light dependent reaction
- C) Light independent reaction
- D) Synthesis of ATP and  $\text{NADPH}_2$

**Q.57** The removal of electrons from an atom or compound is called:

- A) Reduction
- B) Oxidative phosphorylation
- C) Oxidation
- D) Oxidation-reduction reaction

**Q.58** The condition in which reduced metabolic products comprising the “debt” accumulate due to inability of oxidative metabolism to function rapidly enough. The “debt” is payed off when the metabolism that produces reduced products slows. This is called:

- A) Electron debt
- B) Oxygen debt
- C) Hydrogen debt
- D) Carbon debt

**Q.59** The two basic molecular systems for converting light to chemical energy during photosynthesis are called:

- A) Photosystem I and II
- B) Light systems

- C) Pigment systems
- D) PS 660 and PS 730

**Q.60** The hydrogen ions move down their gradient from thylakoid space to outside through special complexes found in thylakoid membrane called:

- A) Ferredoxine
- B) ATP synthase
- C) Cytochrome complex
- D) Plastoquinone

**Q.61** A process of CO<sub>2</sub> fixation in photosynthesis by which the first product is the four-carbon oxaloacetate molecule is called:

- A) C<sub>3</sub> photosynthesis
- B) C<sub>4</sub> photosynthesis
- C) Light reaction
- D) Cyclic electron flow

STEP ENTRY TEST 2020

ANSWER KEY (Worksheet-13(ii))					
1	B	23	A	45	A
2	B	24	C	46	D
3	C	25	C	47	C
4	D	26	D	48	D
5	A	27	D	49	C
6	D	28	A	50	B
7	A	29	B	51	A
8	A	30	D	52	B
9	C	31	C	53	A
10	C	32	B	54	A
11	D	33	A	55	B
12	C	34	D	56	C
13	D	35	D	57	C
14	C	36	A	58	B
15	B	37	C	59	A
16	D	38	D	60	B
17	A	39	C	61	B
18	B	40	C		
19	A	41	D		
20	D	42	D		
21	C	43	D		
22	D	44	A		

### EXPLANATION

**Q.1** Answer is "Glycolysis"

**Explanation:** It indicates formation of two molecules of pyruvate from one molecule of glucose.

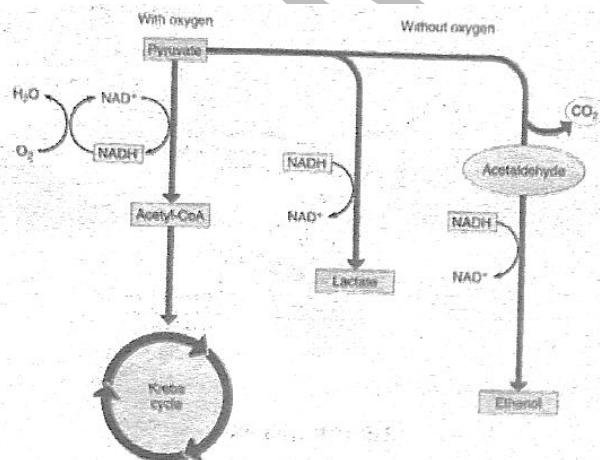
**Q.2** Answer is "Glycolysis"

**Explanation:** Glycolysis is such a process which is found in both prokaryotes and eukaryotes. It occurs in cytoplasm. Without glycolysis there is no other option for provision of energy to the cell.

**Q.3** Answer is "Glycolysis"

**Explanation:** If aerobic conditions prevail after glycolysis it will follow the path of oxidation of pyruvate and Krebs cycle

otherwise it will follow the path of lactic acid fermentation or alcoholic fermentation.



**Q.4** Answer is "Organism and metabolic condition"

**Explanation:** In prokaryotes, membranous organelles like mitochondria are absent. Thus, they follow the path of anaerobic respiration after completion of glycolysis. However, eukaryotes having membranous organelles like mitochondria carry out aerobic respiration. Similarly, in aerobic conditions aerobic respiration is possible but in anaerobic conditions, after glycolysis there is only option of anaerobic respiration.

**Q.5** Answer is "Pyruvate in cell"

**Explanation:** After glycolysis cell gets two molecules of pyruvate. After formation of pyruvate there comes oxidation of pyruvate and Krebs cycle, if oxygen is present and fermentation (Alcoholic or lactic acid fermentation) occurs, if oxygen is absent.

**Q.6** Answer is "Alcoholic and lactic acid fermentation"

**Explanation:** Both alcoholic fermentation and lactic acid fermentation occur in absence of oxygen. It is also called anaerobic respiration.

## Q.7 Answer is “Fermentation”

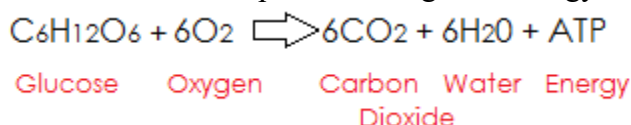
**Explanation:** Fermentation is an anaerobic process which is also called as anaerobic respiration.

## Q.8 Answer is “Aerobic respiration”

**Explanation:** Anaerobic respiration is a sheer wastage of resources and is opted as necessary evil. It yields only 2% of the total potential energy. However, aerobic respiration yield maximum energy.

Q.9 Answer is “CO<sub>2</sub> and water”

**Explanation:** These are the end products of aerobic respiration along with energy.



## Q.10 Answer is “Energy is released”

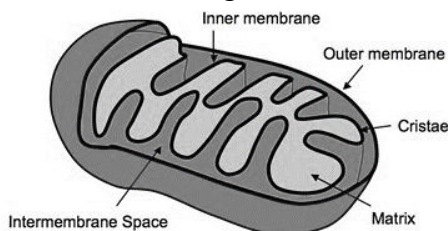
**Explanation:** During aerobic respiration glucose is broken down in the presence of oxygen into carbon dioxide and water and energy is produced. See the explanation of Q No. 9.

## Q.11 Answer is “Lactic acid fermentation”

**Explanation:** As oxygen cannot be provided according to the demand in such situations and due to this deficit in demand and supply of oxygen muscles have to start anaerobic respiration to supplement the energy.

## Q.12 Answer is “Mitochondria”

**Explanation:** Each mitochondrion is constructed of an outer enclosing membrane and an inner membrane with elaborate folds or cristae that extend into the interior of the organelle.



## Q.13 Answer is “Enzymes and coenzymes”

**Explanation:** Aerobic respiration being a long pathway involves many enzymes and coenzymes.

## Q.14 Answer is “ATP”

**Explanation:** That is why it is called energy currency of the cell.

## Q.15 Answer is “Entire phosphate group”

**Explanation:** Conventionally, “P” stands for the entire phosphate group. The second and third phosphate represent the so called “high energy” bonds. If these are broken by hydrolysis far more free energy is released as compared to the other bond in the ATP molecule.

## Q.16 Answer is “Second and third”

**Explanation:** The second and third phosphate represent the so called “high energy” bonds.

## Q.17 Answer is “High energy ‘p’ bond”

**Explanation:** The energy of organic food is extracted from its bonds through aerobic respiration and is called ATP (in high energy ‘p’ bond).

## Q.18 Answer is “Continual supply of free energy”

**Explanation:** Continual supply means rhythmic supply after equal time intervals but does not mean persistent supply or unabated supply.

## Q.19 Answer is “Oxidation process”

**Explanation:** It is stepwise oxidative breakdown of organic food to get energy.

## Q.20 Answer is “Internal respiration or biological oxidation”

**Explanation:** Cellular respiration is called internal respiration and biological oxidation of glucose to get energy.



**Q.21** Answer is "Presence or absence of oxygen"

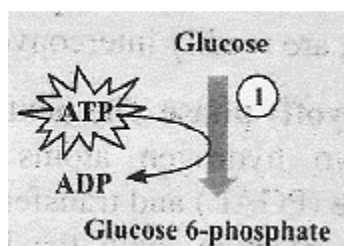
**Explanation:** As glycolysis does not need oxygen.

**Q.22** Answer is "FAD"

**Explanation:** FAD (Flavin adenine dinucleotide) have nothing to do with glycolysis.

**Q.23** Answer is "ATP to glucose"

**Explanation:** As a result Glucose 6-phosphate is formed.

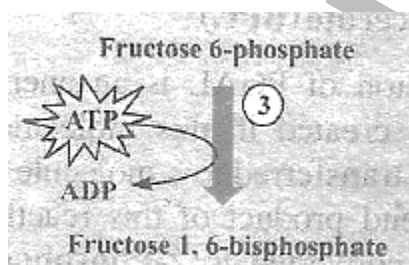


**Q.24** Answer is "Fructose 6-phosphate"

**Explanation:** Aldohexose (glucose 6 phosphate) is transformed into ketohexose (fructose 6 phosphate).

**Q.25** Answer is "Third"

**Explanation:** It is formation of fructose 1, 6 bisphosphate from fructose 6 phosphate.

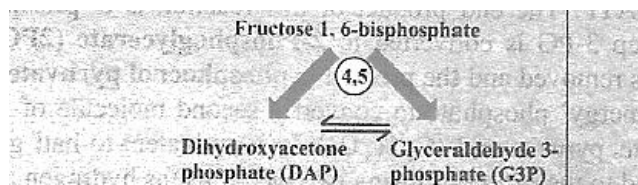


**Q.26** Answer is "Fructose 1,6 bisphosphate"

**Explanation:** As one ATP is again consumed.

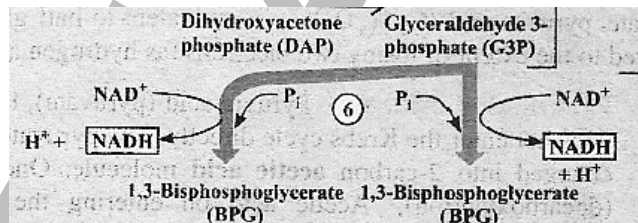
**Q.27** Answer is "G.3.P/3PGAL and dihydroxyacetone phosphate"

**Explanation:** As fructose 1, 6 bisphosphate is cleaved to yield two trioses i.e. Glyceraldehyde 3 phosphate and dihydroxyacetone phosphate.



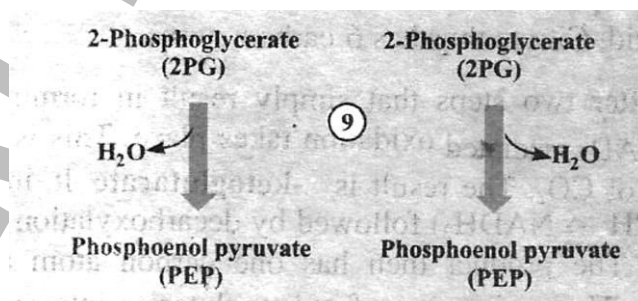
**Q.28** Answer is "Oxidation of PGAL"

**Explanation:** NAD is reduced by oxidation of PGAL and  $\text{NADH}^+$  is formed.



**Q.29** Answer is "2PG → PEP"

**Explanation:** Dehydration occurs during the formation of phosphoenol pyruvate from 2 phosphoglycerate.



**Q.30** Answer is "Pyruvate"

**Explanation:** It occurs during oxidation of pyruvate. Pyruvic acid (pyruvate) the end product of glycolysis does not enter the Krebs cycle directly. The pyruvate (3-carbon molecule) is first changed into 2-carbon acetic acid molecule. One carbon is released as  $\text{CO}_2$  coenzyme-A (CoA) to form acetyl CoA (Active acetate). In addition, more hydrogen atoms are transferred to NAD.

**Q.31** Answer is "Acetic acid"

**Explanation:** Acetic acid on entering the mitochondrion unites with Coenzyme A to form acetyl Co-A.



**Q.32 Answer is "Oxidation of acetate"**

**Explanation:** Oxidation of pyruvate takes places not that of acetate.

**Q.33 Answer is "Oxidation process is completed"**

**Explanation:** Oxidative breakdown of organic food is completed.

**Q.34 Answer is "Decarboxylation and condensation of Co-A"**

**Explanation:** Other three changes given in A), B) and C) occur in first step of Krebs cycle except decarboxylation and condensation of Co-A.

**Q.35 Answer is "Hydration"**

**Explanation:** No hydration occurs in this step.

**Q.36 Answer is "Succinate to fumarate"**

**Explanation:** The succinate is oxidized to get fumarate in presence of succinic acid dehydrogenase enzyme.

**Q.37 Answer is "Two hydrogen atoms"**

**Explanation:** Succinate is converted into fumarate and two hydrogen atoms are removed. The process is catalyzed by succinic acid dehydrogenase.

**Q.38 Answer is "2, 3"**

**Explanation:** Step 2 involves rearrangement i.e. formation of Fructose 6-phosphate from glucose 6-phosphate; and 3 involves ATP phosphorylation.

**Q.39 Answer is "4-5"**

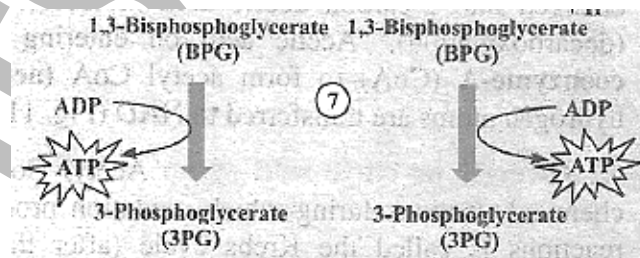
**Explanation:** Fructose 1, 6 bisphosphate splits up into glyceraldehyde 3-phosphate and dihydroxyacetone phosphate during step no.4 of glycolysis which is followed by step no.5 in which dihydroxyacetone phosphate is also converted into glyceraldehyde three phosphate (G.3.P). See explanation of question # 27

**Q.40 Answer is "6"**

**Explanation:** In step no. 6 of glycolysis two molecules of G3P are oxidized and two molecules of NAD are reduced (NADH) and as a result two molecules of 1, 3 bisphosphoglycerate are formed. See the explanation of question # 28.

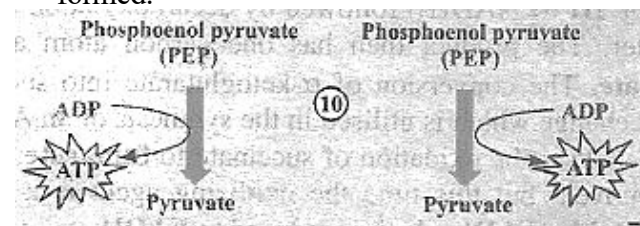
**Q.41 Answer is "Step 7"**

**Explanation:** In step no. 7 of glycolysis, two molecules of 1, 3 bisphosphoglycerate are dephosphorylated, two molecules of ADP are phosphorylated to get two ATPs and as a result two molecules of 3PGA are formed.



**Q.42 Answer is "10"**

**Explanation:** In step no. 10 of glycolysis two molecules of phosphoenol pyruvate (PEP) are converted into two molecules of pyruvate and two molecules of ATP are formed.



**Q.43 Answer is "Cytochrome f"**

**Explanation:** Cytochrome b6f, commonly called as cytochrome f is involved in photosynthesis to mediate the transfer of electron between the two photosynthetic reaction center complexes, from photosystem II to photosystem I, while transferring protons from the chloroplast stroma across the thylakoid membrane into the lumen.

**Q.44 Answer is “NADH”**

**Explanation:** It is first step of respiratory electron transport chain in which NADH is oxidized by coenzyme Q. This oxidation yields enough free energy to permit the synthesis of a molecule of ATP from ADP from ADP and inorganic phosphate.

**Q.45 Answer is “NADH”**

**Explanation:** As NADH stands at higher energy level and electron move from higher to lower energy level, thus NADH is oxidized and coenzymes Q is reduced.

**Q.46 Answer is “Coenzyme – Q”**

**Explanation:** Cytochrome-b is reduced by electrons which are released by the oxidation of coenzyme Q.

**Q.47 Answer is “Cytochrome – C”**

**Explanation:** Cytochrome-a is reduced by cytochrome c which is oxidized and electrons are used to reduced cytochrome a.

**Q.48 Answer is “Cytochrome a<sub>3</sub>”**

**Explanation:** When cytochrome a<sub>3</sub> is oxidized and O<sub>2</sub> is reduced to form water, electrons release some free energy to come to the lower energy state and as a result ADP is phosphorylated into ATP by inorganic phosphate using that free energy.

**Q.49 Answer is “Respiratory electron transport chain”**

**Explanation:** There are three different sites where oxidative phosphorylation occurs to yield three ATP molecules during respiratory electron transport chain.

**Q.50 Answer is “Respiratory chain”**

**Explanation:** This is summary equation of respiratory electron transport chain.

**Q.51 Answer is “Oxidative phosphorylation”**

**Explanation:** The organelle (mitochondrion) clearly indicates it.

**Q.52 Answer is “Pyruvate decarboxylase”**

**Explanation:** If pyruvate decarboxylase is inhibited acetate formation and subsequently Acetyl Co. A formation will be stopped. As a result Kreb’s cycle will be stopped from the beginning. It is called negative feedback or feedback inhibition.

**Q.53 Answer is “Citrate”**

**Explanation:** See Book-I page # 299 fig. 11.15.

**Q.54 Answer is “Electron transport chain”**

**Explanation:** It is respiratory electron transport chain also called oxidative phosphorylation.

**Q.55 Answer is “Light reaction”**

**Explanation:** It is light reaction or photophosphorylation which uses light energy for photolysis of water in which oxygen is released.

**Q.56 Answer is “Light independent reaction”**

**Explanation:** Light independent phase also called as dark reaction or Calvin cycle is that phase which uses the reducing power and assimilatory powers (made in light reaction) to reduce CO<sub>2</sub> and to synthesized glucose.

**Q.57 Answer is “Oxidation”**

**Explanation:** Removal of electrons is oxidation while addition of electrons is reduction.

**Q.58 Answer is “Oxygen debt”**

**Explanation:** It have been taken from glossary of text book of biology book-I. It is definition of oxygen debt.

**Q.59 Answer is “Photosystem-I and photosystem-II”**

**Explanation:** Photosystems convert light energy into chemical energy.

Q.60 Answer is “ATP synthase”

*Explanation:* ATP synthase is an important enzyme that creates the energy storage molecules adenosine triphosphate (ATP). ATP is the most commonly used “energy currency” of cells from most organisms.

Q.61 Answer is “C<sub>4</sub> photosynthesis”

*Explanation:* A photosynthetic process which proceeds in the mesophyll and bundle sheath cells of C<sub>4</sub> plants.

STEP ENTRY TEST 2020

**Worksheet-14 (i)**  
**(Gas Exchange)**

- Q.1** Air passageways of human being consist of following parts EXCEPT:  
A) Nostrils and nasal cavities  
B) Bronchi, bronchioles and alveolar ducts  
C) Pharynx, larynx and trachea  
D) Air sacs and alveoli
- Q.2** Both nasal cavities are collectively sub divided into:  
A) Three passageways  
B) Five passageways  
C) Four passageways  
D) Six passageways
- Q.3** Each nasal cavity is sub divided into three passageways by the projection of bones from the walls of the:  
A) External nose      C) Middle nose  
B) Internal nose      D) Posterior nose
- Q.4** The nasal cavity leads into the throat or pharynx by:  
A) Three internal openings  
B) Two internal openings  
C) Four internal openings  
D) Five internal openings
- Q.5** The larynx or voice box is a complex cartilaginous structure surrounding the:  
A) Upper end of trachea  
B) Upper end of pharynx  
C) Lower end of trachea  
D) Upper end of bronchi
- Q.6** One of the cartilage has a muscularly controlled hinge like action and serves as a lid which automatically covers the opening of the larynx and is called:  
A) Glottis      C) Voice box

- B) Epiglottis      D) Vocal cord
- Q.7** Glottis is the opening of:  
A) Larynx      C) Trachea  
B) Pharynx      D) Windpipe
- Q.8** In the glottis the mucous membrane is stretched across into two thin edged fibrous bands called:  
A) Vocal cords      C) Nerve cords  
B) Epiglottis      D) Notochord
- Q.9** The commonly held belief that the epiglottis closes downward upon the larynx when food is swallowed is:  
A) Quite true      C) Not quite true  
B) Quite wrong      D) Quite baseless
- Q.10** The degree of closure of larynx is determined partly by:  
A) Backward movement of the tongue  
B) Upward movement of the larynx  
C) Backward movement of the tongue and upward movement of the larynx  
D) Backward movement of the larynx and upward movement of the tongue
- Q.11** What forces the epiglottis into more or less horizontal position:  
A) Forward movement of the tongue  
B) Upward movement of the larynx  
C) Backward movement of the tongue  
D) Downward movement of the larynx
- Q.12** Food does not enter the partly open larynx and obstruct breathing primarily because the:  
A) Epiglottis diverts the food mass to one side of the opening  
B) Esophageal sphincter is contracted  
C) Esophageal sphincter is relaxed

- D) Glottis is so narrow to receive the food
- Q.13 Trachea upon entering into the thorax divides into:**
- A) Right and left bronchi  
B) Upper and lower bronchi  
C) Dorsal and ventral bronchi  
D) Smaller and larger bronchi
- Q.14 These are mainly made up of circular smooth muscles:**
- A) Larynx C) Bronchi  
B) Trachea D) Bronchioles
- Q.15 These continue to divide and sub divide deep into the lungs and finally open into a large number of air sacs:**
- A) Larynx C) Bronchi  
B) Trachea D) Bronchioles
- Q.16 Pleural membranes line the part of the thoracic cavity containing the lungs, so the lungs are in the:**
- A) Pleural cavity C) Thoracic cage  
B) Rib cage D) Diaphragm
- Q.17 Air enters the lungs from the oral cavity or nasal passages via trachea and bronchi and eventually reaches the:**
- A) Air sacs C) Bronchioles  
B) Alveoli D) Thoracic cavity
- Q.18 These are the organs placed in the chest cavity:**
- A) Air sacs C) Thorax  
B) Alveoli D) The lungs
- Q.19 Chest cavity is bound on sides by:**
- A) Ribs C) Ribs and Muscles  
B) Muscles D) Diaphragm
- Q.20 C shaped cartilaginous rings present in the wall of trachea prevent it from:**
- A) Bending  
B) Collapsing  
C) Opening

- D) Changing its diameter
- Q.21 Lungs are covered with double layered thin membranous sac called:**
- A) Air sacs C) Pleura  
B) Alveoli D) Rib cage
- Q.22 An uninterrupted supply of energy is required for activities at:**
- A) Cell level  
B) Organs level  
C) Tissue level  
D) Cell, Organs and Tissue levels
- Q.23 It is the process by which cell utilizes oxygen, produces carbon dioxide, extracts and conserves the energy:**
- A) Organismic respiration  
B) Breathing  
C) External Respiration  
D) Cellular respiration
- Q.24 In human being respiratory pigment is:**
- A) Myoglobin C) Hemocyanin  
B) Hemoglobin D) Oxyhaemoglobin
- Q.25 It is contained in the red blood cells:**
- A) Myoglobin C) Hemocyanin  
B) Hemoglobin D) Phycoerythrin
- Q.26 Oxyhemoglobin is unstable and splits into the normal purple red colored hemoglobin and oxygen in the condition of:**
- A) Low oxygen concentration and less pressure  
B) Low oxygen concentration and more pressure  
C) High oxygen concentration and more pressure



- D) High oxygen concentration and low pressure
- Q.27 Carbonic anhydrase enzyme present in R.B.C facilitates:**
- A) Splitting up of oxyhemoglobin
  - B) Splitting up of carboxyhemoglobin
  - C) Formation of hemoglobin
  - D) Formation of carboxyhemoglobin
- Q.28 The maximum amount of oxygen which normal human blood absorbs and carries at sea level is about:**
- A) 19.6 ml/100 ml of blood
  - B) 20 ml/98 ml of blood
  - C) 20 ml/100 ml of blood
  - D) 19.6 ml/98 ml of blood
- Q.29 Under normal conditions, blood of alveoli of the lungs is:**
- A) Completely oxygenated
  - B) Not oxygenated at all
  - C) Not completely oxygenated
  - D) Over oxygenated
- Q.30 At oxygen tension of 115 mm mercury the hemoglobin will carry oxygen as given below:**
- A) 20 ml / 100 ml of blood
  - B) 21 ml / 100 ml of blood
  - C) 19.6 ml / 100 ml of blood
  - D) 22 ml / 100 ml of blood
- Q.31 When oxygen pressure falls below 60 mm mercury in any cell and tissue, the oxygen saturation of hemoglobin:**
- A) Increases very sharply
  - B) Increases slowly
  - C) Decreases very sharply
  - D) Decreases slowly
- Q.32 For a scuba diver to breathe, the oxygen pressure should be:**
- A) Same as at sea level
  - B) Lesser than that at sea level

- C) Greater than that at sea level
  - D) Inversely proportional to the depth
- Q.33 The oxygen carrying capacity of hemoglobin is decreased by:**
- A) Decreasing carbon dioxide pressure
  - B) Decreasing temperature of the blood
  - C) Decreasing pH of the blood
  - D) Increasing pH of the blood
- Q.34 The oxygen carrying capacity of hemoglobin is increased by:**
- A) Increasing carbon dioxide pressure
  - B) Increasing temperature of the blood
  - C) Increasing pH of the blood
  - D) Decreasing pH of the blood
- Q.35 The capacity of hemoglobin to hold oxygen becomes less by:**
- A) Increasing oxygen tension
  - B) Increasing pH of the blood
  - C) Decreasing temperature of the blood
  - D) Increasing carbon dioxide pressure
- Q.36 Increased carbon dioxide tension favors the:**
- A) Greater liberation of oxygen from the tissue to the blood
  - B) Greater liberation of oxygen from the blood to the tissues
  - C) Lesser liberation of oxygen from the blood to the tissues
  - D) Greater liberation of carbon dioxide from the blood of the tissues
- Q.37 What results in a decreased ability of hemoglobin to bind oxygen:**
- A) Decreased pH
  - B) Increased hydrogen ion concentration

- C) Combination of hydrogen ions with protein part of hemoglobin  
D) Low temperature
- Q.38 As regulator of alveolar ventilation carbon dioxide is much important in:**  
A) Conditions of shock  
B) Conditions of emergency  
C) Conditions of shock and emergency  
D) Normal conditions
- Q.39 The carbon dioxide carried as carboxyhemoglobin is \_\_\_\_\_ of the total carried by blood.**  
A) 5% C) 20%  
B) 70% D) 5%
- Q.40 The carbon dioxide carried by other plasma proteins is:**  
A) 5% C) 20%  
B) 70% D) 5%
- Q.41 The maximum amount of CO<sub>2</sub> is carried by blood as:**  
A) Carboxyhemoglobin  
B) Dissolved in plasma  
C) Bicarbonate ion  
D) Combined with potassium
- Q.42 The carbon dioxide carried as bicarbonate ions is combined with:**  
A) Potassium C) Sodium  
B) Calcium D) Magnesium
- Q.43 Pick up the chemical change promoted by carbonic anhydrase enzyme:**  
A)  $HbO \longrightarrow Hb + O_2$   
B)  $H^+ + HCO_3^- \longrightarrow H_2CO_3$   
C)  $H_2CO_3 \longrightarrow H^+ + HCO_3^-$   
D)  $H_2CO_3 \longrightarrow CO_2 + H_2O$
- Q.44 What occurs finally in blood capillaries of tissues:**  
A)  $HCO^- + H^+ \longrightarrow H_2CO_3$

- B)  $H_2CO_3 \longrightarrow CO_2 + H_2O$   
C)  $CO_2 + H_2O \longrightarrow H_2CO_3$   
D)  $Hb + O_2 \longrightarrow HbO_2$
- Q.45 What occurs in blood capillaries surrounding the alveoli:**  
A)  $CO_2 + H_2O \longrightarrow H_2CO_3$   
B)  $Hb + O_2 \longrightarrow HbO_2$   
C)  $H_2CO_3 \longrightarrow CO_2 + H_2O$   
D)  $HCO_3 + H^+ \longrightarrow H_2CO_3$
- Q.46 It diffuses out from the capillaries of the lungs into space of alveolar sac:**  
A) Oxygen  
B) Carbon dioxide  
C) Carboxyhemoglobin  
D) Oxyhemoglobin
- Q.47 It diffuses out from the alveolar sac into the capillaries of the lungs:**  
A) Oxygen  
B) Carbon dioxide  
C) Carboxyhemoglobin  
D) Oxyhemoglobin
- Q.48 Small amount of carbon dioxide is also carried by corpuscles by combining with:**  
A) Sodium C) Calcium  
B) Potassium D) Magnesium
- Q.49 How much amount of CO<sub>2</sub> is given off by blood while passing through the lungs per 100 ml of blood:**  
A) 20ml C) 54ml  
B) 50ml D) 4ml
- Q.50 It is a process in which fresh air containing more oxygen is pumped into lungs:**  
A) Internal respiration C) Breathing  
B) Cellular respiration D) Assimilation

**Q.51 A mechanical process consisting of two phases is:**

- A) Internal respiration C) Breathing
- B) Cellular respiration D) Assimilation

**Q.52 Breathing is a mechanical process consisting of:**

- A) Two phases C) Four phases
- B) Three phases D) Five phases

**Q.53 A phase in which fresh air moves into the lungs is called:**

- A) Expiration
- B) Ventilation
- C) Inspiration
- D) External respiration

**Q.54 A phase in which air with low O<sub>2</sub> and high CO<sub>2</sub> content moves out of the lungs is called:**

- A) Expiration
- B) Ventilation
- C) Inspiration
- D) External respiration

**Q.55 To understand the mechanism of breathing, we should keep in mind \_\_\_\_\_ aspects related to lungs and associated structures.**

- A) Three C) Five
- B) Four D) Six

**Q.56 Pick up the correct statement about lungs:**

- A) During inspiration active expansion takes place
- B) During expiration active contraction takes place
- C) During inspiration passive contraction takes place
- D) During expiration passive contraction takes place

**Q.57 The shape of diaphragm is more dome like:**

- A) At day time
- B) When its muscles relaxed
- C) When its muscle contract
- D) At night time

**Q.58 The shape of diaphragm becomes less dome like:**

- A) At day time
- B) When its muscles are relaxed
- C) When its muscle contract
- D) At night time

**Q.59 Walls of chest cavity are composed of:**

- A) Ribs
- B) Diaphragm
- C) Intercostal muscles
- D) Ribs and intercostal muscles

**Q.60 Ribs are elevated, when:**

- A) Muscles between the ribs contract
- B) Muscles of the lungs contract
- C) Muscles between the ribs are relaxed
- D) Muscles of the diaphragm are relaxed

**Q.61 During inspiration the space inside the chest cavity is increased in:**

- A) Two ways C) Four ways
- B) Three ways D) Five ways

**Q.62 During inspiration; the muscles of the ribs contract and this:**

- A) Elevates the ribs upwards and outwards
- B) Settles down the ribs downwards and backwards
- C) Elevates the ribs upwards and backwards
- D) Settles down the ribs downwards and forwards

**Q.63 During inspiration, the muscles of the diaphragm:**

- A) Relax and diaphragm becomes more dome like

- B) Contract and diaphragm becomes less dome like  
C) Relax and diaphragm becomes less dome like  
D) Contract and diaphragm becomes more dome like
- Q.64 The space in chest cavity is increased due to the movement of:**  
A) Diaphragm upwards  
B) Ribs downwards  
C) Ribs upwards  
D) Diaphragm downwards and ribs upwards
- Q.65 With the expansion of lungs vacuum is created inside the lungs in which the air rushes from outside due to higher atmospheric pressure, this is called:**  
A) Respiration C) Ventilation  
B) Inspiration D) Breathing
- Q.66 Pick up the event which is not fit among the rest of the three events:**  
A) Ribs move downwards and inwards  
B) Diaphragm becomes less dome like  
C) Muscles of the ribs are relaxed  
D) The space in chest cavity becomes less
- Q.67 The immediate cause of the contraction of lungs during expiration is:**  
A) Muscles of diaphragm relax  
B) Reduction in the space of chest cavity  
C) Diaphragm becoming more dome like  
D) Ribs moves downwards and inwards
- Q.68 The chest cavity is reduced from the floor by:**  
A) Contraction of the muscles of diaphragm  
B) Contraction of the muscles of the ribs  
C) Relaxation of the muscles of diaphragm  
D) Relaxation of the muscles of the ribs

- Q.69 In premature infants, respiratory distress syndrome is common, especially for infants with a gestation age:**  
A) Less than 7 months  
B) Less than 8 months  
C) More than 7 months  
D) More than 8 months
- Q.70 The deficiency which becomes ultimate cause of respiratory distress syndrome is that of:**  
A) Gestation age  
B) Number of alveoli  
C) Surfactant  
D) Atmospheric pressure
- Q.71 The most important protein present in many animals including man is:**  
A) Myoglobin C) Albumin  
B) Hemoglobin D) Fibrin
- Q.72 It serves as an intermediate compound for the transfer of oxygen from hemoglobin to aerobic metabolic process of the muscle cells:**  
A) Blood plasma C) Myoglobin  
B) RBCs D) Hemoglobin
- Q.73 Which one of the following is a contagious disease?**  
A) Tuberculosis C) Emphysema  
B) Asthma D) Obesity
- Q.74 The chances of lung cancer are \_\_\_\_\_ times less in those persons who do not smoke:**  
A) 30 C) 10  
B) 20 D) 5
- Q.75 Alveolar walls degenerate and small alveoli combine to form larger alveoli in patients with:**  
A) Lung cancer C) Tuberculosis  
B) Asthma D) Emphysema

ANSWER KEY (Worksheet-14 (i))					
1	D	26	A	51	C
2	D	27	A	52	A
3	B	28	C	53	C
4	B	29	C	54	A
5	A	30	C	55	A
6	B	31	C	56	D
7	A	32	C	57	B
8	A	33	C	58	C
9	C	34	C	59	D
10	C	35	D	60	A
11	C	36	B	61	A
12	A	37	C	62	A
13	A	38	D	63	B
14	D	39	C	64	D
15	D	40	A	65	B
16	A	41	C	66	B
17	B	42	C	67	B
18	D	43	A	68	C
19	C	44	A	69	A
20	B	45	C	70	C
21	C	46	B	71	B
22	D	47	A	72	C
23	D	48	B	73	A
24	B	49	D	74	C
25	B	50	C	75	D

**EXPLANATION**

**Q.1** Answer is "Air sacs and Alveoli"

**Explanation:** Air passageways start from nostrils and end up at alveolar ducts. Alveoli are the sites of exchange of gases which are located inside the air sacs.

**Q.2** Answer is "Six passageways"

**Explanation:** Because each nasal cavity is subdivided into three passageways by the projection of two bones from the walls of the internal nose. These bones are inferior nasal concha and middle nasal concha.

**Q.3** Answer is "Internal nose"

**Explanation:** Each nasal cavity is subdivided into three passageways by the projection of bones from the walls on internal nose.

**Q.4** Answer is "Two internal openings"

**Explanation:** These are internal nostrils or internal nares.

**Q.5** Answer is "Upper end of trachea"

**Explanation:** The larynx or voice box is a complex cartilaginous structure surrounding the upper end of trachea.

**Q.6** Answer is "Epiglottis"

**Explanation:** It is lid of glottis.

**Q.7** Answer is "Larynx"

**Explanation:** The opening of larynx is called glottis and epiglottis is its lid.

**Q.8** Answer is "Vocal cords"

**Explanation:** In the glottis the mucous membrane is stretched across into two thin edged fibrous bands called vocal cords, which help in voice production, when vibrated by air.

**Q.9** Answer is "Not quite true"

**Explanation:** Glottis is never closed completely, so it is not quite true. However, glottis is partially closed by epiglottis during swallowing, thus it is baseless or quite wrong concept.

**Q.10** Answer is "Backward movement of the tongue and upward movement of the larynx"

**Explanation:** By both of these movements glottis is partly closed and food is directed towards food pipe.

**Q.11** Answer is "Backward movement of tongue"

**Explanation:** The closure of glottis is never complete; the degree of closure is determined partly by the backward movement of the tongue during



swallowing which forces the epiglottis into more or less horizontal position.

**Q.12 Answer is “Epiglottis diverts the food mass to one side of the opening”**

**Explanation:** Food does not enter the partly open larynx and obstruct breathing primarily because the epiglottis diverts the food mass to one side of the opening safely down the esophagus.

**Q.13 Answer is “Right and left bronchi”**

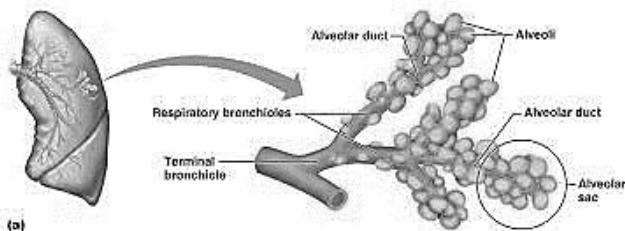
**Explanation:** Trachea sub-divides into light right and left bronchi. Each bronchus enters into a kidney.

**Q.14 Answer is “Bronchioles”**

**Explanation:** Trachea or wind pipe is a tubular structure lying ventral to the oesophagus and extends to the chest cavity or thorax where it is divided into right and left bronchi.

**Q.15 Answer is “Bronchioles”**

**Explanation:** Air sacs are functional units of lungs and receive air from bronchioles.



**Q.16 Answer is “Pleural cavity”**

**Explanation:** Pleural cavity provides protection to the lungs from over extension and also contains the pleural fluid.

**Q.17 Answer is “Alveoli”**

**Explanation:** Alveoli are structural units of lungs having thin membrane through which gases are exchanged with blood.

**Q.18 Answer is “The lungs”**

**Explanation:** Lungs are located in chest cavity also called as thoracic cavity.

**Q.19 Answer is “Ribs and Muscles”**

**Explanation:** Ribs provide bony protection to lungs against external physical trauma, whereas muscles are used in breathing.

**Q.20 Answer is “Collapsing”**

**Explanation:** Otherwise the walls will not be stronger enough to keep the lumen open.

**Q.21 Answer is “Pleura”**

**Explanation:** The pulmonary pleurae are the two pleurae of the invaginated sac surrounding lungs and attaching to the thoracic cavity.

**Q.22 Answer is “Cell organs and tissue levels”**

**Explanation:** Energy is basic need for any activity taking place at any level in an organism.

**Q.23 Answer is “Cellular respiration”**

**Explanation:** Cellular respiration is the process that utilizes oxygen, produces carbon dioxide and produces energy.

**Q.24 Answer is “Hemoglobin”**

**Explanation:** Main respiratory pigment in human body is hemoglobin, however in muscle cells myoglobin acts as a secondary respiratory pigment.

**Q.25 Answer is “Hemoglobin”**

**Explanation:** About 95% of the cytoplasm of red blood cells is occupied by hemoglobin and nucleus is also sacrificed to accommodate it.

**Q.26 Answer is “Low oxygen concentration and less pressure”**

**Explanation:** Oxyhaemoglobin is unstable and splits into the normal purple-red colored hemoglobin and oxygen in the condition of low oxygen concentration and less pressure. Carbonic anhydrase

enzyme present in R.B.C facilitates this activity

**Q.27 Answer is “Splitting up of oxyhemoglobin”**

**Explanation:** Carbonic anhydrase catalyses both formation and splitting up of oxyhemoglobin.

**Q.28 Answer is “20 ml / 100 ml of blood”**

**Explanation:** It is maximum oxygen carrying capacity of blood.

**Q.29 Answer is “Not completely oxygenated”**

**Explanation:** Because complete oxygenation requires optimum conditions and normal optimum conditions do not prevail.

**Q.30 Answer is “19.6ml / 100 ml of blood”**

**Explanation:** When oxygen tension is 115mm mercury, hemoglobin is 98 percent saturated and therefore, contains 19.6 ml of oxygen per 100ml of blood.

**Q.31 Answer is “Decreases very sharply”**

**Explanation:** Oxygen saturation level can be achieved under high pressure of O<sub>2</sub> only. When oxygen pressure falls, oxygenation level also falls.

**Q.32 Answer is “Greater than that at sea level”**

**Explanation:** Otherwise inhalation will not occur as air always moves from higher pressure to lower one.

**Q.33 Answer is “Decreasing pH of the blood”**

**Explanation:** As pH is decreased by increase in H<sup>+</sup> ion concentration and H<sup>+</sup> have antagonistic relation with O<sub>2</sub> for hemoglobin.

**Q.34 Answer is “Increasing pH of the blood”**

**Explanation:** By increasing pH concentration of hydroxyl (OH<sup>-</sup>) ions is increased and concentration of (H<sup>+</sup>) ions is decreased. As H<sup>+</sup> ions antagonize with O<sub>2</sub> for combining with hemoglobin, the low concentration of H<sup>+</sup> ions will favour the oxygen to combine with hemoglobin.

**Q.35 Answer is “Increasing CO<sub>2</sub> pressure”**

**Explanation:** CO<sub>2</sub> and O<sub>2</sub> also have antagonistic relation with hemoglobin.

**Q.36 Answer is “Greater liberation of oxygen form the blood to the tissues.”**

**Explanation:** As O<sub>2</sub> and CO<sub>2</sub> both have bonding affinity with hemoglobin, so both compete with each other for it and if one is low in concentration the other will face lesser opposition in binding with hemoglobin and vice versa.

**Q.37 Answer is “Combination of hydrogen ions with protein of hemoglobin”**

**Explanation:** When pH is decreased, by increase in hydrogen ion concentration, the hydrogen ions get a chance to combine with the protein part of hemoglobin instead of oxygen and ability of oxygen to combine with hemoglobin decreases. Thus ultimate cause is combination of hydrogen ions with protein part of hemoglobin.

**Q.38 Answer is “Normal conditions”**

**Explanation:** Because the chemoreceptors of the body are more sensitive to CO<sub>2</sub> as compared to oxygen. That is why CO<sub>2</sub> acquires regulatory role.

**Q.39 Answer is “20%”**

**Explanation:** Some carbon dioxide (about 20%) is carried as carboxyhemoglobin. Carboxyhemoglobin is formed when carbon dioxide combines with amino group of hemoglobin

**Q.40** Answer is “5%”

**Explanation:** Other plasma proteins also carry about 5% carbon dioxide from the body fluids to the capillaries of the lungs.

**Q.41** Answer is “Bicarbonate ion”

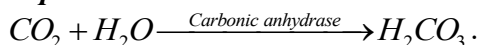
**Explanation:** About 70% carbon dioxide is carried as bicarbonate ions combined with sodium in the plasma.

**Q.42** Answer is “Sodium”

**Explanation:** About 70% carbon dioxide is carried as bicarbonate ions combined with sodium in the plasma.

**Q.43** Answer is “ $HbO \rightarrow Hbo + O_2$ ”

**Explanation:**



**Q.44** Answer is “ $HCO^- + H^+ \rightarrow H_2CO_3$ ”

**Explanation:** As  $CO_2$  is being moved and carried towards heart and finally to the lungs.

**Q.45** Answer is “ $H_2CO_3 \rightarrow CO_2 + H_2O$ ”

**Explanation:** As  $CO_2$  is required to be released from blood for exhalation.

**Q.46** Answer is “Carbon dioxide”

**Explanation:** As  $CO_2$  is going to be exhaled or removed from the body and lungs, through are passageways.

**Q.47** Answer is “Oxygen”

**Explanation:** Because it is required to be carried to the tissues and cells of the body.

**Q.48** Answer is “Potassium”

**Explanation:** Small amount of carbon dioxide is also carried by corpuscles combined with potassium.

**Q.49** Answer is “4ml”

**Explanation:** As 50 ml of  $CO_2$  per 100 ml of blood is residual volume of arterial

blood. However, it becomes 54 ml of  $CO_2$  per 100 ml of blood in venuous blood.

**Q.50** Answer is “Breathing”

**Explanation:** It is also called as organismic respiration, external respiration and ventilation.

**Q.51** Answer is “Breathing”

**Explanation:** Mechanical movement of ribs diaphragm and associated muscles is carried out in it breathing and it consists of two phases i.e. inhalation and exhalation.

**Q.52** Answer is “Two phases”

**Explanation:** Inspiration and expiration.

**Q.53** Answer is “Inspiration”

**Explanation:** Inspiration or inhalation means bringing fresh air into lungs.

**Q.54** Answer is “Expiration”

**Explanation:** Expiration or exhalation means bringing  $CO_2$  rich air from the lungs to the outside.

**Q.55** Answer is “Three aspects”

**Explanation:**

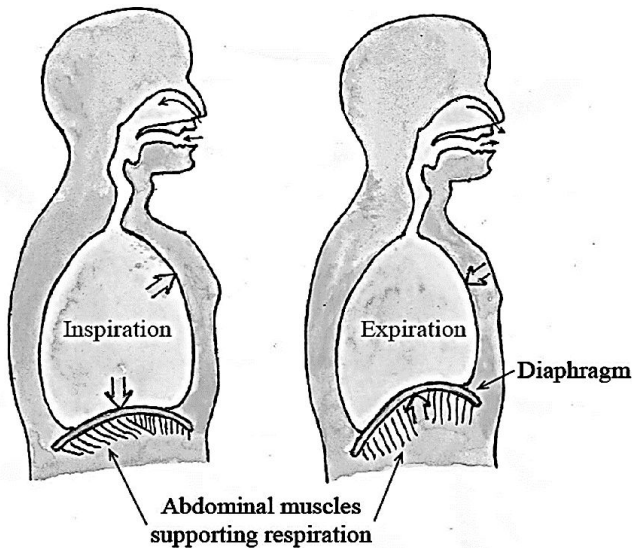
- (i) Passive role of lungs
- (ii) Role of diaphragm
- (iii) Role of chest wall and ribs

**Q.56** Answer is “During expiration passive contraction takes place”

**Explanation:** As chest wall moves inward and downwards and diaphragm moves upwards the space around lungs is squeezed, they contract passively. During expiration these movements are reversed.

**Q.57** Answer is “When its muscles are relaxed”

**Explanation:** Because by contraction it is flattened i.e. becomes less dome like.



**Q.58 Answer is “When its muscles contract”**

**Explanation:** By contraction of the muscles of diaphragm it is flattened and becomes less dome like.

**Q.59 Answer is “Ribs and inter costal muscles”**

**Explanation:** The walls of chest cavity consist of ribs and intercostal muscles

**Q.60 Answer is “Muscles between the ribs contract”**

**Explanation:** Ribs are lifted upwards and outwards by contraction of inter costal muscles and vice versa.

**Q.61 Answer is “Two ways”**

**Explanation:** When chest wall move outwards and diaphragm moves downwards, the space on lateral sides and lower side of lungs is increased.

**Q.62 Answer is “Elevate the ribs upwards and outwards”**

**Explanation:** When muscles of diaphragm contract it is flattened and becomes less dome like, creating space beneath the lungs.

**Q.63 Answer is “Contract and diaphragm becomes less dome like”**

**Explanation:** When muscles of diaphragm contract it is flattened and becomes less dome like, creating space beneath the lungs.

**Q.64 Answer is “Diaphragm downwards and ribs upwards”**

**Explanation:** During inspiration, to create space around the lungs rib cage is lifted upward and outwards whereas diaphragm moves downwards.

**Q.65 Answer is “Inspiration”**

**Explanation:** Inspiration means bringing free oxygen into lungs.

**Q.66 Answer is “Diaphragm” becomes less dome like”**

**Explanation:** Rest of the three events are associated with expiration whereas B choice is associated with inspiration, so it is odd among the rest of the three choices.

**Q.67 Answer is “Reduction is space of chest cavity”**

**Explanation:** Lungs contract when pressure outside the lungs increases due to decreased space and they are forced to squeeze.

**Q.68 Answer is “Relaxation of the muscles of diaphragm”**

**Explanation:** As muscles of the diaphragm relax, the sheet of diaphragm moves back to its normal place and becomes more dome like, reducing space below the lungs.

**Q.69 Answer is “Less than 7 months”**

**Explanation:** Because lungs attain maturity after 7 months of gestation period.

**Q.70 Answer is “Surfactant”**

**Explanation:** A substance which strengthens the alveolar membrane against surface tension.



**Q.71 Answer is “Hemoglobin”**

**Explanation:** Hemoglobin being respiratory protein (carrier protein) is the most important protein in many animals including man.

**Q.72 Answer is “Myoglobin”**

**Explanation:** Myoglobin is a hemoglobin like iron-containing protein pigment occurring in muscle fibers. Myoglobin is also known as muscle hemoglobin. It serves as intermediate compound for the transfer of oxygen from hemoglobin to aerobic metabolic processes of muscle cells.

**Q.73 Answer is “Tuberculosis”**

**Explanation:** Tuberculosis spreads through physical contact and air i.e. it is contagious.

**Q.74 Answer is “10”**

**Explanation:** As chances of lung cancer are 10 times more in smokers, thus these 10 times less in non-smokers.

**Q.75 Answer is “Emphysema”**

**Explanation:** Due to persistent and constant coughing weakened alveoli burst and fuse together.



**Worksheet-14 (ii)**  
**(Transport in Plants)**

- Q.1** Which one of the following is xerophyte?  
A) Hydrilla C) *Cactus*  
B) Rose D) Corn
- Q.2** Most of the minerals enter the root hairs of roots along with water in the form:  
A) Active transport  
B) Diffusion  
C) Bulk flow  
D) Facilitated diffusion
- Q.3** Which one of the following is always -ve?  
A) Water potential  
B) Solute potential  
C) Pressure potential  
D) Water and pressure potential
- Q.4** Pulling upward of water and dissolved minerals towards the leaves through the xylem tissue is called:  
A) Transpiration pull C) Root pressure  
B) Ascent of sap D) All of these
- Q.5** Translocation of food in phloem is due to:  
A) Transpiration pull C) Ascent of sap  
B) Pressure of flow D) Cohesion
- Q.6** Most important pathway for transport of water and solutes in root is \_\_\_\_\_ pathway:  
A) Vacuolar C) Symplast  
B) Apoplast D) Stomatal
- Q.7** At very high temperature, mesophyll cells secrete \_\_\_\_\_, which closes stomata:  
A) Auxins C) Gibberellins  
B) Cytokinins D) Abscissic acid
- Q.8** The guard cells are the only photosynthesizing cells of \_\_\_\_\_ of leaf:  
A) Mesophyll C) Endodermis  
B) Epidermis D) Hypodermis
- Q.9** It constitutes the inner bark:  
A) Xylem C) Endodermis  
B) Phloem D) Epidermis

- Q.10** The active transport of  $K^+$  ions into the guard cell is stimulated by:  
A) High level of  $H_2$   
B) Low level of  $CO$   
C) Low level of  $O_2$   
D) Low level of  $CO_2$
- Q.11** It directly controlled by the opening and closing of stomata:  
A) Gravity C) Light  
B) Temperature D) Oxygen
- Q.12** Transpiration increases with increase in the:  
A) Availability of light to the plant  
B) Dryness of the atmosphere  
C) Velocity of wind  
D) Availability of soil water
- Q.13** Rate of transpiration doubles by every rise of  $10^\circ C$  in temperature:  
A) Respiration C) Perspiration  
B) Photosynthesis D) Transpiration
- Q.14** It is not directly related to the rate of transpiration:  
A) Temperature  
B) Light  
C) Cellular respiration  
D) Wind
- Q.15** The evaporation of water through surface of plant is called:  
A) Evaporation C) Transpiration  
B) Condensation D) Pressure flow
- Q.16** Transpiration decreases when guard cells of stomata become?  
A) Flaccid C) Collapsed  
B) Turgid D) Ruptured
- Q.17** Companion cells are important in phloem tissue because they supply \_\_\_\_\_ to sieve elements:  
A) Water C) Carbohydrates  
B) ATPs D) Proteins
- Q.18** The main force that draws water from the soil for plant is caused by a process called:  
A) Evaporation  
B) Transpiration pull  
C) Guttation  
D) Wilting

- Q.19** The shrinkage of protoplast due to exosmosis is:  
A) Ascent of sap      C) Plasmolysis  
B) Guttation      D) Deplasmolysis
- Q.20** A plant requires nitrogen and sulphur for its:  
A) Cell wall  
B) Starch deposit  
C) Enzyme  
D) DNA replication
- Q.21** A rye plant less than \_\_\_\_\_ tall has branch roots about:  
A) Two-meter      C) One meter  
B) Five meter      D) Half meter
- Q.22** Which of the following process cause substances to move across membranes without expenditure of cellular energy?  
A) Endocytosis      C) Active transport  
B) Diffusion      D) None
- Q.23** The casparian strips are present in:  
A) Cortex cells of root  
B) Pericycle  
C) Endodermis cells of roots  
D) Xylem
- Q.24** Most of mycorrhizae are present in:  
A) 50% of vascular plants  
B) 70% of angiosperms  
C) 70% of gymnosperms  
D) 90% of angiosperms
- Q.25** Force exerted by protoplast against cell wall is called \_\_\_\_\_ potential:  
A) Osmotic      C) Pressure  
B) Solute      D) Generator
- Q.26** Hydathodes are associated with:  
A) Transpiration      C) Guttation  
B) Conduction      D) Deplasmolysis
- Q.27** The force of attraction between water molecules is:  
A) Adhesion      C) Tensile  
B) Cohesion      D) Imbibition

- Q.28** The xylem water tension is strong enough to pull water to \_\_\_\_\_:  
A) 200 meters      C) 300 meters  
B) 400 feet      D) 500 feet
- Q.29** Which of the following is soluble in water?  
A) Cellulose      C) Pectin  
B) Lignin      D) Glucose
- Q.30** The volume of dry seed increased by imbibitions is \_\_\_\_\_ times:  
A) 100      C) 300  
B) 200      D) 150
- Q.31** 1% of the absorbed water is used by plants in its activities during:  
A) Metabolism      C) Photosynthesis  
B) Respiration      D) Vernalisation
- Q.32** In tall trees large quantities of water is carried at speed of:  
A)  $2\text{mh}^{-1}$       C)  $8\text{mh}^{-1}$   
B)  $3\text{mh}^{-1}$       D)  $10\text{mh}^{-1}$
- Q.33** Total transpiration which can take place through stomata is  
A) 60-70      C) 80-90%  
B) 1-2%      D) 5-7%
- Q.34** Pick up the types of transpiration which does not occur in all plants:  
A) Cuticular transpiration  
B) Stomatal transpiration  
C) Lenticular transpiration  
D) Stem transpiration
- Q.35** During the exposure of blue light all of the following events occurs, EXCEPT:  
A) Acidification of environment  
B) Turgidity of guard cells  
C) Uptake of K ions of guard cells  
D) Flaccidity of guard cells
- Q.36** Which one of the following is involved in the closing of stomata?  
A) Gibberellins      C) Abscisis acid  
B) Ethane      D) Cytokinine

- Q.37** When leaves transpire the water potential of mesophyll cells is:  
A) Increased  
B) Does not change  
C) Decreased  
D) First increased and decreased
- Q.38** When guard cells become turgid, transpiration?  
A) Increases  
B) No effect  
C) Decreases  
D) Stops
- Q.39** Phloem is generally found on outer side of:  
A) Xylem  
B) Endodermis  
C) Epidermis  
D) Pericycle
- Q.40** Root of beet acts as:  
A) Source  
B) Sink  
C) Producer  
D) Source and sink both
- Q.41** Average velocity of movement of sugars in phloem is:  
A) 1 meter/8 years  
B) 1 meter/day  
C) 1 meter/hour  
D) 20cm/min
- Q.42** While moving towards the sieve elements sucrose takes the \_\_\_\_\_ mostly?  
A) Apoplast pathway  
B) Vacuolar pathway  
C) Symplast pathway  
D) Apoplast pathway
- Q.43** Cytoplasmic strands that extend through pores in adjacent cell walls are known as:  
A) Pseudopods  
B) Plasmodesmata  
C) Symplasts  
D) Pili
- Q.44** The movement of water molecules from a region of higher water potential to a region of lower water potential (through membrane):  
A) Diffusion  
B) Active transport  
C) Osmosis  
D) Facilitated diffusion
- Q.45** Cuticular transpiration is \_\_\_\_\_ of total transpiration:  
A) 6-8%  
B) 7-9%  
C) 5-7%  
D) 4-6%

- Q.46** Lenticular transpiration is \_\_\_\_\_ of total transpiration:  
A) 2-3%  
B) 1-4%  
C) 1-3%  
D) 1-2%
- Q.47** \_\_\_\_\_ have the adaptations for reduced rate of transpiration:  
A) Hydrophytes  
B) Xerophytes  
C) Mesophytes  
D) Halophytes
- Q.48** Many \_\_\_\_\_ posses small, thick leaves to limit water loss by reducing surface area proportional to the volume:  
A) Hydrophytes  
B) Xerophytes  
C) Mesophytes  
D) Halophytes
- Q.49** They have thick, waxy and leathery cuticle:  
A) Hydrophytes  
B) Mesophytes  
C) Xerophytes  
D) Sciophytes
- Q.50** Stomata are on lower surface of leaves and located in depression in:  
A) Hydrophytes  
B) Mesophytes  
C) Sciophytes  
D) Xerophytes

ANSWER KEY (Worksheet-14(ii))					
1	C	21	C	41	C
2	C	22	B	42	C
3	B	23	C	43	B
4	B	24	D	44	C
5	B	25	C	45	C
6	B	26	C	46	D
7	D	27	B	47	B
8	B	28	A	48	B
9	B	29	D	49	C
10	D	30	B	50	D
11	C	31	C		
12	B	32	C		
13	D	33	C		
14	C	34	C		
15	C	35	D		
16	A	36	C		
17	B	37	C		
18	B	38	A		
19	C	39	A		
20	C	40	D		

**EXPLANATION**

- Q.1 Answer is "Cactus"  
*Explanation:* Cactus is xerophytic plant.
- Q.2 Answer is "Bulk flow"  
*Explanation:* Most of the minerals enter the root hairs of roots along with water in the form bulk flow.
- Q.3 Answer is "Solute potential"  
*Explanation:* Solute potential is always -ve.
- Q.4 Answer is "Ascent of sap"  
*Explanation:* Pulling upward of water and dissolved minerals towards the leaves through the xylem tissue is called ascent of sap.
- Q.5 Answer is "Pressure of flow"  
*Explanation:* The theory called, Pressure – Flow Theory, is the most acceptable theory for the transport in the phloem of angiosperms. We have considerable evidence to support this theory. There

were two main categories of theories to account for movement of sap in phloem.

**Q.6 Answer is "Apoplast"**

*Explanation:* The apoplast pathway is of greatest importance for both water and solutes. The symplast pathway is less important, except for salts in the region of the endodermis. Movement along the vacuolar pathway is negligible.

**Q.7 Answer is "Abscissic acid"**

*Explanation:* Hormones are involved in stomatal movement in plants. At high temperature when leaf cells start wilting a hormone is released by mesophyll cells. This hormone is called abscissic acid. This hormone stops the active transport of  $K^+$  into guard cells, overriding the effect of light and  $CO_2$  concentration. So  $K^+$  pumping stops. Stomata close.

**Q.8 Answer is "Epidermis"**

*Explanation:* The German botanist H. Van Mohl proposed that the guard cells are the only photosynthesizing cells of epidermis of leaf and sugars are produced in them during day time when light is available.

**Q.9 Answer is "Phloem"**

*Explanation:* The phloem is generally found on the outer side of both primary and secondary vascular tissue in plants with secondary growth. The phloem constitute the inner bark. The cells of phloem that conduct or transport sugars and other organic material throughout the plant are called sieve elements.

**Q.10 Answer is "Low level of  $CO_2$ "**

*Explanation:* What controls the movement of  $K^+$  into and out of guard cells? Level of carbon dioxide in the spaces inside the leaf and light, control this movement. A low level of carbon dioxide favours opening of the stomata, thus allowing an increased carbon dioxide level and increased rate of photosynthesis.

**Q.11 Answer is “Light”**

**Explanation:** The opening and closing of stomata is directly controlled by the light. In strong light the rate of transpiration is much more as compared with that in dim light or no light. As potassium actively enters the guard cells when light is available, water follows – and guard cells become turgid, and stoma opens.

**Q.12 Answer is “Dryness of the atmosphere”**

**Explanation:** When air is dry, the rate of diffusion of water molecules, from the surfaces of mesophyll cells, air spaces, and through stomata to outside the leaf, increases. So more water is lost, increasing the rate of transpiration. In humid air the diffusion rate is reduced. This decreases the rate of transpiration appreciably.

**Q.13 Answer is “Transpiration”**

**Explanation:** The rate of transpiration doubles by every rise of  $10^0$  C in temperature. Very high environmental temperature. i.e.  $40-45^0$  C cause closure of stomata, so that plant does not lose much needed water.

**Q.14 Answer is “Cellular respiration”**

**Explanation:** Cellular respiration is not directly related to the rate of transpiration. There are some important factors which affect the rate of transpiration in a plant.

- i. Light
- ii. Temperature
- iii.  $\text{CO}_2$  concentration
- iv. Humidity and vapour pressure
- v. Wind
- vi. Availability of soil water

**Q.15 Answer is “Transpiration”**

**Explanation:** The evaporation of water through surface of plant is called transportation.

**Q.16 Answer is “Flaccid”**

**Explanation:** When guard cells become turgid the stoma or pore opens. When flaccid stoma or pore between them closes.

**Q.17 Answer is “ATPs”**

**Explanation:** Companion cells supply ATP and proteins to sieve tubes. The photosynthetic products from

photosynthesizing cells, the mesophyll and palisade layer of leaf, pass into sieve tubes, through the companion cell via plasmodesmata.

**Q.18 Answer is “Transpiration pull”**

**Explanation:** The main force that draws water from the soil for plant is caused by a process called Transpiration pull.

**Q.19 Answer is “Plasmolysis”**

**Explanation:** Plasmolysis can be defined as the shrinkage of protoplast due to exosmosis of water. When a living cell is placed in a solution having lower water potential than that of the cell, plasmolysis takes place and the cell is called plasmolysed.

**Q.20 Answer is “Enzyme”**

**Explanation:** A plant requires nitrogen and sulphur for its enzyme.

**Q.21 Answer is “One meter”**

**Explanation:** A rye plant less than one meter tall has some 14 million branch roots of a combined length of over 600 kilometers.

**Q.22 Answer is “Diffusion”**

**Explanation:** Diffusion cause substances to move across membranes without expenditure of cellular energy.

**Q.23 Answer is “Endodermis cells of roots”**

**Explanation:** The casparian strip separates the extracellular space in the root into two compartments: an outer compartment that is continuous with the soil water, and an inner compartment that is continuous with the inside of the conducting cells of the xylem.

**Q.24 Answer is “90% of angiosperms”**

**Explanation:** Mycorrhizal fungi get sugar, and shelter from the plant and in exchange increase the plant’s mineral nutrient uptake efficiency. Mycorrhizae are present in 90% families of flowering plants.

**Q.25 Answer is “Pressure”**

**Explanation:** Force exerted by protoplast against cell wall is called pressure potential.



**Q.26 Answer is “Guttation”**

**Explanation:** Closely associated with root pressure is a phenomenon called guttation or exudation. Guttation is loss of liquid water through water secreting glands or hydathodes. The dew drops that can be seen on the tips of grass leaves or strawberry leaves are actually guttation droplets exuded from hydathodes.

**Q.27 Answer is “Cohesion”**

**Explanation:** The force of attraction between water molecules is cohesion. It is the attraction among water molecules which hold water together, forming a solid chain-like column within the xylem tubes. The water molecules form hydrogen bonds between them.

**Q.28 Answer is “200 meters”**

**Explanation:** It is provided when this water chain is pulled up in the xylem. Transpiration provides the necessary energy or force. Tension is between the molecules of water by hydrogen bonds. This xylem water tension is strong enough to pull water up to 200 meters (more than 600 feet) in plants.

**Q.29 Answer is “Glucose”**

**Explanation:** Glucose is soluble in water because it is a monosaccharide in nature.

**Q.30 Answer is “200”**

**Explanation:** The volume of dry seed increase up to 200 times by imbibition, as a result, the seed coat ruptures and makes the germination of seed effective.

**Q.31 Answer is “Photosynthesis”**

**Explanation:** 1% of the absorbed water is used by plants in its activities during photosynthesis.

**Q.32 Answer is “8mh<sup>-1</sup>”**

**Explanation:** Large quantities of water are carried at relatively high speed, upto 8mh<sup>-1</sup> being recorded in tall trees, and commonly in other plants at 1mh<sup>-1</sup>.

**Q.33 Answer is “80-90%”**

**Explanation:** The degree of opening of stomatal pores also affects the rate of

transpiration. 90% of total transpiration in a plant is stomatal.

**Q.34 Answer is “Lenticular transpiration”**

**Explanation:** Lenticular transpiration is the loss of water vapours through lenticels present in the stem of some plants. All plants do not possess lenticels.

**Q.35 Answer is “Flaccidity of guard cells”**

**Explanation:** Exposure to blue light, which is also effective in photosynthesis has been shown to acidify the environment of the guard cells (i.e. pumps out protons) which enable the guard cells to take up K<sup>+</sup> followed by water uptake resulting in increased turgidity of guard cells. So in general stoma are open during day and closed at night. This prevents needless loss of water by the plant when it is too dark for photosynthesis.

**Q.36 Answer is “Abscisis acid”**

**Explanation:** Hormones are involved in stomatal movement in plants. At high temperature when leaf cells start wilting a hormone is released by mesophyll cells. This hormone is called abscisic acid. This hormone stops the active transport of K<sup>+</sup> into guard cells, overriding the effect of light and CO<sub>2</sub> concentration. So K<sup>+</sup> pumping stops. Stomata close.

**Q.37 Answer is “Decreased”**

**Explanation:** When leaves transpire the water potential of mesophyll cells is decreased. As a leaf transpires the water potential of its mesophyll cells drops.

**Q.38 Answer is “Increases”**

**Explanation:** When sugar level rises i.e. solute concentration increases of water potential decreases- and the guard cells become turgid due to entry of water and they separate from one another, and stoma or pore opens.

**Q.39 Answer is “Xylem”**

**Explanation:** Phloem is generally found on outer side of xylem.

- Q.40 Answer is “Source and sink both”**  
*Explanation:* Root of beet acts as source and sink both.
- Q.41 Answer is “1 meter/hour”**  
*Explanation:* Average velocity of movement of sugars in phloem is 1 meter/hour.
- Q.42 Answer is “Symplast pathway”**  
*Explanation:* While moving towards the sieve elements sucrose takes the symplast pathway mostly.
- Q.43 Answer is “Plasmodesmata”**  
*Explanation:* Cytoplasmic strands that extend through pores in adjacent cell walls are known as plasmodesmata.
- Q.44 Answer is “Osmosis”**  
*Explanation:* The movement of water molecules from a region of higher water potential to a region of lower water potential through membrane osmosis.
- Q.45 Answer is “5-7%”**  
*Explanation:* The loss of water in the form of water vapours through the cuticle of leaves is called cuticular transpiration. About 5-7% of total transpiration takes place through this route.
- Q.46 Answer is “1-2%”**  
*Explanation:* The lenticular transpiration is 1-2% of the total transpiration by a plant.
- Q.47 Answer is “Xerophytes”**  
*Explanation:* Many xerophytes possess small, thick leaves to limit water loss by reducing surface area proportional to the volume. Their cuticle is thick, waxy and leathery.
- Q.48 Answer is “Xerophytes”**  
*Explanation:* Many xerophytes possess small, thick leaves to limit water loss by reducing surface area proportional to the volume.
- Q.49 Answer is “Xerophytes”**  
*Explanation:* Their cuticle is thick, waxy and leathery.
- Q.50 Answer is “Xerophytes”**  
*Explanation:* Stomata are on lower surface of leaves and located in depression.

**Worksheet-15 (i)**  
**(Transport in Human)**

**Q.1 Lymphatic system is responsible for the transport and returning of material:**

- A) From the tissues of the body to blood
- B) From the tissues of the body to lymph
- C) From the tissue of the body to external environment
- D) From the respiratory system to blood

**Q.2 A fluid that flows in the lymphatic system is called:**

- A) Circulatory fluid
- B) Tissue fluid
- C) Lymph
- D) Lymph or tissue fluid

**Q.3 The system that comprises lymph capillaries, lymph vessels, lymphoid masses, lymph nodes and lymph is called:**

- A) Transport system
- B) Blood vascular system
- C) Lymphatic system
- D) Immune system

**Q.4 Lymph capillaries end blindly in the body tissues, where pressure from the accumulation of \_\_\_\_\_ forces the fluid into the lymph capillaries:**

- A) Interstitial fluid
- B) Extracellular
- C) Intracellular fluid
- D) Interstitial or extracellular fluid

**Q.5 Lymph is a fluid in transit between interstitial fluids and:**

- A) Lymph
- B) Blood
- C) Tissue fluid
- D) Body fluid

**Q.6 The intercellular spaces in the walls of lymph vessels are larger than those of:**

- A) Capillaries of blood vascular system
- B) Veins of blood vascular system
- C) Arteries of blood vascular system
- D) Vanae Cavae

**Q.7 Lymph capillaries join to form:**

- A) Lacteals
- B) Larger and larger lymph vessels
- C) Smaller lymph vessels
- D) Venae cave

**Q.8 Lacteals are the branches of lymph capillaries located within:**

- A) Ileum
- B) Microvilli
- C) Villi
- D) Small intestine

**Q.9 Along the pathway, the lymph vessels have at certain points, masses of connective tissue, where lymphocytes are present; these are:**

- A) Lymphoid masses
- B) Lymph nodes
- C) Thymus
- D) Adenoid

**Q.10 Lymph nodes get supply by:**

- A) Many efferent lymph vessels
- B) Single efferent lymph vessels
- C) Many afferent lymph vessels
- D) Single afferent lymph vessels

**Q.11 Several \_\_\_\_\_ are present in the walls of digestive tract in the mucosa and sub mucosa.**

- A) Lymph nodes
- B) Lacteals
- C) Lymphoid masses
- D) Lymph vessels

**Q.12** The net difference between the fluid taken back by blood capillaries from interstitial spaces and the fluid given out by blood capillaries into the interstitial spaces in an average person per day is:

- A) 1000 ml                      C) 3000 ml  
B) 2000 ml                      D) 4000 ml

**Q.13** The lacteals of villi absorb:

- A) Small fat globules  
B) Large polypeptides  
C) Large fat globules  
D) Small polypeptides

**Q.14** \_\_\_\_\_ have lymphocytes and macrophages that destroy bacteria and viruses.

- A) Lymphoid masses  
B) Lymph nodes  
C) Lymphatic vessels  
D) Lymphatic ducts

**Q.15** The painful swelling of lymph nodes in certain diseases is largely a result of the accumulation of:

- A) Dead lymphocytes and microphages  
B) Dead lymphocytes and macrophages  
C) Living lymphocytes and microphages  
D) Living lymphocytes and macrophages

**Q.16** Just as the \_\_\_\_\_ filter the lymph, the \_\_\_\_\_ filters blood.

- A) Spleen, Lymph nodes  
B) Lymph nodes, Lymph nodes  
C) Spleen, Spleen  
D) Lymph nodes, Spleen

**Q.17** The heart is enclosed in a double membranous sac called:

- A) Thoracic cavity      C) Pericardial cavity  
B) Chest cavity        D) Pleural cavity

**Q.18** Pericardium prevents the heart from:

- A) Over extension      C) Physical trauma  
B) Abrasion              D) Contraction

**Q.19** \_\_\_\_\_ of the heart is made up of special type of muscles, the cardiac muscles.

- A) Pericardium              C) Myocardium  
B) Epicardium              D) Endocardium

**Q.20** The cardiac muscles contain:

- A) Myofibrils  
B) Myofilaments of actin  
C) Myofilaments of myosin  
D) Myofibrils and Myofilaments of actin and myosin

**Q.21** The heart contracts:

- A) Voluntarily              C) Irregularly  
B) Passively                D) Rhythmically

**Q.22** The left atrioventricular valve is:

- A) Tricuspid valve      C) Semilunar valve  
B) Bicuspid valve      D) Sphincter valve

**Q.23** There are four chambers of the heart:

- A) Two upper thick-walled atria  
B) Two lower thin walled ventricles  
C) Two upper thin walled atria and two lower thick-walled ventricles  
D) Two upper thin walled ventricles and two lower thick-walled atria

**Q.24** In human heart complete separation of deoxygenated blood occurs on/in:

- A) Right side              C) Lower chambers  
B) Left side                D) Upper chambers

**Q.25** In human heart complete separation of oxygenated blood occurs on/in:

- A) Right side              C) Lower chambers  
B) Left side                D) Upper chambers

**Q.26** With respect to their relation with rest of the body, the lower chambers of human heart act as:

- A) Expulsion pump      C) Dual pump  
B) Suction pump      D) Reservoir

**Q.27** \_\_\_\_\_ receives deoxygenated blood via venae cavae.

- A) Right atrium      C) Right ventricle  
B) Left atrium      D) Left ventricle

**Q.28** Blood is passed on to right ventricle through:

- A) Tricuspid valve      C) Semilunar valve  
B) Bicuspid valve      D) Mitral valve

**Q.29** The flaps of tricuspid valve are attached to papillary muscles of the wall of right ventricle by means of:

- A) Fibrous cords  
B) Fibrous cords called chordae tendineae  
C) Fibrous cords called ligaments  
D) Epithelial extensions

**Q.30** Chordae tendineae are attached to the:

- A) Papillary muscles  
B) Papillary muscles and wall of tricuspid valve  
C) Flaps of tricuspid valve  
D) Walls of the right ventricle

**Q.31** When right ventricle contracts, the blood is passed to the:

- A) Right atrium      C) Left ventricle  
B) Pulmonary trunk      D) Left atrium

**Q.32** Pulmonary trunk is sub divided into:

- A) Left and right pulmonary veins  
B) Left and right pulmonary trunks  
C) Left and right pulmonary arteries  
D) Superior and inferior venae cavae

**Q.33** After oxygenation in lungs, the blood is brought by pulmonary veins to the:

- A) Left atrium      C) Left ventricle  
B) Right atrium      D) Right ventricle

**Q.34** Left atrium passes the blood via \_\_\_\_\_ to the left ventricle.

- A) Tricuspid valve      C) Semilunar valve  
B) Bicuspid valve      D) Sphincter valve

**Q.35** When left ventricle contracts, it pushes the blood through \_\_\_\_\_ to all parts of the body.

- A) Aorta      C) Pulmonary artery  
B) Pulmonary trunk      D) Pulmonary vein

**Q.36** At the base of aorta \_\_\_\_\_ valves are also present.

- A) Bicuspid      C) Sphincter  
B) Tricuspid      D) Semilunar

**Q.37** Coronary arteries supply the blood to the:

- A) Liver      C) Heart  
B) Spleen      D) Gut

**Q.38** The aorta forms an arch, and before descending down gives of:

- A) Two branches      C) Four branches  
B) Three branches      D) Five branches

**Q.39** Aorta gives many small branches to the chest wall and then passes down to the abdominal region; Here it gives branches, which supply blood to:

- A) Different parts of alimentary canal  
B) Kidneys  
C) Lower abdomen  
D) Different parts of alimentary canal, kidneys and Lower abdomen

**Q.40** The blood from the upper part of the body is collected by different veins, which join to form:

- A) Aorta  
B) Pulmonary trunk  
C) Superior vena cava  
D) Inferior vena cava



**Q.41 Femoral veins pour deoxygenated blood into:**

- A) Renal veins                      C) Iliac veins  
B) Femoral veins                  D) Hepatic veins

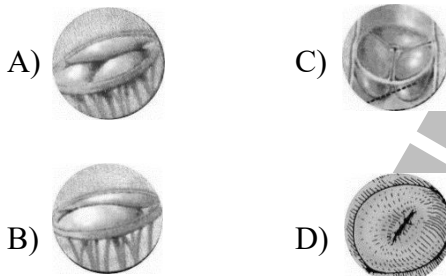
**Q.42 Renal veins pour blood into:**

- A) Superior vena cava  
B) Inferior vena cava  
C) Hepatic portal vein  
D) Jugular vein

**Q.43 The vein which is formed by many veins collecting deoxygenated blood with absorbed food from different parts of alimentary canal, is called:**

- A) Hepatic portal vein    C) Hepatic vein  
B) Iliac vein                      D) Renal vein

**Q.44 Identify the tricuspid valve:**



**Q.45 Identify the bicuspid valve:**



**Q.46 The walls of atria and walls of ventricles are relaxed during:**

- A) Systole  
B) Diastole  
C) Atrial systole  
D) Ventricular systole

**Q.47 As the atria are filled with blood, they become distended and have:**

- A) More pressure than ventricles  
B) Same pressure as ventricles  
C) Less pressure than ventricles  
D) Less volume than ventricles

**Q.48 'Lubb' sound is produced by closure of:**

- A) Outlet valves  
B) Atrioventricular valves  
C) Semilunar valves  
D) Inter ventricular valves

**Q.49 'Dubb' sound is produced by the closure of:**

- A) Bicuspid valves  
B) Tricuspid valves  
C) Bicuspid and tricuspid valves  
D) Semilunar valves

**Q.50 In one's life, heart contracts \_\_\_\_\_, without stopping.**

- A) 2-5 billion times    C) 2-5 million times  
B) 1-5 billion times    D) 1.5 million times

**Q.51 The oxygenated blood enters the left atrium through:**

- A) Pulmonary artery  
B) Pulmonary veins  
C) Interior vena cava  
D) Superior vena cava

**Q.52 One complete heart beat consists of:**

- A) One systole  
B) One diastole  
C) One systole and one diastole  
D) One systole and two diastoles

**Q.53** What occurs, just prior to ventricular contraction:

- A) P wave                      C) QRS wave  
B) T wave                      D) S wave

**Q.54** Highest blood pressure is generated by:

- A) Atrial diastole  
B) Atrial systole  
C) Ventricular diastole  
D) Ventricular systole

**Q.55** Highest blood pressure is observed in:

- A) Capillaries                      C) Venae cavae  
B) Veins                      D) Arteries

**Q.56** There is no pulse in:

- A) Veins  
B) Arteries  
C) Capillaries  
D) Veins and capillaries

**Q.57** There are no valves in:

- A) Arteries  
B) Capillaries  
C) Arteries and capillaries  
D) Veins

**Q.58** The role of globulins in maintenance of osmotic pressure of blood is:

- A) 75%                      C) 35%  
B) 65%                      D) 25%

**Q.59** The average life span of a RBC is:

- A) 120 days                      C) 60 days  
B) 30 days                      D) 90 days

**Q.60** On one hand its high level in our blood produces cardiovascular disorder on the other hand it serves as a precursor for steroid hormones. It is:

- A) Acylglycerol                      C) Animal fat  
B) Cholesterol                      D) Edible oil

**Q.61** Which one of the following gives rise to macrophages?

- A) Neutrophils                      C) Monocytes  
B) Eosinophils                      D) Lymphocytes

**Q.62** They are without nucleus since their origin:

- A) RBCs                      C) Platelets  
B) WBCs                      D) Erythrocytes

**Q.63** A solid mass or plug of blood constituents in the blood vessels is called:

- A) Thrombus                      C) Embolus  
B) Thrombosis                      D) Atheroma

**Q.64** In thromboembolism:

- A) Thrombosis is followed by embolism  
B) Thrombosis follows the embolism  
C) Thrombosis and embolism occur simultaneously  
D) Thrombosis occurs independent of embolism

**Q.65** Damage to portion of cardiac muscle is called:

- A) Cerebral infraction  
B) Arythonia  
C) Myocardial infarction  
D) Heart attack

**Q.66** Cerebral infarction is also called as:

- A) Paralysis                      C) Heart attack  
B) Stroke                      D) Hemorrhage

**ANSWER KEY (Worksheet-15 (i))**

1	A	23	C	45	B
2	D	24	A	46	B
3	C	25	B	47	A
4	D	26	A	48	B
5	B	27	A	49	D
6	A	28	A	50	A
7	B	29	B	51	B
8	C	30	B	52	C
9	A	31	B	53	C
10	C	32	C	54	D
11	C	33	A	55	D
12	C	34	B	56	D
13	C	35	A	57	C
14	B	36	D	58	D
15	B	37	C	59	A
16	D	38	B	60	B
17	C	39	D	61	C
18	A	40	C	62	C
19	C	41	C	63	A
20	D	42	B	64	A
21	D	43	A	65	C
22	B	44	A	66	B

**EXPLANATION**

**Q.1** Answer is "From the tissues of the body to blood"

**Explanation:** Lymph or tissue fluid is actually a fluid of interstitial spaces i.e. it oozes out from the blood in interstitial spaces then collected and drained through lymph vessels and finally it is returned to blood via subclavian vein. Thus lymph is a fluid in transit between interstitial fluid and the blood.

**Q.2** Answer is "Lymph or tissue fluid"

**Explanation:** Lymph capillaries end blindly in the body tissue, where pressure from the accumulation of interstitial fluid forces the fluid to enter the lymph capillaries. This fluid is called lymph. The lymph vessels empty in veins, so lymph is

fluid in transit between interstitial fluid and blood.

**Q.3** Answer is "Lymphatic system"

**Explanation:** The system that is responsible for the transport and returning of materials from the tissues of the body to the blood is called lymphatic system. It comprises lymph capillaries, lymph vessels, lymphoid masses, lymph nodes and lymph the fluid which flows in the system.

**Q.4** Answer is "Interstitial or extracellular fluid"

**Explanation:** Lymph capillaries or lymphatic capillaries are tiny, thin walled vessels located in the spaces between cells (except in the central nervous system and non-vascular tissues) which serve to drain and process extracellular fluid. Upon entering the lumen of a lymphatic capillary, the collected fluid along with associated cells (notably white blood cells) is known as lymph.

Lymphatic capillaries are slightly larger in diameter than blood capillaries and have closed ends. Their unique structure permits, interstitial fluid to flow into them but not out.

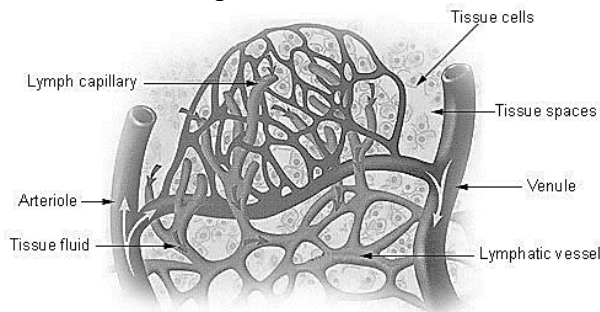
**Q.5** Answer is "Blood"

**Explanation:** Lymph is the fluid that circulates throughout the lymphatic system. The lymph is formed when the interstitial is collected through lymph capillaries. It is then transported through larger lymphatic vessels to lymph nodes, where it is cleaned by lymphocytes, before emptying ultimately into the right or the left sub-clavian vein, where it mixes back with the blood.

**Q.6** Answer is "Capillaries of blood vascular system"

**Explanation:** Lymph capillaries are slightly larger in diameter than blood capillaries and have closed ends. Their

unique structure permits interstitial fluid to flow into them but not out. The ends of the endothelial cells that make up the wall of a lymphatic capillary overlap. When pressure is greater in the interstitial fluid than in lymph, the cells separate slightly, like the opening of a one-way swinging door and interstitial fluid enters the lymphatic capillaries. When pressure is greater inside the lymphatic capillary, the cells adhere more closely and lymph cannot escape back into interstitial fluid.

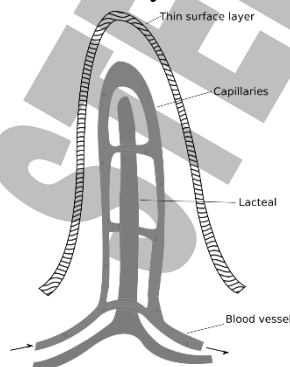


**Q.7 Answer is “Larger and larger lymph vessels”**

**Explanation:** Lymph capillaries join to form larger and larger lymph vessels and ultimately form thoracic lymphatic duct which opens into sub-clavian vein. The flow of lymph is always towards the thoracic duct.

**Q.8 Answer is “Villi”**

**Explanation:** They are called lacteal because fluid inside them contains fats and appears milky (lacteal-milk). In the intestine, the branches of lymph capillaries, within villi are called lacteals that absorb dietary fats.



**Q.9 Answer is “Lymphoid masses”**

**Explanation:** Several lymphoid masses are present in the walls of digestive tract, in the mucosa and sub-mucosa. The larger masses spleen and thymus, tonsils and adenoids are all lymphoid masses. These produce lymphocytes.

**Q.10 Answer is “Many afferent lymph vessels”**

**Explanation:** Several afferent lymph vessels bring lymph into lymph nodes whereas single efferent lymph vessel drains the lymph node.

**Q.11 Answer is “Lymphoid masses”**

**Explanation:** Several lymphoid masses are present in the walls of digestive tract, in the mucosa and sub-mucosa. The larger masses like spleen and thymus, tonsils and adenoids are all lymphoid masses. These produce lymphocytes.

**Q.12 Answer is “3000ml”**

**Explanation:** In an average person, about three liters more fluid leaves the blood capillaries than is reabsorbed by them each day. Lymphatic system returns this excess fluid and its dissolved proteins and other substances to the blood.

**Q.13 Answer is “Large fat globules”**

**Explanation:** The lacteals of villi absorb large fat globules, which are released by interstitial cells after the products of digestion of fats are absorbed. After a fatty meal these fat globules may make up 1% of the lymph.

**Q.14 Answer is “Lymph nodes”**

**Explanation:** The lymphatic system helps defend the body against foreign invaders. Lymph nodes have lymphocytes and macrophages that destroy bacteria and viruses. The painful swelling of lymph nodes in certain diseases (mumps is an extreme example) is largely a results of accumulation of dead lymphocytes and macrophages.



**Q.15** Answer is “Dead lymphocytes and macrophages”

**Explanation:** The lymphatic system helps defend the body against foreign invaders. Lymph nodes have lymphocytes and macrophages that destroy bacteria and viruses. The painful swelling of lymph nodes in certain diseases (mumps in an extreme example) is largely a results of accumulation of dead lymphocytes and macrophages.

**Q.16** Answer is “Lymph nodes, spleen”

**Explanation:** Just as the lymph nodes filter lymph, the spleen filters blood, exposing it to macrophages and lymphocytes that destroy foreign particles and aged red blood cells.

**Q.17** Answer is “Pericardial cavity”

**Explanation:** The heart of human is located in the chest cavity. The heart is enclosed in a double membranous sac the pericardial cavity, which contains pericardial fluid. Pericardium prevents the heart, prevents it from overextension and pericardial fluid protects it from abrasion.

**Q.18** Answer is “Overextension”

**Explanation:** Pericardium prevents the heart from overextension; Pericardial fluid prevents the heart from abrasion and ribcage prevents it from external physical trauma.

**Q.19** Answer is “Myocardium”

**Explanation:** Myocardium of the heart is made up of special type of muscles called cardiac muscles. These muscles contains myofibrils and myofilaments of myosin and actin. Their arrangement is similar to those in skeletal muscles fibres and their mechanism of contraction is essentially the same, except they are branched cells in which the successive cells are separated by junctions called intercalated discs.

**Q.20** Answer is “Myofibril and myofilaments of actin and myosin”

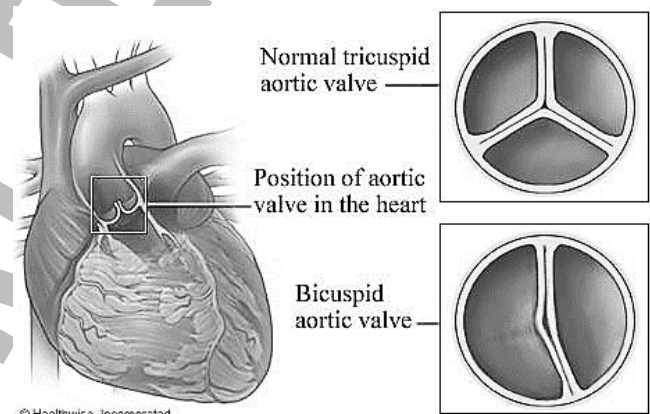
**Explanation:** The arrangement of cardiac muscle cells or fibres is similar to those in skeletal muscles fibre. These muscles also contains myofibrils and myofilaments of actin and myosin. The difference is that of branches and intercalated discs which are found in cardiac muscles fibres only.

**Q.21** Answer is “Rhythmically”

**Explanation:** Cardiac contraction is set at a rhythmic cycle.

**Q.22** Answer is “Bicuspid valve”

**Explanation:** It is also called mitral valve. It contains two flaps.



**Q.23** Answer is “Two upper thin walled atria and two lower thick-walled ventricles”

**Explanation:** Two upper chambers containing thin walls are called atria whereas two lower chambers containing thick wall are called ventricles.

**Q.24** Answer is “Right side”

**Explanation:** The right chambers of heart right i.e. atrium and right ventricle contain deoxygenated blood.

**Q.25** Answer is “Left side”

**Explanation:** The left chambers of heart (left atrium and left ventricle) contain oxygenated blood.

**Q.26** Answer is “expulsion pumps”



**Explanation:** As right ventricle pushes out the blood to pulmonary artery for pulmonary circulation whereas left ventricle pushes it to aorta for systemic circulation.

**Q.27 Answer is "Right atrium"**

**Explanation:** Both superior and inferior venae cavae open into right atrium.

**Q.28 Answer is "Tricuspid valve"**

**Explanation:** It is right atrioventricular valve or right inlet valve having three flaps.

**Q.29 Answer is "Fibrous cords called chordae tendineae"**

**Explanation:** These are called heart strings (tendons) which connect papillary muscles to the inlet valves of the heart. These are made up of 80% collagen and 20% elastin and epithelial cells.

**Q.30 Answer is "Papillary muscles and walls of tricuspid valve"**

**Explanation:** The flaps of bicuspid and tricuspid valves are similarly attached through chordae tendinae to papillary muscles of the walls of ventricles.

**Q.31 Answer is "Pulmonary trunk"**

**Explanation:** Right ventricle carrying deoxygenated blood, pushes it upon contraction to the lungs through pulmonary artery or pulmonary trunks.

**Q.32 Answer is "Left and right pulmonary arteries"**

**Explanation:** These bring the deoxygenated blood to right and left lungs respectively.

**Q.33 Answer is "Left atrium"**

**Explanation:** Left atrium receives oxygenated blood from lungs via pulmonary veins.

**Q.34 Answer is "Bicuspid valve"**

**Explanation:** The left atrioventricular valve, also called left inlet valve or mitral

valve controls the unidirectional flow of oxygenated blood from left atrium to left ventricle.

**Q.35 Answer is "Aorta"**

**Explanation:** Aorta or Aortic arch receives oxygenated blood from left ventricle and distributes it to the entire body through systemic circulation.

**Q.36 Answer is "Semilunar"**

**Explanation:** Outlet valves are called semilunar valves which exist at the base of all vessels leaving the heart or entering into heart.

**Q.37 Answer is "Heart"**

**Explanation:** Coronary arteries are the first arteries which emerge from the aorta before turning towards left side and they provide blood supply to the heart itself.

**Q.38 Answer is "Three branches"**

**Explanation:** An innominate artery, a left common carotid artery and left subclavian artery.

**Q.39 Answer is "different parts of alimentary canal, kidney and lower abdomen"**

**Explanation:** After arching towards left behind the heart aorta covers the chest area through bronchial arteries and then enters into the abdominal areas to cover the alimentary canal, kidneys and lower abdomen through renal arteries and mesenteric arteries.

**Q.40 Answer is "Superior vena cava"**

**Explanation:** It drains upper half of the body.

**Q.41 Answer is "Iliac veins"**

**Explanation:** Right and left iliac veins which fuse to give rise to inferior vena cava receive blood from right and left femoral veins and pour the blood into the inferior vena cava.

**Q.42 Answer is "Inferior vena cava"**

**Explanation:** Renal veins drain kidneys and pour the deoxygenated blood into inferior vena cava.

**Q.43 Answer is “Hepatic portal vein”**

**Explanation:** It fuses with hepatic vein and then opens into inferior vena cava.

**Q.44 Answer is “A”**

**Explanation:** Having three flaps, ‘A’ is a tricuspid valve.

**Q.45 Answer is “B”**

**Explanation:** Having two flaps.

**Q.46 Answer is “Diastole”**

**Explanation:** Diastole is a phase of relaxation of heart chambers.

**Q.47 Answer is “More pressure than ventricles”**

**Explanation:** Because they are filled with blood but ventricles are empty.

**Q.48 Answer is “Atrioventricular valves”**

**Explanation:** “Lubb” sound is produced when inlet valves or atrioventricular valves close and their flaps strike with each other.

**Q.49 Answer is “Semilunar valves”**

**Explanation:** Semilunar valves which are also called outlet valves produce dub sound on closure.

**Q.50 Answer is “2-5 billion times”**

**Explanation:** As per statistical evaluation given in text book.

**Q.51 Answer is “Pulmonary veins”**

**Explanation:** All veins carry deoxygenated blood except pulmonary veins, which carry blood from lungs to the left atrium.

**Q.52 Answer is “One systole and one diastole”**

**Explanation:** Two upper chamber (atria) contract in a single step and both lower chambers (ventricles) relax at that time, then both lower chambers contract simultaneously and upper chamber relax at that time.

**Q.53 Answer is “QRS wave”**

**Explanation:** A normal electrocardiogram (ECG) indicates that the heart is functioning properly. The P wave occurs just prior to atrial contraction; the QRS wave occurs just prior to ventricular contraction and the T wave occurs when the ventricles are recovering from contraction.

**Q.54 Answer is “Ventricular systole”**

**Explanation:** When ventricles contract, blood is pushed through aorta to arterial system and highest blood pressure is generated as the walls of ventricles are thicker than those of atria.

**Q.55 Answer is “Arteries”**

**Explanation:** As blood is directly pumped into aorta.

**Q.56 Answer is “Veins and capillaries”**

**Explanation:** Blood is not directly being pumped into veins and capillaries so they don’t exhibit pulse pressure.

**Q.57 Answer is “Arteries and capillaries”**

**Explanation:** The pumping pressure of heart does not allow blood to move backward in these two types of vessels.

**Q.58 Answer is “25%”**

**Explanation:** As per available statistical data from text book.

**Q.59 Answer is “120 days”**

**Explanation:** It is four months i.e. 120 days.

**Q.60 Answer is “Cholesterol”**

**Explanation:** Excess of cholesterol cause some cardiovascular problems however a fixed amount of cholesterol is inevitable for animals including human being due to its role in stabilization of the structure and fluidity of cell membranes and its role in hormone synthesis.

**Q.61 Answer is “Monocytes”**

**Explanation:** Monocytes carry out macrophagocytosis (destruction of larger foreign particles) however Neutrophils carry out microphagocytosis (destruction of smaller foreign particles).

**Q.62 Answer is “Platelets”**

*Explanation:* Platelets are fragments of megakaryocytes i.e., not complete cells.

**Q.63 Answer is “Thrombus”**

*Explanation:* This plug is thrombus but its formation is thrombosis.

**Q.64 Answer is “Thrombosis is followed by embolism”**

*Explanation:* First thrombosis occurs and then thrombus is dislodged and is trapped at new site. Now it is called embolus and process is called embolism. So as one follows the other so collectively called thromboembolism.

**Q.65 Answer is “Myocardial infarction”**

*Explanation:* Myocardial infarction will lead to heart attack as the supply of blood to heart muscles is reduced or stops.

**Q.66 Answer is “Stroke”**

*Explanation:* Cerebral infarction results in sudden death so that is why it is called stroke.

**Worksheet-15(ii)**  
**(Immunity)**

**Q.1 Immunity is a capacity to do following things, EXCEPT:**

- A) Recognition of intrusion
- B) Effective and timely removal of intruders
- C) Mobilization of cells and cell products
- D) Blockage of entrance of intruders

**Q.2 A biological defense of our body with greater speed and effectiveness is called:**

- A) Infestation                      C) Immunity
- B) Disinfestation                D) Antisepsis

**Q.3 The capacity of our body to identify and eradicate intruders is called:**

- A) Disinfestation                C) Antisepsis
- B) Chemotherapy               D) Immunity

**Q.4 The first defence line of our body is:**

- A) Skin
- B) Phagocytes
- C) Mucous membrane
- D) Skin and Mucous membranes both

**Q.5 Pick up the one which is part of general defense system of our body:**

- A) Antibodies
- B) Humoral immune response
- C) Phagocytes
- D) Cell mediated response

**Q.6 Lymphocyte B and T have been named due to their:**

- A) Relationship with bursa of Fabricius and thymus gland respectively
- B) Origin from bursa Fabricius and thymus, respectively
- C) Storage in bursa of Fabricius and thymus

D) Destruction in bursa of Fabricius

**Q.7 Thymus gland provides immunological competence to:**

- A) B lymphocytes
- B) Antibodies
- C) T-lymphocytes
- D) Immunoglobulins

**Q.8 An antibody molecule consists of:**

- A) Two identical light chains
- B) Two identical heavy chains
- C) Two identical light and two identical heavy chains
- D) Two identical light chains and two non-identical heavy chains

**Q.9 In light chain of antibodies:**

- A) Variable sequence of amino acid is longer one
- B) Variable sequence of amino acid is shorter one
- C) Both variable and constant amino acids sequences have equal length
- D) Only variable sequence of amino acids occurs

**Q.10 Globular blood proteins that are produced by B – lymphocytes and that bind specifically to foreign antigenic materials in the body and destroy them are called:**

- A) Antigens                              C) Antibodies
- B) Immunogens                        D) Antibiotics

**Q.11 The antigen – antibody complexes formed in the body are taken up by:**

- A) Phagocytes                        C) Monocytes
- B) Lymphocytes                      D) Leukocytes

**Q.12 In the case of snake bite venom passive immunity is produced by:**

- A) Antitoxins
- B) Antivenome serum
- C) Material from some similar disease

- D) Attenuated germs
- Q.13 The AIDS victim often succumbs to a:**
- A) Bacterial disease
  - B) Cancer
  - C) Viral disease
  - D) Bacterial disease or cancer
- Q.14 There is no known cure of the:**
- A) Snake bite
  - B) Rabies
  - C) Infectious hepatitis
  - D) AIDS
- Q.15 Antivenom serum is used to carry out:**
- A) Active immunization
  - B) Natural immunization
  - C) Passive immunization
  - D) Innate immunity
- Q.16 Anti-rabies serum is a source of:**
- A) Active immunization
  - B) Natural immunization
  - C) Passive immunization
  - D) Innate immunity
- Q.17 Anti-tetanus serum (ATS) is a source of:**
- A) Active immunization
  - B) Natural immunization
  - C) Passive immunization
  - D) Innate immunity
- Q.18 Pick up the one which is not role of plasma cells:**
- A) Synthesis of antibodies
  - B) Liberation of antibodies in blood plasma
  - C) Attaching the antibodies to the surface of bacteria
  - D) Liberation antibodies in tissue fluid
- Q.19 Pasteur next applied the principle of inoculation with attenuated cultures to the prevention of:**
- A) Small pox
  - C) Cox pox

- B) Anthrax                      D) Chicken Cholera
- Q.20 Louis Pasteur used the word vaccine for:**
- A) Cow pox pus
  - B) Attenuated cultures of bacteria
  - C) Small pox pus
  - D) Attenuated cultures of viruses
- Q.21 \_\_\_\_\_ include in second defense line.**
- A) Skin
  - B) Mucus
  - C) Neutrophils
  - D) Saliva
- Q.22 Physical components of the skin defense include(s):**
- A) Sweat gland
  - B) Dermis
  - C) Dermis and epithelium
  - D) Sweat gland, dermis and epithelium
- Q.23 Following provide defense against infections in our digestion tract:**
- A) HCl in stomach
  - B) Mucus and cilia in nose/in nasal cavity
  - C) Mucus of bronchi
  - D) HCl in stomach, Mucus and cilia in nose/in nasal cavity and Mucus of bronchi.
- Q.24 A typical antibody molecule is \_\_\_\_\_ shaped:**
- A) X                                      C) J
  - B) Y                                      D) H
- Q.25 Antibodies are proteins and made up of how many polypeptide chains?**
- A) One                                      C) Three
  - B) Two                                      D) Four
- Q.26 A typical antibody molecule is composed of how many identical heavy chains?**
- A) One                                      C) Three
  - B) Two                                      D) Four



- Q.27** A typical antibody molecule is made up of how many identical light chains?  
A) One C) Three  
B) Two D) Four
- Q.28** Which part of antibody recognizes the antigen during immune response?  
A) Heavy part C) Light part  
B) Variable part D) Constant part
- Q.29** Variable amino acid sequences in antibody molecule are found in:  
A) Both light chains only  
B) One heavy and one light chain  
C) Both heavy chains only  
D) Both heavy and light chains
- Q.30** In the structural diagram of an antibody molecule which portion is occupied by variable chains:  
A) Lower region  
B) Upper region  
C) Middle region  
D) In between chains
- Q.31** On antibody molecule, two heavy chains and two light chains are bonded by:  
A) Disulphide bonds  
B) Hydrogen bonds  
C) Phosphodiester bonds  
D) Ionic bonds
- Q.32** Substance that can be recognized by the receptor of B-cells:  
A) Antigen C) Immunogen  
B) Antibody D) Food
- Q.33** All antibodies of an individual are manufactured in:  
A) Alpha cells C) T-cells  
B) B-cells D) Delta cells
- Q.34** Any foreign substance, often a protein which stimulates the formation of antibodies is called:  
A) Antigen C) Prion

- B) Antibody D) Virion
- Q.35** Any substance that elicits an immune response, by inducing production of antibodies:  
A) Antigen C) Virion  
B) Antibody D) Food
- Q.36** The capacity to recognize the intrusion of any material foreign to the body and to mobilize cells products to help remove the particular sort of foreign material with greater speed and effectiveness is called:  
A) Prion C) Antigen  
B) Immunity D) Antibody
- Q.37** The study of our protection from foreign macromolecules or invading organisms and our responses to them is called:  
A) Bacteriology C) Ethology  
B) Virology D) Immunology
- Q.38** Globular blood proteins that are produced by B-lymphocytes and that bind specifically to foreign antigenic materials in the body and destroy them:  
A) Viroid C) Antigen  
B) Immunity D) Antibody
- Q.39** Cells of the immune system which responds to foreign substance; some time secrete antibodies:  
A) Lymphocytes C) Erythrocytes  
B) Monocytes D) Macrophages
- Q.40** The branch of biology which is the study of our protection from foreign macromolecules or invading organisms and our responses to them is called:  
A) Virology C) Protection  
B) Immunity D) Immunology
- Q.41** Vaccine is available for all, EXCEPT:  
A) Hepatitis B  
B) Tuberculosis  
C) Malaria  
D) Polio

**Q.42** The body's response to foreign particles such as the production of antibodies directed against a specific antigen is called:

- A) Immune response
- B) Immunity
- C) Temperature response
- D) Inflammatory response

**Q.43** Which one of the following are called cytotoxic cells?

- A) B-lymphocyte      C) Monocytes
- B) T-lymphocyte      D) Neutrophils

**Q.44** Which one of the following type of T cells secrete cytotoxin which triggers destruction of the pathogen's DNA?

- A) Helper T cells
- B) Suppressor T cells
- C) Memory T cells
- D) Cytotoxic T cells

**Q.45** \_\_\_\_\_ are Y-shaped proteins that circulate through blood stream and bind to specific antigens thereby attacking microbes:

- A) Haemoglobin      C) Interferons
- B) Antibodies      D) Myoglobulines

**Q.46** The antibodies are transported through \_\_\_\_\_ and the \_\_\_\_\_ to the pathogen invasion sites:

- A) Blood lymph      C) Water, injection
- B) Water, flood      D) Food, injection

**Q.47** \_\_\_\_\_ is the kind of immunity which is obtained as a result of an infection:

- A) Natural active immunity
- B) Artificial active immunity
- C) Natural passive immunity
- D) Artificial passive immunity

**Q.48** In which point, pulmonary artery is different from pulmonary vein?

- A) Its lumen is broad
- B) It does not possess endothelium
- C) It has valves
- D) Its wall is thick

**Q.49** Antibodies are specific i.e. cause the destruction of the antigen, are manufactured in:

- A) Monocytes      C) Basophils
- B) B-lymphocytes      D) Granulocytes

**Q.50** Production of immunity when antibodies are injecting in form of antisera is called:

- A) Active immunity      C) Passive immunity
- B) Inoculation      D) Antibodies

**ANSWER KEY (Worksheet-15(ii))**

1	D	23	A	45	B
2	C	24	B	46	A
3	D	25	D	47	A
4	D	26	B	48	D
5	C	27	B	49	B
6	A	28	B	50	C
7	C	29	D		
8	C	30	B		
9	C	31	A		
10	C	32	A		
11	A	33	B		
12	B	34	A		
13	D	35	A		
14	D	36	B		
15	C	37	D		
16	C	38	D		
17	C	39	A		
18	C	40	D		
19	B	41	C		
20	B	42	A		
21	C	43	B		
22	D	44	D		

**EXPLANATION**

**Q.1** Answer is “Blockage of entrance of intruder”

*Explanation:* Blockage is not responsibility of immune system rather it is carried out by physical barriers.

**Q.2** Answer is “Immunity”

*Explanation:* Infestation is a troublesome invasion of some parasite whereas disinfection and antisepsis minimize the chances of infestation. However, immunity becomes active after infestation. Speed and effectiveness are characteristics of defense provided by immune system.

**Q.3** Answer is “Immunity”

*Explanation:* In biology, immunity is the balanced state of multicellular organisms having adequate biological defenses to fight infection, diseases or other unwanted biological invasions, while having adequate tolerance to avoid allergy and autoimmune diseases.

**Q.4** Answer is “Skin and mucous membranes both”

*Explanation:* Skin provides physical barrier against outer threats whereas mucous membranes provide barrier against inner threats.

**Q.5** Answer is “Phagocytes”

*Explanation:* Phagocytes are part of general defence system of our body and make second line of defence in our body.

**Q.6** Answer is “Relationship with bursa of Fabricius and thymus gland”

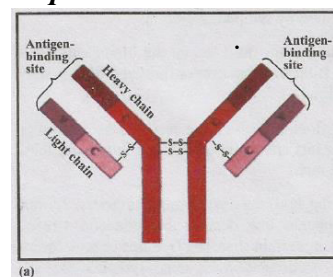
*Explanation:* T cells attain immunological competence by thymus gland whereas B cells were discovered from Bursa of Fabricius.

**Q.7** Answer is “T-lymphocytes”

*Explanation:* The influence of the thymus gland is essential in making the T-cells immunologically competent.

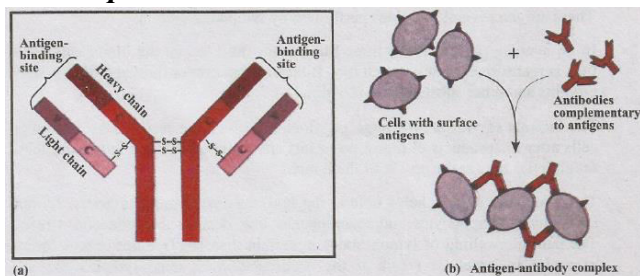
**Q.8** Answer is “Two identical light and two identical heavy chains”

*Explanation:*



**Q.9** Answer is “Both variable and constant amino acid sequences have equal length”

**Explanation:**



**Q.10** Answer is “Antibodies”

**Explanation:** An antibody (Ab), also known as an immunoglobulin (Ig), is a large Y-shaped protein produced mainly by plasma cells that is used by the immune system to identify and neutralize pathogens such as bacteria and viruses. The antibody recognizes a unique molecule of the harmful agent, called antigen, via variable region.

**Q.11** Answer is “Phagocytes”

**Explanation:** Antibodies tag the foreign cells and help phagocytes identify and destroy them.

**Q.12** Answer is “Antivenome serum”

**Explanation:** A serum containing antibodies against venome.

**Q.13** Answer is “Bacterial disease or cancer”

**Explanation:** Because his/her immune system fails to defend him/her.

**Q.14** Answer is “AIDS”

**Explanation:** No cure have been discovered or developed for AIDS so far.

**Q.15** Answer is “Passive immunization”

**Explanation:** As antibodies are being introduced into the body, so it is passive immunization.

**Q.16** Answer is “Passive immunization”

**Explanation:** Antirabies serum contains antibodies against rabies and injection of antibodies to somebody is called passive immunization.

**Q.17** Answer is “Passive immunization”

**Explanation:** Anti tetanus serum contains antibodies against tetanus (*Clostridium tetani*), thus injection of anti-tetanus serum is a source of passive immunization.

**Q.18** Answer is “Attaching antibodies to the surface of bacteria”

**Explanation:** Antibodies are synthesized and liberated into the blood by plasma cells, however, they do not attach them. Antibodies are attached themselves, to the surface of bacteria.

**Q.19** Answer is “Anthrax”

**Explanation:** Pasteur made many discoveries concerning the cause and prevention of infectious diseases. In 1880s he isolated the bacterium responsible for chicken cholera. He grew it in a pure culture. To prove that he really had isolated the bacterium responsible for this disease Pasteur made use of the fundamental techniques devised by Koch. He arranged experiments for public demonstration in which he repeated an experiment that had been successful in many previous trails in his laboratory. Unluckily his demonstration failed badly, as he had used an attenuated culture for that. It was accidentally proved that attenuated culture of some pathogenic bacteria will be unable to cause infection, however it will be capable enough to stimulate the immune system to synthesize antibodies.

Pasteur next applied this principle of inoculation with attenuated cultures to the prevention of Anthrax.

**Q.20** Answer is “Attenuated cultures of bacteria”

**Explanation:** Louis Pasteur called the attenuated cultures of bacterial vaccine and immunization with attenuated cultures of bacteria vaccination.

**Q.21** Answer is “Neutrophils”

**Explanation:** Once pathogens are able to neutralize the responses from the first line of defense i.e. skin and mucous membrane and are able to penetrate inside the body they are encountered by the second line of defense which is nonspecific because it handles a variety of microbes. Nonspecific defense includes macrophages, neutrophils, natural killer cells, the complement system etc.

**Q.22** Answer is “Sweat gland, Dermis and Epithelium”

**Explanation:** Our first line of defense is nonspecific and includes structures, chemicals and processes that work to prevent pathogens entering the body. These first line defenders include the skin and mucous membranes of the respiratory, digestive, urinary and reproductive systems. Skin is comprised of two main layers

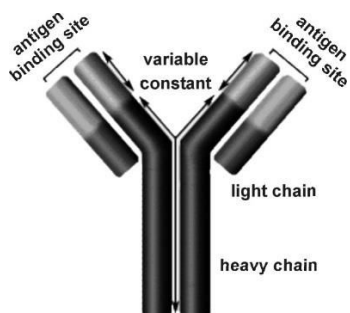
- Epidermis
- Dermis

**Q.23** Answer is “HCl in stomach”

**Explanation:** Proper levels of HCl in the stomach are our first line of defense against bacterial and viral infections.

**Q.24** Answer is “Y”

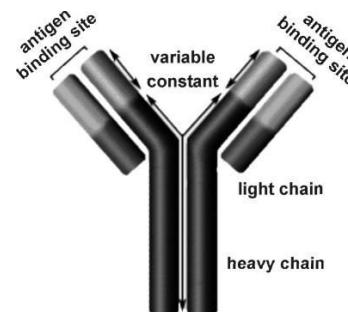
**Explanation:**



Each antibody consists of four polypeptides – two heavy chains and two light chains joined to form a “Y” shaped molecule.

**Q.25** Answer is “Four”

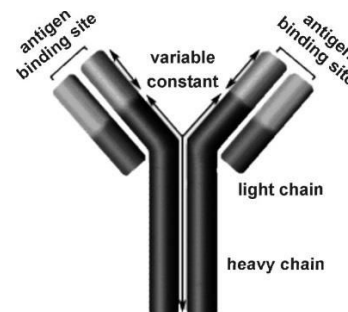
**Explanation:**



Each antibody consists of four polypeptides – two heavy chains and two light chains joined to form a “Y” shaped molecule.

**Q.26** Answer is “Two”

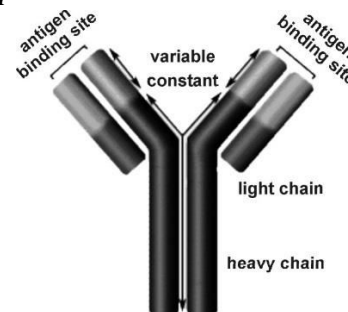
**Explanation:**



Each antibody consists of four polypeptides – two heavy chains and two light chains.

**Q.27** Answer is “Two”

**Explanation:**

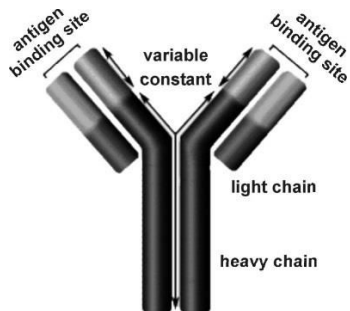


Each antibody consists of four polypeptides – two heavy chains and two light chains.



Q.28 Answer is “Variable part”

*Explanation:*



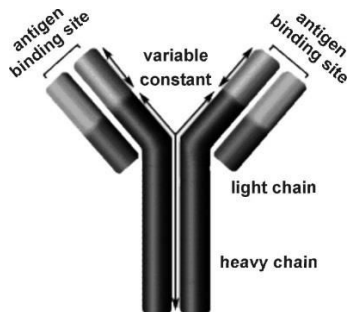
The variable region, composed of 110-130 amino acids, give the antibody its specificity for binding antigen. The variable region includes the ends of the light and heavy chains.

Q.29 Answer is “Both heavy and light chains”

*Explanation:* The variable region includes the ends of the light and heavy chains.

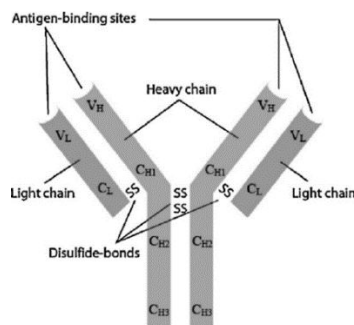
Q.30 Answer is “Upper region”

*Explanation:*



Q.31 Answer is “Disulphide bonds”

*Explanation:*



An antibody molecule consists of four polypeptide chains – two identical light chain and two identical heavy chains – linked by disulfide (-S - S -) bridges.

Q.32 Answer is “Antigen”

*Explanation:* Any substance that elicits an immune response, by inducing production of antibodies is called antigen.

Q.33 Answer is “B-cells”

*Explanation:* B-cells recognize antigen and form plasma cell clone. These plasma cells synthesize and liberate antibodies into the blood plasma and tissue fluid.

Q.34 Answer is “Antigen”

*Explanation:* Any substance that elicits an immune response, by inducing production of antibodies is called antigen.

Q.35 Answer is “Antigen”

*Explanation:* Any substance that elicits an immune response, by inducing production of antibodies is called antigen.

Q.36 Answer is “Immunity”

*Explanation:* The capacity to recognize the intrusion of any material foreign to the body and to mobilize cells products to help remove the particular sort of foreign material with greater speed and effectiveness is called immunity.

Q.37 Answer is “Immunology”

*Explanation:* The study of our protection from foreign macro molecules or invading organisms and our responses to them is called immunology.

Q.38 Answer is “Antibody”

*Explanation:* Globular blood proteins that are produced by B-lymphocytes and that bind specifically to foreign antigenic materials in the body and destroy them is called antibody.

**Q.39 Answer is “Lymphocytes”**

**Explanation:** Lymphocytes of the immune system which responds to foreign substance; some time secrete antibodies.

**Q.40 Answer is “Immunology”**

**Explanation:** The branch of Biology which is the study of our protection from foreign macromolecules or invading organisms and our responses to them is called immunology.

**Q.41 Answer is “Malaria”**

**Explanation:** Malarial vaccine is not available.

**Q.42 Answer is “Immune response”**

**Explanation:** The body's response to foreign particles, such as the production of antibodies directed against a specific antigen, is called immune response.

**Q.43 Answer is “T-lymphocytes”**

**Explanation:** Natural killer cells are the type of T-lymphocytes. They are also called cytotoxic T-cells. In general, natural killer cells do not directly attack invading microbes.

**Q.44 Answer is “Cytotoxin T cells”**

**Explanation:** these cells secrete cytotoxin which triggers destruction of the pathogen's DNA or perforin which is a protein that creates holes in the pathogens plasma membrane. The holes cause the pathogen to lyse (rupture).

**Q.45 Answer is “Antibodies”**

**Explanation:** Antibodies (also called immunoglobulin or Ig's) are Y-shaped proteins that circulate through the blood

stream and bind to specific antigens, thereby attacking microbes. The antibodies are transported through the blood and the lymph to the pathogen invasion site.

**Q.46 Answer is “Blood, lymph”**

**Explanation:** The antibodies are transported through blood and the lymph to the pathogen invasion sites.

**Q.47 Answer is “Natural active immunity”**

**Explanation:** Natural active immunity is the kind of immunity, which is obtained as a result of an infection. The body manufactures its own antibodies when exposed to an infectious agent. This type of immunity is most effective and generally persists for a long time, sometimes even for life.

**Q.48 Answer is “Its wall is thick”**

**Explanation:**

Table 14.3 Comparison in structure and function of an artery, capillary and vein

Arteries	Veins	Capillaries
1. These transport blood away from the heart to the various parts of the body through capillaries.	1. These collect blood from the body through capillaries and transport it towards heart.	1. These link arteries with veins.
2. All arteries carry oxygenated blood except pulmonary arteries.	2. All veins carry deoxygenated blood except pulmonary veins.	2. These have mixed oxygenated and deoxygenated blood.
3. There are no valves in them except at the base of pulmonary trunk and aorta.	3. Valves are present. These prevent the back flow of blood.	3. There are no valves.
4. Have high blood pressure.	4. Have low blood pressure.	4. Falling pressure in these.
5. Wave of blood pressure or pulse due to heartbeat can be detected.	5. No pulse.	5. No pulse.
6. Blood flow rapid. 400-500mm per second in aorta and decreasing in arteries and arterioles.	6. Rate of blood flow increases from smaller to larger veins.	6. Blood flow slowest less than 1mm per second.
7. Have smaller bore and thick wall.	7. Have larger bore and thin walls.	7. Larger bore; wall one cell in thickness.
8. Thick muscle layer and elastic fibres present. The elasticity helps changing the pulsating flow of blood.	8. Thin muscle layer and less elastic fibres. So they are less elastic.	8. No muscles or elastic fibres.
9. No exchange of materials.	9. No exchange of materials.	9. Responsible for exchange of materials.

**Q.49** Answer is “B-lymphocytes”

*Explanation:* B-cells recognize antigen and form plasma cell clone. These plasma cells synthesise and liberate antibodies into the blood plasma and tissue fluid. Here antibodies attach to the surfaces of bacteria and speed up their phagocytosis, or combine with and neutralise toxins produced by micro-organisms, by producing antitoxins. This is called humoral Immune response..

**Q.50** Answer is “Passive immunity”

*Explanation:* In contrast to active immunity, in which case antigens are introduced to stimulate the production of antibodies, by artificial or natural method; antibodies are injected in the form of antisera, to make a person immune against a disease. This is called passive immunity.

**Worksheet-16**

**(Genetics)**

**Q.1 Humans have X – linked recessive traits like:**

- A) Hemophilia
- B) Vitamin D – resistant rickets
- C) Hypophosphatemic rickets
- D) SRY gene

**Q.2 Many X – linked traits in man are also found X – linked in other mammals like:**

- A) Mouse and rabbit
- B) Dog and Sheep
- C) Donkey and horse
- D) Mouse, rabbit, dog, sheep, donkey, cattle, kangaroo and chimpanzee all

**Q.3 Gene is a basic unit of:**

- A) Inheritance
- B) Coordination
- C) Excretion
- D) Respiration

**Q.4 Genes are actually parts of \_\_\_\_\_ comprising its base sequence:**

- A) Chromosome
- B) DNA
- C) RNA
- D) Chromatid

**Q.5 \_\_\_\_\_ are responsible for producing startling inherited resemblances as well as distinctive variations among generations.**

- A) Chromosomes
- B) Genes
- C) Genomes
- D) Nucleic acids

**Q.6 When genes pass in the form of intact parental combination between generations:**

- A) Inherited similarities are conserved
- B) Non-inherited similarities are conserved
- C) Variations energy
- D) Non-inherited variations emerge

**Q.7 When genes shuffle, mutate or juggle with each other:**

- A) Genetic continuity is conserved
- B) Inherited variations are conserved
- C) Variations occur
- D) Inherited similarities are conserved

**Q.8 Genes form \_\_\_\_\_ on \_\_\_\_\_ of homologous chromosomes.**

- A) Pairs, Pairs
- B) Pairs, tetrads
- C) Tetrads, pairs
- D) Tetrads, tetrads

**Q.9 When an effect caused by a gene or gene pair at one locus interferes with or hides the effect caused by another gene or gene pair at another locus, such phenomenon of gene interaction is called:**

- A) Epistasis
- B) Pleiotropy
- C) Over dominance
- D) Co dominance

**Q.10 ABO locus is on chromosome number:**

- A) 19
- B) 9
- C) 11
- D) 21

**Q.11 The epistatic gene H changes a precursor substance into substance:**

- A) H
- B) D
- C) A
- D) B

**Q.12 Substance H produces an enzyme that inserts sugar into a precursor \_\_\_\_\_ on the surface of RBC:**

- A) Lipoprotein
- B) Nucleoprotein
- C) Glycoprotein
- D) Glycolipids

**Q.13 Insertion of antigen A and B on the surface of RBC depends upon the product of gene:**

- A) H
- B) I<sup>A</sup>
- C) I<sup>B</sup>
- D) I<sup>A</sup> or I<sup>B</sup>

**Q.14** A person with Bombay phenotype lacks:

- A) Antigen A and B in blood
- B) Antigen A and B in body
- C) Antigen A and B on RBC
- D) Antigen A and B in lymph

**Q.15** Pick up the one which illustrate Bombay phenotype:

- A)  $I^A I^A$ , HH
- B)  $I^A I^B$ , Hh
- C)  $I^A I^B$ , hh
- D) ii, HH

**Q.16** A phenomenon of gene interaction in which a gene interferes in the effect of another gene is called:

- A) Pleiotropy
- B) Epistasis
- C) Over dominance
- D) Co dominance

**Q.17** Epistasis is an interaction between:

- A) Different alleles of the same gene
- B) Different genes occupying different loci
- C) Same gene of the different loci
- D) Different genes occupying same locus

**Q.18** Bombay phenotype is an example of:

- A) Dominance
- B) Pleiotropy
- C) Epistasis
- D) Gene linkage

**Q.19** The cells of \_\_\_\_\_ contains an enormous amount of DNA.

- A) Prokaryotes
- B) Protists
- C) Eukaryotes
- D) Fungi

**Q.20** The mutation in \_\_\_\_\_ have little evolutionary consequence than germ line changes.

- A) Sex cells
- B) Gametes
- C) Gamete mother cells
- D) Somatic cells

**Q.21** The mutation in \_\_\_\_\_ is passed to subsequent generations thus providing the raw material from which natural selection produces evolutionary changes.

- A) Somatic cells
- B) Non – reproductive cells
- C) Germ line cells
- D) Skin cells

**Q.22** Mutations can broadly be classified as:

- A) Chromosomal aberration of number and structure
- B) Point mutation and gene mutation
- C) Chromosomal aberration of number and point mutation
- D) Chromosomal aberration and point mutation

**Q.23** Allele  $I^A$  specifies production of antibodies:

- A) Against A
- B) Against B
- C) Against A and B
- D) Against O

**Q.24** Allele i is recessive to:

- A)  $I^A$
- B)  $I^B$
- C)  $I^A$  and  $I^B$  both
- D) D

**Q.25** Pick up the genotype which produces phenotype A:

- A)  $I^A I^A$
- B)  $I^A i$
- C)  $I^A I^A$  or  $I^A i$
- D) ii

**Q.26** The homozygous “ii” will produce phenotype:

- A) A
- B) B
- C) AB
- D) O

**Q.27** The blood group alleles start their expression at early embryonic stage and keep on expressing themselves till:

- A) Puberty
- B) Old stage
- C) Death
- D) Eighties



**Q.28 The blood serum of A phenotype contains:**

- A) Anti – A antibodies
- B) No antibodies
- C) Anti – B antibodies
- D) Both antibodies

**Q.29 B phenotype of blood contains:**

- A) Anti – A antibodies
- B) Anti – B antibodies
- C) Anti A and Anti B antibodies
- D) No antibody

**Q.30 Blood phenotype AB have:**

- A) Anti – A antibodies
- B) Anti – B antibodies
- C) Both Anti A and B antibodies
- D) Neither anti – A nor Anti – B antibodies

**Q.31 Any blood transfusion is ideally safe if it:**

- A) Does not cause agglutination in the recipient
- B) Cause agglutination in the recipient
- C) Does not cause agglutination in the donor
- D) Cause agglutination in the donor

**Q.32 Agglutination of blood leads to serious results because clumped blood cells cannot:**

- A) Carry O<sub>2</sub>
- B) Pass through fine capillaries
- C) Carry CO<sub>2</sub>
- D) Carry food and wastes

**Q.33 Before giving transfusion the blood samples of the donor and the recipient are:**

- A) Screened for compatibility
- B) Cross matched for compatibility
- C) Filtered for compatibility
- D) Centrifuged for compatibility

**Q.34 If incompatible blood is transfused, the RBCs of the:**

- A) Recipient are destroyed
- B) Either recipient or donor or both are destroyed
- C) Donor are destroyed
- D) No body are destroyed

**Q.35 Blood group A can be transfused only into:**

- A) A recipient
- B) B recipient
- C) AB recipient
- D) A and AB recipient

**Q.36 AB blood can be transfused only into:**

- A) B recipient
- B) A recipient
- C) AB recipient
- D) B and AB recipient

**Q.37 ABO blood system is encoded by a single:**

- A) Polymorphic gene
- B) Homomorphic gene
- C) Isomorphic gene
- D) Amorphic gene

**Q.38 The gene I at chromosome # 9 of human population have:**

- A) Two alleles
- B) Three alleles
- C) Four alleles
- D) Five alleles

**Q.39 If the alterations involve only one or a few base pairs in the coding sequence they are called:**

- A) Chromosomal mutations
- B) Mega changes
- C) Chromosomal aberrations
- D) Point mutations

**Q.40 Modern industrial societies are exposed to point mutations mainly by:**

- A) Mutagenic radiations
- B) Spontaneous pairing errors
- C) Chemical mutagens
- D) Non-disjunction

**Q.41 Sickle cell anemia and phenyl ketonuria are well known examples of:**

- A) Point mutations
- B) Chromosomal aberrations
- C) Chromosomal mutations
- D) Non-disjunctions

**Q.42 In sickle cell anemia a point mutations leads to the change of \_\_\_\_\_ at position 6 from N terminal end in hemoglobin  $\beta$  chain.**

- A) Glutamic acid into serine
- B) Serine into glutamic acid
- C) Glutamic acid into valine
- D) Valine into glutamic acid

**Q.43 Sickle cell hemoglobin have reduced ability to:**

- A) Carry  $\text{CO}_2$
- B) Carry  $\text{O}_2$
- C) Release  $\text{O}_2$
- D) Release  $\text{CO}_2$

**Q.44 Humans have:**

- A) 46 chromosomes
- B) 46 pairs of chromosomes
- C) 23 chromosomes
- D) 22 pairs of chromosomes

**Q.45 In humans division of chromosomes is as under:**

- A) 23 autosome, one pair of sex chromosomes
- B) 22 autosome, one pair of sex chromosomes
- C) 23 pairs of autosome, one pair of sex chromosomes
- D) 22 pairs of autosome, one pair of sex chromosomes

**Q.46 The human female differs from human male in having:**

- A) X chromosome
- B) Two X chromosomes
- C) Y chromosome
- D) XY chromosomes

**Q.47 Human female differs from human male in having:**

- A) 22 homologous pairs of chromosomes
- B) 22 homologous pairs of autosomes
- C) 23 homologous pairs of chromosomes
- D) One pair of sex chromosomes

**Q.48 Human male differs from human female in having:**

- A) One non-homologous pairs of chromosomes
- B) 23 non-homologous pairs of chromosomes
- C) 22 homologous pairs of chromosome
- D) 23 homologous pairs of chromosome

**Q.49 The male determining gene of the Y – chromosome is called:**

- A) tfm
- B) SRY
- C) SDRY
- D) TSDRY

**Q.50 It is essential for triggering the development of maleness in humans:**

- A) Presence of Y chromosome
- B) Presence of SRY gene on Y chromosome
- C) X – Y balance
- D) Autosome and X chromosome balance

**Q.51 In humans:**

- A) Same type of gametes are produced
- B) Same type of sperms are produced
- C) Same type of eggs are produced
- D) Different type of eggs are produced

- Q.52** In humans, the chances of male and female offspring are theoretically:  
A) 1:2:1 C) 1:1  
B) 2:1 D) 3:1
- Q.53** In humans, if X-carrying sperm fertilizes the egg, the offspring will be:  
A) Female  
B) Male  
C) Abnormal male  
D) Abnormal female
- Q.54** All sixty four codons were tested by making artificial mRNA and triplet codons by:  
A) Nierenberg  
B) Leader  
C) Khorana  
D) Nierenberg, Leader and Khorana
- Q.55** Many different alleles of a gene may be produced by:  
A) Evolution C) Reshuffling  
B) Mutation D) Crossing over
- Q.56** All such altered, alternative forms of a gene, whose number is more than two, are called:  
A) Allelomorphs C) Multiple alleles  
B) Fixed alleles D) Pseudo alleles
- Q.57** ABO blood system have:  
A) Two different phenotypes  
B) Four different phenotypes  
C) Three different phenotypes  
D) Five different phenotypes
- Q.58** A person having antigen A on the surface of RBC, has:  
A) Antibodies against A  
B) Antibodies against O  
C) Antibodies against B  
D) Antibodies against A and B

- Q.59** A person having neither antigen A nor B have:  
A) No antibodies  
B) Antibodies against B  
C) Antibodies against A  
D) Antibodies against A and B both
- Q.60** In phenylketonuria:  
A) Phenylalanine hydroxylase is not formed  
B) Phenylalanine hydroxylase is not degraded  
C) Phenylalanine is not formed  
D) Adenosine deaminase is not formed
- Q.61** In phenylketonuria, phenylalanine accumulates in the cells leading to mental retardation as the brain fails to develop:  
A) During embryonic development  
B) In childhood  
C) In infancy  
D) During puberty
- Q.62** ABO locus is found on chromosome number:  
A) 19 C) 11  
B) 9 D) 21
- Q.63** Genetics of wheat grain color was studied by:  
A) Darwin C) Mendel  
B) Nilsson-Ehle D) Correns
- Q.64** When we cross a true breeding dark red grain wheat plant with a true breeding white grain wheat plant, all F<sub>1</sub> grains will have:  
A) Pink color C) Red color  
B) Light red color D) Dark red color

- Q.65 Nilson–Ehle got seven shades of color in F<sub>2</sub> of wheat grain with ratio of:**  
A) 1:6:15:20:15:6:1  
B) 1:2:3:04:03:2:1  
C) 3:6:9:12:9:6:3  
D) 5:10:15:20:15:10:5
- Q.66 A wheat plant with Aabbcc genotype will have how many doses of red pigment in its grains:**  
A) One  
B) Two  
C) Three  
D) Four
- Q.67 Human skin color is also a quantitative trait which is controlled by:**  
A) Three gene pairs  
B) Three to four gene pairs  
C) Three to five gene pairs  
D) Three to six gene pairs
- Q.68 In polygenic traits majority of the population will represent the:**  
A) Extreme phenotypes  
B) Any phenotype  
C) Intermediate phenotype  
D) Strange phenotype
- Q.69 A continuously varying trait is encoded by:**  
A) Alleles of two or more different gene pairs  
B) Alleles of a gene pair  
C) Alleles of two or more genomes  
D) Multiple alleles of two or more different gene pairs
- Q.70 Pick up the discontinuously varying trait:**  
A) Human intelligence  
B) Skin color in humans  
C) Grain color of wheat  
D) 4 O'clock flower color
- Q.71 MN blood group system is an example of:**  
A) Complete dominance  
B) Incomplete dominance  
C) Over dominance  
D) Co-dominance

- Q.72 If both contrasting alleles of a gene are fully expressed in a heterozygous condition their mutual relation will be called as:**  
A) Dominance  
B) Over dominance  
C) Co-dominance  
D) Incomplete dominance

**ANSWER KEY (Worksheet-16)**

1	A	21	C	41	A	61	C
2	D	22	D	42	C	62	B
3	A	23	B	43	B	63	B
4	B	24	C	44	A	64	B
5	B	25	C	45	D	65	A
6	A	26	D	46	B	66	A
7	C	27	C	47	C	67	D
8	A	28	C	48	A	68	C
9	A	29	A	49	B	69	A
10	B	30	D	50	B	70	D
11	A	31	A	51	C	71	D
12	C	32	B	52	C	72	D
13	A	33	B	53	A		
14	C	34	B	54	D		
15	C	35	D	55	B		
16	B	36	C	56	C		
17	B	37	A	57	B		
18	C	38	B	58	C		
19	C	39	D	59	D		
20	D	40	C	60	A		

**EXPLANATION****Q.1 Answer is “Hemophilia”**

**Explanation:** The gene for hemophilia is located on X-chromosome and it is a recessive trait. However, vitamin D resistant rickets also called as hypophosphatemic rickets is controlled by a dominant allele located on X – chromosome. SRY gene is located on short arm of Y – chromosome

**Q.2 Answer is “Mouse, rabbits, dog, sheep, donkey, cattle, kangaroo and chimpanzee”**

**Explanation:** As man along with mouse, rabbit, dog, sheep, donkey, cattle, kangaroo and chimpanzees belong to class mammalia of vertebrates and have close evolutionary link, their genetic similarity is no surprise.

**Q.3 Answer is “Inheritance”**

**Explanation:** Gene are physical units of inheritance located on chromosomes and control the traits of organisms.

**Q.4 Answer is “DNA”**

**Explanation:** The sequence of nucleotides that determines the amino acid sequence of a protein is called a gene. In fact DNA stores all sorts of biological information coded in the sequence of its bases in a linear order and genes are actually parts of DNA comprising its basic sequences.

**Q.5 Answer is “Genes”**

**Explanation:** As genes are basic units of biological information, so they are responsible for transmission of parental characters to their offsprings as well as for the creation of new characters by the combination of maternal-paternal genes i.e. non parental characters.

**Q.6 Answer is “Inherited similarities are conserved”**

**Explanation:** If an entire set of genes of a parent are transferred to an offspring that offspring will be a clone of that parent i.e. it will have 100% similarities with that parent and as a result all parental characters will be conserved in offspring.

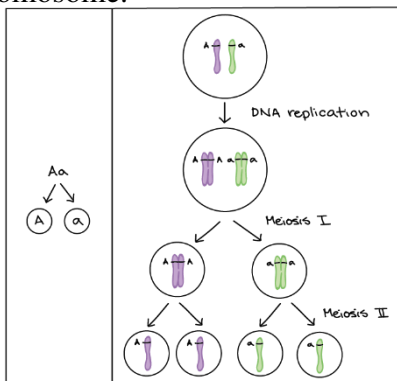
**Q.7 Answer is “Variations occur”**

**Explanation:** By reshuffling of genetic makeup of parents variants are produced and recombination occurs.



**Q.8 Answer is “Pairs, Pairs”**

**Explanation:** Gene pair occurs on pair of homologous chromosomes which indicates a parallelism in the behavior of gene and chromosome.

**Q.9 Answer is “Epistasis”**

**Explanation:** It is definition of epistasis.

**Q.10 Answer is “9”**

**Explanation:** It is a fact.

**Q.11 Answer is “H”**

**Explanation:** Substance H is associated with insertion of antigens on the surface of RBCs.

**Q.12 Answer is “Glycoproteins”**

**Explanation:** Glycoproteins develop particular receptor sites on cell surfaces.

**Q.13 Answer is “H”**

**Explanation:** As gene H will produce a receptor site for antigen A or/and B on the surface of RBCs.

**Q.14 Answer is “Antigen A and B on RBC”**

**Explanation:** Bombay phenotype is actually a person having AB antigen but lacking the substance H which is required for insertion of antigens on the surface of RBC. Thus phenotypically he or she will be O.

**Q.15 Answer is “I<sup>A</sup>I<sup>B</sup>,hh”**

**Explanation:** Substance H is required for the insertion of AB antigen on the surface

of RBCs and for that purpose at least on H (dominant) is required at locus H.

**Q.16 Answer is “Epistasis”**

**Explanation:** It is definition of epistasis.

**Q.17 Answer is “Different genes occupying different loci”**

**Explanation:** An interaction between the alleles of a same gene is called dominance relation, however, an interaction between alleles of two different genes is called epistasis and hypostasis.

**Q.18 Answer is “Epistasis”**

**Explanation:** In Bombay phenotype the phenotypic effect of AB gene located on chromosome number 9 is being interfered by H gene located on chromosome number 19.

**Q.19 Answer is “Eukaryotes”**

**Explanation:** They have more chromosomes.

**Q.20 Answer is “Somatic cells”**

**Explanation:** As they have no role in sexual reproduction.

**Q.21 Answer is “Germ line cells”**

**Explanation:** As germ line cells are involved in sexual reproduction.

**Q.22 Answer is “Chromosomal aberrations or point mutation”**

**Explanation:** Chromosomal aberrations occur at chromosome level while point mutations occur at nucleotide level.

**Q.23 Answer is “Against- B”**

**Explanation:** As that person lacks antigen B

**Q.24 Answer is “I<sup>A</sup> or I<sup>B</sup> both”**

**Explanation:** These are alleles of same gene located on some locus.

**Q.25** Answer is “ $I^A I^A$  or  $I^A i$ ”

*Explanation:* As ‘i’ is recessive to  $I^A$  a person with ‘ $I^A$ ’ will be heterozygous for blood type A. A person with  $I^A I^A$  will be homozygous for blood type-A.

**Q.26** Answer is “O”

*Explanation:* As there will be neither antigen A nor antigen B.

**Q.27** Answer is “Death”

*Explanation:* As the antigens persist throughout life.

**Q.28** Answer is “Anti-B antibodies”

*Explanation:* A person with A blood type lacks antigens B thus antigen B is foreign to him/her and it will produce antibodies against it.

**Q.29** Answer is “Anti-A antibodies”

*Explanation:* A person having blood group ‘B’ will lack antigen ‘A’ and thus produce antibodies against ‘A’.

**Q.30** Answer is “Neither Anti-A nor Anti-B antibodies”

*Explanation:* As it contains both antigens.

**Q.31** Answer is “Does not cause agglutination in the recipient”

*Explanation:* It means donor blood either matches to that of recipient or it lacks any antibodies i.e O type. (a universal donor)

**Q.32** Answer is “Pass through fine capillaries”

*Explanation:* It is life threatening situation as blood vessels will be choked by it.

**Q.33** Answer is “Cross matched for compatibility”

*Explanation:* Cross matching is carried out to check the compatibility whereas screening is carried out to ensure that it is infection free.

**Q.34** Answer is “Either recipient or donor or both are destroyed”

*Explanation:* It is consequence of incompatibility which means either donor’s blood have antibodies against that of recipient or vice versa or both have antibodies against each other’s blood.

**Q.35** Answer is “A and AB”

*Explanation:* AB is universal recipient and A is same blood group.

**Q.36** Answer is “AB recipient”

*Explanation:* AB blood lacks any antibody, thus it can be transfused to only ‘AB’ recipient because any other blood type will have antibodies against it and its agglutination will occur.

**Q.37** Answer is “Polymorphic gene”

*Explanation:* Having more than two morphological (Phenotypic) manifestations or having more than two alleles.

**Q.38** Answer is “Three alleles”

*Explanation:*  $I^A$ ,  $I^B$  or i

**Q.39** Answer is “Point mutation”

*Explanation:* As it occurs at nucleotide level or molecular level and is called point mutation or molecular mutation of gene mutation.

**Q.40** Answer is “Chemical mutagens”

*Explanation:* Such chemicals which cause point mutations are called chemical mutagens.

**Q.41** Answer is “Point mutations”

*Explanation:* These genetic disorders are consequence of a change in the nucleotide sequence of DNA which results in a change in amino acid sequence of proteins and as a result the function of that associated with that protein is stopped.

**Q.42** Answer is “Glutamic acid into valine”

*Explanation:* Glutamic acid is replaced by valine as thymine have been replaced by adenine in gene regulating the synthesis of hemoglobin.

**Q.43** Answer is “Carry O<sub>2</sub>”

*Explanation:* As it have modified  $\beta$  chains.

**Q.44** Answer is “46 chromosomes”

*Explanation:* 44 autosomes and 2 sex chromosomes.

**Q.45** Answer is “22 pairs of autosomes, one pair of sex chromosome”

*Explanation:* T.H. Morgan classified the chromosomes into two functional categories i.e. autosomes and sex chromosomes.

**Q.46** Answer is “Two X chromosomes”

*Explanation:* Female have XX chromosomes whereas male have XY chromosome.

**Q.47** Answer is “23 homologous pairs of chromosomes”

*Explanation:* Sex chromosomes are also homologous in female (XX) whereas autosomes are homologous in both male and females both. However in male sex chromosomes (XY) are non-homologous.

**Q.48** Answer is “One non-homologous pair of chromosomes”

*Explanation:* Sex chromosomes are also homologous in female (XX) whereas autosomes are homologous in both male and females. However in male sex chromosomes (XY) are non-homologous.

**Q.49** Answer is “SRY”

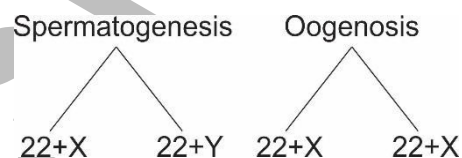
*Explanation:* Sex determining region of the Y-chromosome.

**Q.50** Answer is “Presence of SRY gene on Y chromosome”

*Explanation:* Presence of SRY on the short arm of Y-chromosome is inevitable for triggering male development in the embryo.

**Q.51** Answer is “Same type of eggs are produced”

*Explanation:* As all pairs of chromosomes are homologous in female. However, sperms are of two types.



**Q.52** Answer is “1:1”

*Explanation:* According to probability rule, the chances for two types of sperms in fertilizing the single type of egg are fifty fifty.

**Q.53** Answer is “Female”

*Explanation:* All the eggs of human female carry X-chromosome. However male produces two types of sperms; half having X-chromosomes and half having Y-chromosomes. Thus the gender of the offspring will depend upon the type of sperm used in fertilization. If X chromosome carrying sperm fertilized the egg the offspring will be female (XX) otherwise male XY.

**Q.54** Answer is “Nierenberg, Leader and Khorana”

*Explanation:* As a historical fact.

**Q.55** Answer is “Mutation”

*Explanation:* Mutation is a source of formation of multiple alleles.

**Q.56** Answer is “Multiple alleles”

*Explanation:* If a gene have more than two alternate forms or allelomorphs it is called a multiple alleles e.g. ABO blood

type. Such multiple variants of a gene come into being by mutation.

**Q.57 Answer is “Four different phenotypes”**

*Explanation:* A, B, AB and O.

**Q.58 Answer is “Antibodies against B”**

*Explanation:* Antibodies are formed against that antigen which is absent in that body.

**Q.59 Answer is “Antibodies against A and B both”**

*Explanation:* A person lacking both antigen A and B will produce antibodies against both antigens as both antigens are foreign to him or her.

**Q.60 Answer is “Phenylalanine hydroxylase is not formed”**

*Explanation:* Phenylalanine hydroxylase enzyme is required to degrade phenylalanine. As a result phenylalanine accumulates in the cells leading to mental retardation, as the brain fails to develop in infancy. So synthesis of phenylalanine hydroxylase is inevitable and any mutation causing its deficiency will result in a disease called phenylketonuria.

**Q.61 Answer is “in infancy”**

*Explanation:* Phenylalanine accumulates during infancy in post embryonic development as during embryonic phase phenylalanine is metabolized by mother and fetus gets metabolized food. Thus phenylketonuria occurs in infancy as an in born error of metabolism.

**Q.62 Answer is “9”**

*Explanation:* It is a fact.

**Q.63 Answer is “Nilsson-Ehle”**

*Explanation:* Nilsson – Ehle studied the genetics of wheat grain color. When he crossed a true breeding dark red grain plant with true breeding white grain plant, all  $F_1$  grains had light red color,

intermediate between two parental shades. It seemed as if it was a case of incomplete dominance. But when  $F_1$  grains were grown to mature to mature plants and crossed with each other.  $F_2$  grains had exactly seven shades of color in the ratio of 1 dark red : 6 modestly dark red : 15 red : 20 light red : 15 pink : 6 light pink : 01 white.

**Q.64 Answer is “Light red color”**

*Explanation:* See explanation of Q # 63.

**Q.65 Answer is “1:6:15:20:15:6:1”**

*Explanation:* See explanation of Q # 63.

**Q.66 Answer is “One”**

*Explanation:* Alleles A, B and C code for equal amount (dose) of red pigment, which is a positive effect. But none of a, b, and c code red pigment.

**Q.67 Answer is “Three to six gene pairs”**

*Explanation:* Human skin color is also a quantitative trait which is controlled by three to six gene pairs. The greater the number of pigment specifying genes, the darker the skin. A child can have darker or lighter skin than his parents.

**Q.68 Answer is “Intermediate phenotype”**

*Explanation:* It is evident from the ratio obtained by Nilsson-Ehle in  $F_2$  i.e.;

$$1 : 6 : 15 : 20 : 15 : 6 : 1$$

**Q.69 Answer is “Alleles of two or more different gene pairs”**

*Explanation:* A continuously varying trait is encoded by two or more different gene pairs found at different loci all influencing the same trait in an additive way. These quantitative traits are called polygenes. Each polygene has a small positive or negative effect on the character.

**Q.70** Answer is “4 O’clock flower color”

**Explanation:** Human intelligence, human skin color and grain color of wheat are continuously varying polygenic traits however flower color in four O clock plants is a single gene controlled trait with incomplete dominance and three phenotypes.

**Q.71** Answer is “Co-dominance”

**Explanation:**

Dominance relations	Examples
Traits of pea studied by Mendel	Complete dominance
Flower color in four O clock plant	Incomplete dominance
MN and ABO blood groups	Co-dominance
Eye color in <i>Drosophila</i>	Over dominance

**Q.72** Answer is “Incomplete dominance”

**Explanation:** See explanation of Q # 71.



**Worksheet-17 (i)**  
**(Genetics)**

**Q.1 Hemophiliac's blood fails to clot properly after an injury, because of the following reasons, EXCEPT:**

- A) A reduction of blood clotting factors
- B) A malfunction of blood clotting factors
- C) A complete absence of blood clotting factors
- D) A reduction in hemopoietic stem cells

**Q.2 Hemophilia is a serious:**

- A) Hereditary disease
- B) Cardiovascular disease
- C) Physiological disease
- D) Immunodeficiency

**Q.3 A hemophiliac may:**

- A) Suffer from immune deficiency
- B) Suffer from respiratory infection
- C) Bleed to death
- D) Suffer from hypertension

**Q.4 Hemophilia is of:**

- A) Two types
- B) Three types
- C) Four types
- D) One types

**Q.5 Pick up the odd pair:**

- A) Hemophilia – A, Factor VIII
- B) Hemophilia – C, Factor XI
- C) Hemophilia – B, Factor XI
- D) Hemophilia – B, Factor IX

**Q.6 Pick up the choice not true with respect to both hemophilia A and hemophilia-B:**

- A) Non – allelic
- B) Recessive
- C) Allelic
- D) Sex linked

**Q.7 The percentage of hemophiliacs suffering from type – B of hemophilia is:**

- A) 10%
- B) 80%
- C) 20%
- D) 30%

**Q.8 The percentage of Hemophiliac patients suffering from type – C is:**

- A) Negligible
- B) 80%
- C) 20%
- D) 30%

**Q.9 Pick up the one that affects more men as compared to women:**

- A) Hemophilia – A
- B) Both Hemophilia A and B
- C) Hemophilia – B
- D) Hemophilia – C

**Q.10 Type of Hemophilia which affects the both men and women equally is:**

- A) Hemophilia – A
- B) Both Hemophilia – A and Hemophilia – B
- C) Hemophilia – B
- D) Hemophilia – C

**Q.11 Chances for a man to be affected by Hemophilia – A and B are:**

- A) Greater than a woman
- B) Equal to a woman
- C) Less than a woman
- D) Variable as compared to woman

**Q.12 A woman can suffer from Hemophilia A or B only when she is:**

- A) Homozygous dominant
- B) Heterozygous dominant
- C) Homozygous recessive
- D) Homozygous dominant

**Q.13 Pick up the disorder that occurs by one recessive allele in man but by two recessive alleles in woman:**

- A) Hemophilia – A
- B) Hemophilia – C
- C) Hemophilia – B
- D) Hemophilia – A and B

**Q.14** It zigzags from maternal grandfather through a carrier daughter to a grandson:

- A) Hemophilia – A
- B) Hemophilia – C
- C) Hemophilia – B
- D) Hemophilia – A and B

**Q.15** Hemophilia A and B always pass from:

- A) Father to son
- B) Maternal grandfather to grandson
- C) Father to daughter
- D) Paternal grandfather to grandson

**Q.16** A hemophiliac father passes his 'h' gene directly to his:

- A) Son
- B) Son's son
- C) Daughter
- D) Daughter's son

**Q.17** A hemophiliac man receive 'X<sup>h</sup>' indirectly from his:

- A) Father's father
- B) Mother's father
- C) Grandfather's father
- D) Grandmother's father

**Q.18** The single recessive allele for hemophilia is expressed successfully in the:

- A) Hemizygous daughter
- B) Homozygous son
- C) Hemizygous son
- D) Heterozygous son

**Q.19** A son of a carrier daughter will be affected by hemophilia if he inherits X chromosome of:

- A) Maternal grandmother or paternal grandmother
- B) Maternal grandfather or maternal grandmother
- C) Paternal grandmother or paternal grandfather
- D) Paternal grandfather, maternal grandfather

**Q.20** Queen Victoria's hemophiliac son was prince:

- A) Prince Nicholas
- B) Leopold
- C) Rupert
- D) Charles

**Q.21** The pedigree of Queen Victoria's family shows hemophilic sons in generation no.:

- A) II
- B) III
- C) IV
- D) II, III and IV all

**Q.22** Pick up the sign denoting carrier daughter:

- A) 
- B) 
- C) 
- D) 

**Q.23** Three primary colors associated with normal trichromatic vision are:

- A) Orange, green and blue
- B) Red, green and blue
- C) Red, green and yellow
- D) Red, green and purple

**Q.24** Mutations in opsin genes cause \_\_\_\_\_ types of colorblindness.

- A) One
- B) Two
- C) Three
- D) Four

**Q.25** Red blindness is called:

- A) Protanopia
- B) Deuteranopia
- C) Tritanopia
- D) Dichromacy

**Q.26** Deuteranopia is:

- A) Blue blindness
- B) Green blindness
- C) Red blindness
- D) Colors blindness

**Q.27** Blue blindness is called:

- A) Protanopia
- B) Deuteranopia
- C) Tritanopia
- D) Protanomaly

**Q.28 Blue cone monochromacy is an:**

- A) X – linked recessive trait
- B) Autosomal trait
- C) X – linked dominant trait
- D) Y – linked trait

**Q.29 A person suffering from blue cone monochromacy will be:**

- A) Red blind
- B) Green blind
- C) Blue blind
- D) Red and Green blind

**Q.30 The type of color blindness which inherits equally in men and women is called:**

- A) Blue blindness
- B) Green blindness
- C) Red blindness
- D) Red and Green blindness

**Q.31 A normal woman, whose father was red blind marries a red blind man, what proportion of their children can have normal color vision?**

- A) 100%                      C) 25%
- B) 33%                      D) 50%

**Q.32 The cause of testicular feminization syndrome is:**

- A) A recessive gene on X – chromosome
- B) A recessive gene on Y – chromosome
- C) A dominant gene on X – chromosome
- D) A dominant gene on Y – chromosome

**Q.33 Following are the symptoms of testicular feminization syndrome EXCEPT:**

- A) Female genitalia
- B) No breast
- C) Blind vagina
- D) Degenerated testes

**Q.34 “Such persons are happily married as female but are sterile”, because they suffer from:**

- A) Down’s syndrome
- B) Turner’s syndrome
- C) Testicular feminization syndrome
- D) Klinefelter’s syndrome

**Q.35 All daughters of an affected father, but none of his sons are affected in case of:**

- A) X – linked dominant traits
- B) Y – linked dominant traits
- C) X – linked recessive traits
- D) Y – linked recessive traits

**Q.36 The example of X – linked dominant trait is:**

- A) Color blindness
- B) Pattern baldness
- C) Hemophilia
- D) Hypophosphatemic rickets

**Q.37 It cannot be cured by taking vitamin D:**

- A) Dietary rickets
- B) Hypophosphatemic rickets
- C) Osteomalacia
- D) Weakness of bones

**Q.38 It does not result from vitamin – D deficiency:**

- A) Dietary rickets
- B) Hypophosphatemic rickets
- C) Osteomalacia
- D) Weakness of bones

**Q.39 Its cause is genetic communication failure at molecular level:**

- A) Dietary rickets
- B) Hypophosphatemic rickets
- C) Osteomalacia
- D) Weakness of bones

**Q.40 Gene for hypophosphatemic rickets is:**

- A) d C) H  
B) D D) h

**Q.41 Maleness is a:**

- A) X – linked trait  
B) Y – linked trait  
C) XY – linked trait  
D) XX – linked trait

**Q.42 Maleness passes through:**

- A) Y – chromosome from father to son only  
B) X – chromosome from father to son only  
C) Y – chromosome from mother to son only  
D) X – chromosome from mother to son only

**Q.43 All sons of an affected father will be affected in case of:**

- A) X – linked recessive traits  
B) Y – linked traits  
C) X – linked dominant traits  
D) X X linked traits

**Q.44 \_\_\_\_\_ gene on Y chromosome determines maleness in man.**

- A) tfm C) SRY  
B) D D) H

**Q.45 It is a male sex switch which triggers developmental process towards maleness after six week pregnancy:**

- A) SRY gene C) D gene  
B) tfm gene D) H gene

**Q.46 Such traits affect a structure or function of the body part and occur only in males or only in females:**

- A) Sex – linked traits  
B) Sex limited traits  
C) Sex influenced traits  
D) X – linked traits

**Q.47 Pick up the one not true about a woman:**

- A) She does not grow a beard herself  
B) She cannot have a gene for beard  
C) She can have a gene for beard  
D) She can pass the genes specifying heavy beard growth to her sons

**Q.48 A trait that can occur in both male and female but it is more common in one sex, cannot be:**

- A) X linked recessive trait  
B) Sex influenced trait  
C) Sex limited trait  
D) X linked dominant trait

**Q.49 It is controlled by an allele which is dominant in one sex but recessive in other:**

- A) Sex – limited trait  
B) Sex – influenced trait  
C) Y – linked trait  
D) X – linked trait

**Q.50 Pattern baldness is a:**

- A) Sex – limited trait  
B) Sex – influenced trait  
C) Y – linked trait  
D) X – linked trait

**Q.51 Gregor John Mendel laid down the foundation of:**

- A) Modern genetics  
B) Classical genetics  
C) Population genetics  
D) Phylogenetics

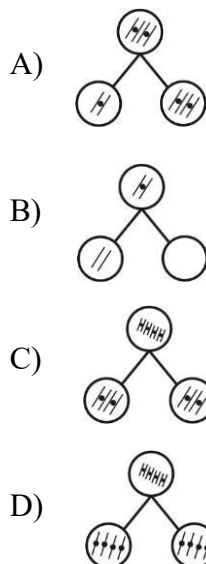
**Q.52 Mendel performed series of breeding experiments on garden pea:**

- A) In his farmhouse garden  
B) In his monastery garden  
C) In a public park garden  
D) In his school garden

- Q.53** Pick up the dominant one among the following traits of *Pisum sativum*:  
A) Yellow pod  
B) Constricted pod  
C) Green colored seed  
D) Round shaped seed
- Q.54** As a result of monohybrid cross Mendel got:  
A) 25% round C) 75% round  
B) 50% round D) 100% round
- Q.55** Punnet square indicates that \_\_\_\_\_ of  $F_2$  progeny would have been homozygous round \_\_\_\_\_ heterozygous round and \_\_\_\_\_ wrinkled, respectively:  
A)  $1/4$ ,  $2/4$ ,  $1/4$  C)  $2/4$ ,  $1/4$ ,  $1/4$   
B)  $1/4$ ,  $1/4$ ,  $2/4$  D)  $2/4$ ,  $1/4$ ,  $2/4$
- Q.56** Mendel devised a cross called test cross, which is used to test the \_\_\_\_\_ of an individual showing a dominant \_\_\_\_\_:  
A) Genotype, phenotype  
B) Phenotype, genotype  
C) Vigor, phenotype  
D) Vigor, genotype
- Q.57** \_\_\_\_\_ could be homozygous (RR) or heterozygous (Rr):  
A) A genotypically round seed  
B) A phenotypically round seed  
C) A genotypically wrinkled seed  
D) A phenotypically wrinkled seed
- Q.58** Wrinkled seed plant is:  
A) Always heterozygous recessive  
B) Always heterozygous dominant  
C) Always homozygous recessive  
D) Always homozygous dominant
- Q.59** What is depicted from the results of test cross given here below?  
Round = 50%  
Wrinkled = 50%  
A) The tested individual was heterozygous dominant  
B) The tested individual was heterozygous recessive  
C) The tested individual was homozygous dominant

D) The tested individual was homozygous recessive

- Q.60** What was the ratio of new phenotypic combination in  $F_2$  of Mendel's dihybrid?  
A)  $3/16$  C)  $9/16$   
B)  $1/16$  D)  $6/16$
- Q.61** What type of gametes will be formed by a plant with RrYy genotype?  
A) RR, YY, rr, yy C) RY, Ry, rY, ry  
B) RR, yy, Rr, Yy D) Rr, Yy, rr, yy
- Q.62** In  $F_2$  offspring of a monohybrid cross the independent chance for a pea seed to be round is:  
A)  $3/4$  C)  $4/4$   
B)  $1/4$  D)  $2/4$
- Q.63** Independent assortment of \_\_\_\_\_ depends upon independent assortment of their \_\_\_\_\_, respectively:  
A) Genes, chromosomes  
B) Chromosomes, genes  
C) Genes, nucleotide sequence  
D) Genes, cells
- Q.64** Mendel's work was rediscovered and acknowledged after:  
A) Sixteen years of his death  
B) Twenty years of his death  
C) Twenty-four years of his death  
D) Thirty-four years of his death
- Q.65** Which one of the following exhibits segregation?





**Q.66 Genes for color blindness, hemophilia and gout form a linkage group on:**

- A) Sex chromosome
- B) Autosome
- C) X – chromosome
- D) Y – chromosome

**Q.67 In F<sub>2</sub> of dihybrid cross Mendel obtained \_\_\_\_% parental types:**

- A) 37.5
- B) 62.5
- C) 66.5
- D) 33.5

**Q.68 In P<sub>1</sub> of test cross, one parent will always be:**

- A) Homozygous dominant
- B) Homozygous recessive
- C) Heterozygous dominant
- D) Heterozygous recessive

**Q.69 Gene linkage means:**

- A) Linkage of a gene with male
- B) Linkage of a gene with female
- C) Linkage of a gene with particular gender
- D) Linkage of a gene with a particular gene

**Q.70 Linked genes can be separated by:**

- A) Meiosis
- B) Crossing over
- C) Mitosis
- D) Gametogenesis

**ANSWER KEY (Worksheet-17(ii))**

1	D	21	D	41	B	61	C
2	A	22	D	42	A	62	A
3	C	23	B	43	B	63	A
4	B	24	C	44	C	64	A
5	C	25	A	45	A	65	D
6	C	26	B	46	B	66	C
7	C	27	C	47	B	67	B
8	A	28	A	48	C	68	B
9	B	29	D	49	B	69	D
10	D	30	A	50	B	70	B
11	A	31	D	51	B	71	
12	C	32	A	52	B	72	
13	D	33	B	53	D	73	
14	D	34	C	54	C	74	
15	B	35	A	55	A	75	
16	C	36	D	56	B	76	
17	B	37	B	57	B	77	
18	C	38	B	58	C	78	
19	B	39	B	59	A	79	
20	B	40	B	60	D	80	

**EXPLANATION**

**Q.1** Answer is “A reduction in hemopoietic stem cells”

**Explanation:** Hemopoiesis is associated with formation of new blood cells. It is not associated with blood clotting. However deficiency of blood clotting factors, malfunction of blood clotting factors and a complete absence of blood clotting factors may cause hemophilia of different types.

**Q.2** Answer is “Hereditary disease”

**Explanation:** Hemophilia A, B and C are exclusively inherited and most prevalent types of hemophilia, however, hemophilia A and B are sex-linked recessive traits, whereas hemophilia C is autosomal.

Parahemophilia is a type of hemophilia which may be inherited or acquired. Acquired hemophilia (caused by autoantibodies against factor VIII) is non-

inherited. So majority of the types of hemophilia are inherited

**Q.3** Answer is “Bleed to death”

**Explanation:** As there is some deficiency or complete absence of clotting factors, in case of an injury bleeding will not stop.

**Q.4** Answer is “Three types”

**Explanation:** There are three major inherited types of hemophilia i.e. A, B and C which have been mentioned in textbook of Biology. However there are two other types of hemophilia as well i.e. **parahemophilia** and **acquired hemophilia**. But according to textbook three is correct answer.

**Q.5** Answer is “Hemophilia B, factor XI”

**Explanation:** Hemophilia B is due to disturbance in factor IX. Whereas factor XI is associated with hemophilia C

**Q.6** Answer is “Allelic”

**Explanation:** Hemophilia A and Hemophilia B are non-allelic recessive sex linked traits because they exhibit discriminative inheritance.

**Q.7** Answer is “20%”

**Explanation:**

Type	Percentage of Sufferers
1. Hemophilia -A	80%
2. Hemophilia-B	20%
3. Hemophilia-C	Less than 1%

**Q.8** Answer is “Negligible”

**Explanation:** The frequency of Hemophilia-C in human population is less than 1 percent.

**Q.9** Answer is “Hemophilia A and B”

**Explanation:** Hemophilia A and B being sex linked (X-linked) recessive traits

occurs 17% more in men as compared to women.

**Q.10 Answer is “Hemophilia - C”**

*Explanation:* As it is autosomal.

**Q.11 Answer is “Greater than a woman”**

*Explanation:* The gene of sex linked (X-linked) traits is located on X-chromosome. In such traits female (having homologous pair of X-chromosome) is diallelic and can have three types of genotypes i.e.  $X^H X^H$  or  $X^H X^h$  or  $X^h X^h$ . Out of these three types of genotypes only  $X^h X^h$  will cause hemophilia i.e.  $1/3$  or 33%.

On the other hand male having single X chromosome is monoallelic and as a result only two types of genotypes are possible  $X^H Y$  or  $X^h Y$  :  $X^h Y$  will be hemophilic which represents  $1/2$  or 50% subtracting 33 from 50 we get 17. Thus sex-linked (X-linked) recessive traits appear 17% more in male as compared to female.

**Q.12 Answer is “Homozygous recessive”**

*Explanation:* Female will suffer from hemophilia by being homozygous recessive  $X^h X^h$  only.

**Q.13 Answer is “Hemophilia A and B”**

*Explanation:* All X-linked traits including Hemophilia A and B are monoallelic in male ( $X^h Y$ ) because their genes are located on X chromosome and male have single X-chromosome however female will be diallelic (having two X chromosomes).

**Q.14 Answer is “Hemophilia A and B”**

*Explanation:* All X-linked recessive traits exhibit zigzag inheritance. An affected male will transfer his single X chromosome ( $X^h$ ) to his daughter and other X chromosome will be contributed by mother ( $X^H$ ). Thus daughter will be carrier ( $X^H X^h$ ). Now she will produce two types of gametes i.e. 50%  $X^H$  and 50%  $X^h$ .

Her son getting  $X^h$  from mother will be hemophiliac. Thus the gene of disorder of maternal grandfather after passing through female gender in next generation appears again in male gender in third generation.

**Q.15 Answer is “Maternal grandfather to grandson”**

*Explanation:* Hemophilia A and B are X-linked recessive traits and their genes are located on X-chromosome. For a son X-chromosome is always contributed by mother.

**Q.16 Answer is “Daughter”**

*Explanation:* A father always contribute Y-chromosome to son and X-chromosome to daughter. Gene for hemophilia (H or h) is carried by X chromosome. So father will transfer it to his daughters, not to sons.

**Q.17 Answer is “Mother’s father”**

*Explanation:*  $X^h$  is inherited by a male directly from his affected or carrier mother. However, the mother have inherited it from her father or mother. Thus the male will inherit it indirectly from mother’s father or mother’s mother.

**Q.18 Answer is “Hemizygous son”**

*Explanation:* In sex linked (X-linked) traits male cannot be homozygous because the genes for such traits are located on X-chromosomes and male have single X-chromosome. Thus male will be hemizygous dominant  $X^H$  (Normal) or hemizygous recessive  $X^h$  (hemophiliac).

**Q.19 Answer is “Maternal grandfather or maternal grandmother”**

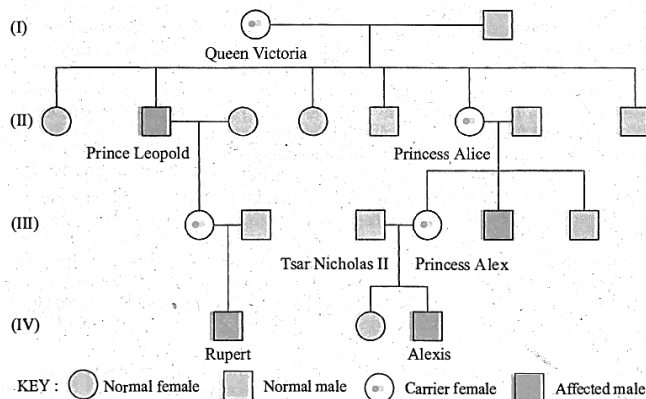
*Explanation:*  $X^h$  is inherited by a male directly from his affected or carrier mother. However, the mother have inherited it from her father or mother. Thus the male will inherit it indirectly from mother’s father or mother’s mother.

**Q.20** Answer is "Leopold"

**Explanation:** See pedigree of British Royal family given at page 194 of textbook of biology book part II.

**Q.21** Answer is "II, III and IV all"

**Explanation:** Except generation-I, all the rest of the generations shown in figure 22.28 of Textbook of biology have hemophiliac sons.



**Q.22** Answer is "D"

**Explanation:** A circle with dot in centre indicates carrier daughter.

**Q.23** Answer is "Red, green and blue"

**Explanation:** These represent three opsins found in the cone cells of a person with normal trichromatic vision.

**Q.24** Answer is "Three"

**Explanation:** There are three types of opsins in the cone cells of our eyes which are associated with normal trichromatic vision. These three types of opsins are controlled by three different types of genes. Thus mutation in these three genes can cause three types of color blindness.

**Q.25** Answer is "Protanopia"

**Explanation:** A form of colorblindness characterized by defective perception of red and confusion of red with green.

**Q.26** Answer is "Green blindness"

**Explanation:** Defective color vision with confusion of greens with reds.

**Q.27** Answer is "Tritanopia"

**Explanation:** Defective color vision in which the blue sensitive pigment of the retinal cones is absent.

**Q.28** Answer is "X-linked recessive trait"

**Explanation:** That person will have only blue opsin and lack both red and green opsin.

**Q.29** Answer is "Red and green blind"

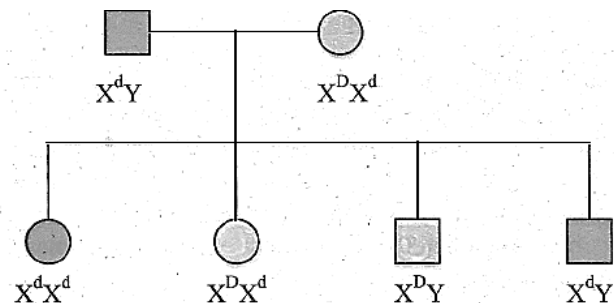
**Explanation:** Because he/she have only blue opsin in cone cells.

**Q.30** Answer is "Blue blindness"

**Explanation:** Because it is autosomal.

**Q.31** Answer is "50%"

**Explanation:** As it becomes a testcross where mother is heterozygous normal and father is hemizygous colour blind.



**Q.32** Answer is "a recessive gene on X-chromosome"

**Explanation:** tfm gene located on X-chromosome controls it.

**Q.33** Answer is "No breasts"

**Explanation:** A person suffering from testicular feminization syndrome have breasts like a female.

**Q.34** Answer is “Testicular feminization syndrome”

**Explanation:** Persons suffering from testicular feminization syndrome physically look female. They have breast, female genitalia, a blind vagina but no uterus. Degenerated testis are also present in abdomen. Such individuals are happily married as females but are sterile. It is an androgen insensitivity syndrome. Male sex hormone testosterone has no effect on them.

**Q.35** Answer is “X-linked dominant trait”

**Explanation:** As sons receive Y-chromosome from father and X-chromosome from mother. Whereas daughters receive X chromosome from both parents

**Q.36** Answer is “Hypophosphatemic Rickets”

**Explanation:** Hypophosphatemic rickets inherits 17% more in females as compared to that in males.

**Q.37** Answer is “Hypophosphatemic Rickets”

**Explanation:** Because the patient is vitamin-D resistant i.e., unable to receive vitamin D’s message.

**Q.38** Answer is “Hypophosphatemia Rickets”

**Explanation:** The person have become resistant to vitamin D’s message, though vitamin D is not deficient, rather it is genetic communication failure at molecular level. The genes encoding bone proteins never receive vitamin D’s message to function.

**Q.39** Answer is “Hypophosphatemia Rickets”

**Explanation:** Vitamin-D enhances the mineral uptake by increasing absorption of calcium and phosphorus from the digestive tract. If a person becomes deficient in vitamin D or becomes insensitive (resistant) against vitamin D his mineral uptake will be dangerously reduced and

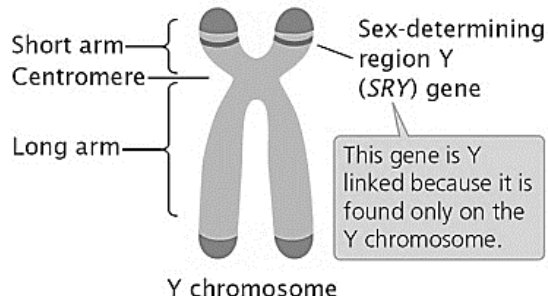
bones will become weak and he/she will suffer from rickets.

**Q.40** Answer is “D”

**Explanation:** D gene is dominant gene which is associated with vitamin-D resistance and as result hypophosphatemia.

**Q.41** Answer is “Y-linked trait”

**Explanation:** As SRY gene is carried by short arm of Y-chromosome.



**Q.42** Answer is “Y-chromosome from father to son only”

**Explanation:** As Y-chromosome is received by male zygote only and SRY is carried by male

**Q.43** Answer is “Y-linked traits”

**Explanation:** Genes carried by Y chromosome are transferred to son only as son inherit Y-chromosome from father.

**Q.44** Answer is “SRY”

**Explanation:** SRY (Sex determining region of Y) is located on short arm of Y-chromosome and it determines the maleness in humans.

**Q.45** Answer is “SRY gene”

**Explanation:** SRY is considered a male sex switch. It triggers the developmental.

**Q.46** Answer is “sex limited traits”

**Explanation:** They limited to one sex gender only i.e. either male or female due to their anatomical differences.



**Q.47** Answer is “She cannot have a gene for beard”

**Explanation:** She can have gene for beard but never have beard because she lacks hair follicle underneath the skin required to produce beard.

**Q.48** Answer is “Sex limited trait”

**Explanation:** Sex-limited trait of exclusively occur in either male or female. However, x-linked dominant traits occur more in male. Whereas, X-linked recessive traits occur more in female, but both can occur in opposite gender as well.

**Q.49** Answer is “Sex-influenced traits”

**Explanation:** In such traits a particular sex hormone magnifies the effect of single allele up to that shown by two alleles e.g. pattern boldness.

**Q.50** Answer is “Sex influenced trait”

**Explanation:** It is influenced by a particular sex hormone, so that is why it is called so.

**Q.51** Answer is “Classical genetics”

**Explanation:** Gregor Johann Mendel laid down the foundation of classical genetics by formulating two laws of heredity. Law of segregation and law of independent assortment.

**Q.52** Answer is “In his monastery garden”

**Explanation:** Mendel was a priest. He performed series of breeding experiments on garden pea *Pisum sativum* in his monastery garden for eleven years (1854-1865).

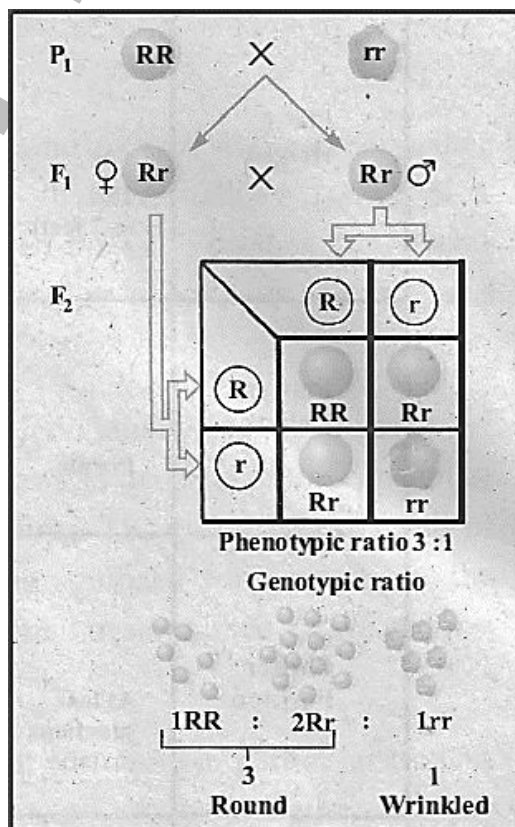
**Q.53** Answer is “Round shaped seed”

**Explanation:**

Trait	Dominant	Recessive
Plant height	Tall	Short
Flower color	Purple	White
Flower position	Axial	Terminal
Pod color	Green	Yellow
Pod shape	Inflated	Constricted
Seed color	Yellow	Green
Seed shape	Round	Wrinkled

**Q.54** Answer is “75% round”

**Explanation:**



Q.55 Answer is "1/4, 2/4, 1/4"

**Explanation:** As per previous explanation.

Q.56 Answer is "Phenotype, genotype"

**Explanation:** Mendel devised a cross called test cross, which is used to test the genotype of an individual showing a dominant phenotype. It is a mating in which an individual showing a dominant phenotype is crossed with an individual showing its recessive phenotype. This cross finds out the homozygous and heterozygous nature of the genotype.

Q.57 Answer is "A phenotypically round seed"

**Explanation:** Round shape in pea seed is dominant character and a dominant phenotype may have two genotypes RR (homozygous round) and Rr (heterozygous round).

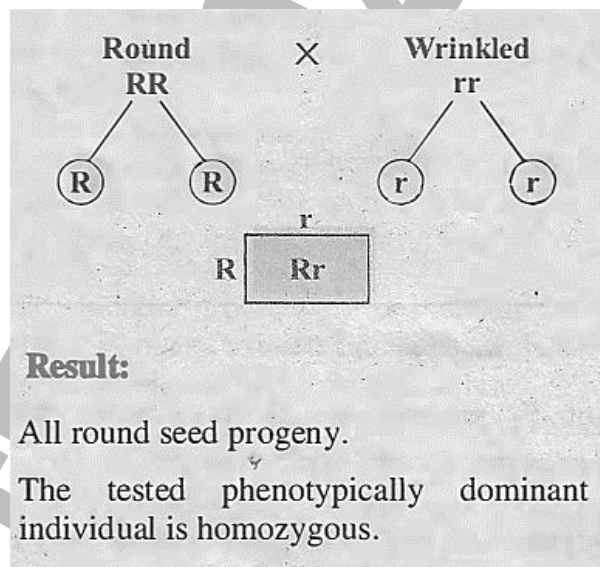
Q.58 Answer is "Always homozygous recessive"

**Explanation:** Wrinkled shape in pea seed is a recessive trait having single genotype rr (homozygous recessive) as recessive can't be heterozygous.

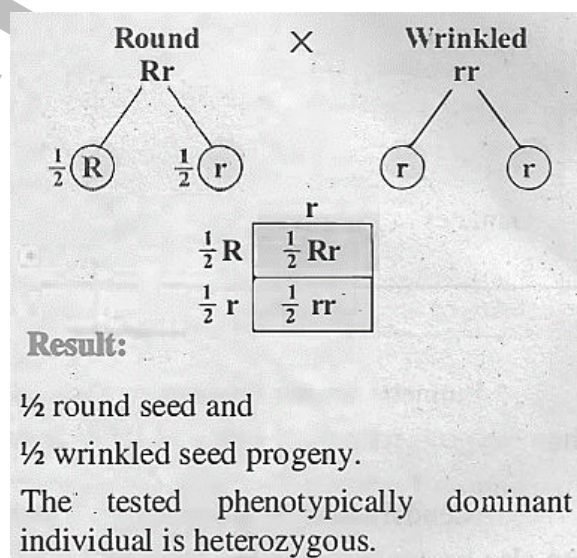
Q.59 Answer is "The tested individual was heterozygous dominant"

**Explanation:**

Test cross (Case I)



Test cross (Case II)



Q.60 Answer is “6/16”

**Explanation:** Phenotypic ratio of F<sub>2</sub> of Mendel’s dihybrid cross was as under.

Round yellow	9/16	Parental type
Wrinkled yellow	3/16	Recombinants i.e. new combinations
Round green	3/16	
Wrinkled green	1/16	Parental type

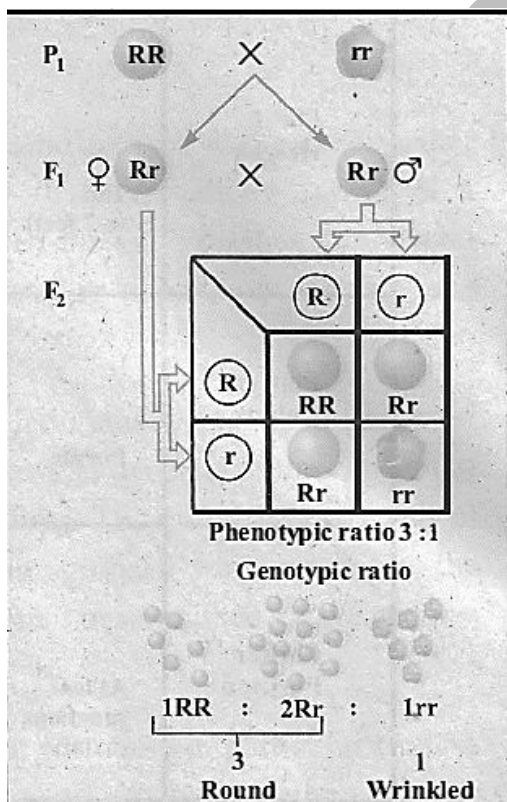
Q.61 Answer is “RY, Ry, rY, ry”

**Explanation:**

RrYy		
	R	r
Y	RY	rY
y	Ry	ry

Q.62 Answer is “3/4”

**Explanation:**



Q.63 Answer is “Genes, chromosomes”

**Explanation:** as given are carried by chromosomes so both exhibit parallel behavior.

Q.64 Answer is “Sixteen years of his death”

**Explanation:** In 1900, 16 years after Mendel’s death, three botanists, Correns, DeVries and Tschermach independently rediscovered and acknowledged his work.

Q.65 Answer is “ ”

**Explanation:** According to the Mendel’s law of segregation chromosomes split up into their respective chromatids during gametogenesis (meiosis) and each gamete receives one chromatid (with one allele of gene pairs).

Q.66 Answer is “X – chromosome”

**Explanation:** Human linkage group number 11 represented by homologous pair number 11 of chromosomes carries linked genes for sickle cell anemia, leukemia and albinism.

Q.67 Answer is “62.5”

**Explanation:**

$$\frac{9}{16} \text{ round yellow} + \frac{1}{16} \text{ wrinkled yellow}$$

$$\text{Total} = \frac{10}{16} \times 100 = 62.5\%$$

Q.68 Answer is “Homozygous recessive”

**Explanation:** See explanation of Q # 59.

Q.69 Answer is “Linkage of a gene with a particular gene”

**Explanation:** All genes located on the same chromosomes are linked to each other. This phenomenon of staying

together is called linkage. Gene linkage is a physical relationship between genes.

**Q.70** Answer is “Crossing over”

**Explanation:** Linked genes can be separated by crossing over. Closer the gene loci, more strongly are their genes linked. The farther apart two genes lie, greater are chances of their separation through crossing over.

STEP ENTRY TEST 2020



**Worksheet-17 (ii)**

**(Evolution)**

**Q.1 Charles Darwin was born in:**

- A) Cantbury
- B) Shrewsbury in western England
- C) Eastern England
- D) Cantbury in Eastern England

**Q.2 Darwin joined the expedition on Beagle to:**

- A) North American coastline
- B) South African coastline
- C) South American coastline
- D) North African coastline

**Q.3 Darwin observed and collected thousands of specimens of diverse:**

- A) Fauna of South America
- B) Fauna and flora of South America
- C) Flora of South America
- D) Fauna and flora of North America

**Q.4 Most of the animal species on Galapagos:**

- A) Live nowhere else in the continents
- B) Live nowhere else in the world
- C) Live everywhere in the world
- D) Live everywhere else in the continent

**Q.5 Pick up the one not true about the finches collected by Darwin on the Galapagos:**

- A) Although quite different seemed to be of same species
- B) Although quite similar, seemed to be different species
- C) Separated from original habitats by geographical barriers
- D) Some were unique to individual islands

**Q.6 Out of the 13 types of finches collected by Darwin from Galapagos:**

- A) All were unique to individual islands
- B) Some were distributed on two or more islands
- C) Some were unique to individual islands

D) Majority were unique to individual islands

**Q.7 The history of life is like a tree, with multiple branching and rebranching from a common trunk, in view of:**

- A) Darwin
- B) Cuvier
- C) Lamarck
- D) Lyell

**Q.8 In Darwinian view, at each fork of evolutionary tree is an ancestor common to all lines branching from that:**

- A) Tree
- B) Trunk
- C) Stem
- D) Fork

**Q.9 Darwin suggested that populations of individual species become better adapted to their local environments through:**

- A) Artificial selection
- B) Adaptation
- C) Variation
- D) Natural selection

**Q.10 Those individuals whose hereditary characteristics fit them best to their environment are likely to leave \_\_\_\_\_ than the less fit individuals:**

- A) More offspring
- B) Less offspring
- C) No offspring
- D) All offspring

**Q.11 The unequal ability of individuals to survive and reproduce will lead to gradual change in a population, with favorable characteristics accumulating over the generations, thus leading to the:**

- A) Struggle for existence
- B) Evolution of new species
- C) Overpopulation
- D) Persistence of species

**Q.12 An important turning point for evolutionary theory was the birth of population genetics, which emphasizes the extensive genetic variation within populations and recognizes the importance of:**

- A) Qualitative characters
- B) Analytical characters
- C) Quantitative characters



- D) Morphological characters
- Q.13 With progress in population genetics Mendelism and Darwinism were reconciled and the genetic basis of \_\_\_\_\_ and \_\_\_\_\_ was worked out.**
- A) Variation, artificial selection  
B) Overpopulation, natural selection  
C) Variation, evolution  
D) Variation, natural selection
- Q.14 By the reconciliation of Mendelism and Darwinism, a comprehensive theory of evolution was developed, that became to be known as:**
- A) Modern synthesis  
B) Modern Darwinism  
C) Neo synthesis  
D) Modern synthesis or Neo Darwinism
- Q.15 In “Modern Synthesis” or “Neo-Darwinism” the word synthesis depicts:**
- A) Origin of discoveries and ideas  
B) Integration of discoveries and ideas  
C) Modification of discoveries and ideas  
D) Confirmation of discoveries and ideas
- Q.16 Evolution leaves:**
- A) No signs  
B) Observable signs  
C) Non-observable signs  
D) Visible signs
- Q.17 Darwin’s theory of evolution was mainly based on the evidence from the:**
- A) Geographical distribution of species  
B) Fossil record  
C) Population genetics  
D) Geographical distribution of species and fossil record
- Q.18 A mammal that lives only in America is:**
- A) Armadillo  
B) Tasmanian Wolf

- C) Kangaroo  
D) Indus Dolphin
- Q.19 The evolutionary view of biogeography predicts that contemporary armadillos are modified descendants of earlier species that occupied:**
- A) Distant continents  
B) Neighboring continents  
C) Other continents  
D) These continents
- Q.20 Most of the animal species on the \_\_\_\_\_ live no-where else in the world:**
- A) South America C) Cape Verde  
B) North America D) Galapagos
- Q.21 Calculate the value of P when the  $p^2 = 0.49$ ,  $2pq = 0.42$  and  $q^2 = 0.09$ :**
- A) 0.8 C) 0.6  
B) 0.7 D) 0.5
- Q.22 According to Hardy-Weinberg \_\_\_\_\_ is not a potent force evolution:**
- A) Sexual recombination  
B) Mutation  
C) Migration  
D) Genetic drift
- Q.23 In Hardy-Weinberg theorem  $2pq$  stands for the frequency of:**
- A) Homozygous dominant individuals  
B) Heterozygous dominant individuals  
C) Homozygous recessive individuals  
D) Dominant alleles
- Q.24 In small populations \_\_\_\_\_ may lead to the loss of particular alleles:**
- A) Genetic drift C) Migration  
B) Mutation D) Selection
- Q.25 The breeders select for the desired characters in:**
- A) Natural selection C) Plant breeding  
B) Artificial selection D) Animal breeding

**ANSWER KEY (Worksheet-17 (ii))**

1	B	13	D
2	C	14	D
3	B	15	B
4	B	16	B
5	A	17	D
6	C	18	A
7	A	19	D
8	D	20	D
9	D	21	B
10	A	22	A
11	B	23	B
12	C	24	A
		25	B

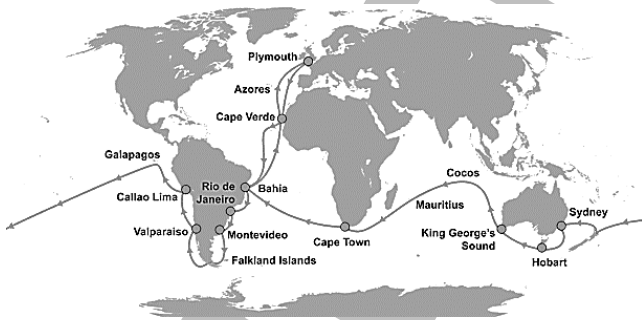
**EXPLANATION**

**Q.1** Answer is “Shrewsbury in Western England”

*Explanation:* Charles Darwin was born in Shrewsbury, in Western, in 1809.

**Q.2** Answer is “South American coastline”

*Explanation:* He was invited by the British Government to joint an expedition of naturalists. That expedition was sent by British Govt. to study the fauna and flora of South American coastline. It is called Beagle’s Voyage, as the ship was H.M.S Beagle.



**Q.3** Answer is “Fauna and flora of South America”

*Explanation:* Darwin observed and collected thousands of specimens of diverse fauna and flora of South America.

**Q.4** Answer is “Live nowhere else in the world”

*Explanation:* A particularly puzzling case of geographical distribution was the fauna and flora of Galapagos Islands. Most of the animals species on the Galapagos live nowhere else in the World, although they resemble species living on the South American mainland.

**Q.5** Answer is “Although quite different seemed to be of same species”

*Explanation:* Among the birds Darwin collected on the Galapagos were 13 types of finches which were, although quite similar but seemed to be of different species.

**Q.6** Answer is “Some were unique to individual islands”

*Explanation:* Among the birds Darwin collected, on the Galapagos were 13 types of finches that, although quite similar seemed to be different species. Some were unique to individual islands, while other species were distributed on two or more islands that were close together.

**Q.7** Answer is “Darwin”

*Explanation:* In Darwinian view the history of life is like a tree with multiple branching and rebranching from a common trunk all the way to the tips of the living twigs, symbolic of the current diversity of organisms. At each fork of the evolutionary tree is an ancestor common to all lines of evolution branching from that fork.

**Q.8** Answer is “Fork”

*Explanation:* In Darwinian view the history of life is like a tree with multiple branching and rebranching from a common trunk all the way to the tips of the living twigs, symbolic of the current diversity of organisms. At each fork of the

evolutionary tree is an ancestor common to all lines of evolution branching from that fork.

**Q.9 Answer is “Natural selection”**

**Explanation:** Natural selection promotes the adaptation which are fit to the environment. Darwin suggested that populations of individual species become better adapted to their local environments through natural selection

**Q.10 Answer is “More offspring”**

**Explanation:** It is in accordance with the principle of the Survival of the fittest.

**Q.11 Answer is “Evolution of new species”**

**Explanation:** This is evolution through natural selection.

**Q.12 Answer is “Quantitative characters”**

**Explanation:** Population genetics is mostly based on quantitative characters.

**Q.13 Answer is “Variation and natural selection”**

**Explanation:** Population genetics explains the variations and natural selection.

**Q.14 Answer is “Modern synthesis or neo Darwinism”**

**Explanation:** With the progress in population genetics in 1930s, Mendalism and Darwinism were reconciled and the genetic basis of variation and natural selection was worked out.

**Q.15 Answer is “Integration of discoveries and ideas”**

**Explanation:** It is called synthesis because it integrated discoveries and ideas from many different fields including paleontology, taxonomy, biogeography and of course population genetics.

**Q.16 Answer is “Observable signs”**

**Explanation:** Evolution leaves observable signs in the form of fossils, vestigial organs, analogous organs and homologous organs etc.

**Q.17 Answer is “Geographical distribution of species and fossil record”**

**Explanation:** It was impact of Beagly's Voyage.

**Q.18 Answer is “Armadillo”**

**Explanation:** It is an example of geographical distribution. Armadillo is also called armored mammal. It is only found in America.

**Q.19 Answer is “These continents”**

**Explanation:** The fossil record confirms that such ancestor existed in past as well.

**Q.20 Answer is “Galapagos”**

**Explanation:** Charles Darwin joined the expedition on H.M.S. Beagle to south American coastline. He observed and collected thousands of specimens of diverse fauna and flora of South America. A particularly puzzling case geographical distribution was the fauna of Galapagos islands. Most of the animal species on Galapagos live nowhere else in the world, although they resemble species living on the South American mainland. It was as though the Islands were colonized by plants and animals that strayed from the South American mainland and then diversified on different islands.

**Q.21 Answer is “0.7”**

**Explanation:**

$$P + q = 01$$

$$0.7 + 03 = 01$$

**Q.22 Answer is “Sexual recombination”**

**Explanation:** Hardy Weinberg principle states that the frequencies of alleles and genotypes in a populations gene pool remain constant over the generations unless acted upon by agents other than sexual recombination.

**Q.23** Answer is “Heterozygous dominant individuals”

**Explanation:** In Hardy Weinberg theorem;

$p^2$  = homozygous dominant.

$2pq$  = heterozygous dominant

$q^2$  = homozygous recessive

**Q.24** Answer is “Genetic drift”

**Explanation:** It is the change in frequency of alleles at a locus that occurs by chance. In small populations, such fluctuations may lead to the loss of particular alleles. This may occur in a small population when a few individual fail to reproduce and then genes are lost from the population.

**Q.25** Answer is “Artificial selection”

**Explanation:** In artificial selection, the breeders select for the desired characters. In natural selection, the environment plays this role, thus affecting the proportions of gene in a population.

**Worksheet-18**  
**(Biotechnology)**

**Q.1 If DNA from two different sources is fused:**

- A) Recombinant DNA is formed
- B) Complementary DNA is formed
- C) Mutant DNA is formed
- D) cDNA is formed

**Q.2 A DNA molecule synthesized from mRNA by reverse transcriptase in laboratory is called:**

- A) cDNA
- B) Extra chromosomal DNA
- C) Chromosomal DNA
- D) Cytoplasmic DNA

**Q.3 Complementary DNA is synthesized by:**

- A) DNA polymerases
- B) DNA ligases
- C) Restricted endonucleases
- D) Reverse transcriptases

**Q.4 The first restriction enzyme was isolated by:**

- A) John Hopkins
- B) Hamilton O. Smith
- C) Kary B-Mullis
- D) Maxim Gilbert

**Q.5 Bacteria produce a variety of restriction enzymes, which cut the DNA at specific sites, characterized by specific sequence of:**

- A) Four nucleotides
- B) Eight nucleotides
- C) Six nucleotides
- D) Four or six nucleotides

**Q.6 Bacteria produce a variety of restriction enzymes, which cut the DNA at specific sites, characterized by specific sequence of DNA arranged:**

- A) Symmetrically in reverse order
- B) Asymmetrically in reverse order
- C) Symmetrically in same order
- D) Asymmetrically in same order

**Q.7 So far 400 such enzymes have been isolated out of which about 20 are frequently used in recombinant DNA technology:**

- A) Reverse transcriptase
- B) Helicases
- C) Ligase
- D) Restriction endonucleases

**Q.8 The single stranded but complementary ends of the two DNA molecules are called "sticky ends" because:**

- A) They cannot bind
- B) They can bind by complementary base pairing
- C) They can bind by non-complementary base pairing
- D) They cannot bind due to non-complementary base pairing

**Q.9 To make a recombinant DNA, one often begins by selecting a \_\_\_\_\_, the means by which recombinant DNA is introduced into a host cell.**

- A) Restriction endonuclease
- B) DNA ligase
- C) Vector
- D) Primase

**Q.10 Plasmids were discovered by the investigators studying the sex-life of the \_\_\_\_\_ bacterium *Escherichia coli*.**

- |               |         |
|---------------|---------|
| A) Faecal     | C) Milk |
| B) Intestinal | D) Soil |



- Q.11** What was discovered by investigators studying the sex-life of the intestinal bacterium *Escherichia coli*?
- A) Restriction enzymes  
B) Plasmids  
C) DNA ligases  
D) Sticky ends
- Q.12** Plasmid having antibiotic resistant gene for tetracycline is called:
- A) pBR 322                      C) RP4  
B) pSC 101                      D) R388
- Q.13** A plasmid that provides resistance against tetracycline as well as ampicillin is called:
- A) pSC101                      C) RP4  
B) pBR322                      D) R388
- Q.14** For preparation of recombinant DNA, the plasmid is cut with the same enzyme which was used for:
- A) Isolation of the gene of interest  
B) Cutting all such plasmids  
C) Cutting any piece of DNA  
D) Cutting extrachromosomal DNA
- Q.15** The enzyme that seals the foreign piece of DNA into the vector is called:
- A) DNA – polymerase  
B) DNA helicase  
C) DNA – ligase  
D) DNA – Primase
- Q.16** A clone can be identical copy of a/an:
- A) Molecule  
B) Organism  
C) Cell  
D) Molecule, Cell and Organisms
- Q.17** Bacterial cells take up \_\_\_\_\_, especially, if they are treated with calcium chloride to make them more permeable.
- A) Recombinant DNA  
B) Plasmid  
C) Recombinant plasmid  
D) Extra chromosomal DNA

- Q.18** Besides plasmids, the other molecular carrier or vector is:
- A) DNA of bacteria  
B) DNA of plant viruses  
C) DNA of bacterial viruses  
D) DNA of animal viruses
- Q.19** The second step of PCR technique is:
- A) Heating DNA for one minute to denature  
B) Cooling for two minutes and adding primer  
C) Addition of DNA polymerase and waiting for 1.5 minutes  
D) Recycling
- Q.20** Third step in PCR technique is:
- A) Heating DNA for one minute to denature  
B) Cooling for two minutes and adding primer  
C) Addition of DNA polymerase and waiting for 1.5 minutes  
D) Recycling
- Q.21** PCR can create:
- A) Thousands of copies of a single gene  
B) Millions of copies of a single gene  
C) Hundreds of copies of a single gene  
D) Tens of copies of a single gene
- Q.22** PCR can create millions of copies of a single gene or any specific piece of DNA quickly in:
- A) Bioreactor  
B) Test tube  
C) Expression system  
D) Petridish
- Q.23** PCR is very specific, the targeted DNA sequence can be \_\_\_\_\_ of total DNA sample.
- A) One part in a million  
B) Less than one part in a million  
C) More than one part in a million  
D) Two parts in a million

**Q.24** PCR is considered a chain reaction because DNA polymerase will carry out replication over and over again, until there are:

- A) Thousand of copies of desired DNA
- B) Millions of copies of desired DNA
- C) Hundreds of copies of desired DNA
- D) Billions of copies of desired DNA

**Q.25** Before carrying out PCR:

- A) Gene product must be available
- B) Vector must be available
- C) Primers must be available
- D) Bacteriophage must be available

**Q.26** In PCR, primers are sequences of 20 bases that are complementary to the bases on either side of the:

- A) Target DNA
- B) DNA polymerase
- C) Primase
- D) RNA polymerase

**Q.27** DNA polymerase \_\_\_\_\_ the replication process.

- A) Continue
- B) Initiate
- C) Extend
- D) Continue and extend

**Q.28** DNA polymerase copies the target DNA, after the:

- A) Primers bind by complementary base pairing
- B) The target DNA duplex is unwound
- C) The target DNA get denatured
- D) The primers get separated from target DNA

**Q.29** *Thermus aquaticus* bacterium lives in:

- A) Hot springs
- B) Hot pools
- C) Hot thermal vents
- D) Hot ponds

**Q.30** By using Taq polymerase in PCR there will be no need to:

- A) Add more enzyme
- B) Interrupt the process to add more enzyme
- C) Interrupt the process
- D) Use high temperature

**Q.31** An animal developed from an egg, having foreign gene inserted in it is called:

- A) Transgenic animal
- B) Transgender animal
- C) Clone
- D) Trans sexual animal

**Q.32** It is possible to insert a foreign DNA into an animal egg by:

- A) Manual microinjection
- B) Vortex mixing
- C) Manual microinjection or vortex mixing
- D) Using electric current

**Q.33** The procedure of transgenic animals has been used to produce larger:

- A) Fishes and cows
- B) Rabbits and sheeps
- C) Cows and pigs
- D) Fishes, cows, pig, rabbits and sheep

**Q.34** Genetically engineered fishes are now being kept in ponds, that offer:

- A) No escape to the wild
- B) Mutualistic help to the wild
- C) Easy escape to the wild
- D) Symbiotic help to the wild

**Q.35** A goat is genetically engineered to produce \_\_\_\_\_, which is secreted in her milk.

- A) Prothrombin
- B) Antithrombin-III
- C) Heparin
- D) Fibrin

**Q.36** Genes that code for \_\_\_\_\_ proteins are incorporated into the animal's DNA and the protein appear in the animal's milk.

- A) Therapeutic
- B) Therapeutic and diagnostic
- C) Diagnostic
- D) Osmotic

**Q.37** There are plans to produce drugs by transgenic animals, for the treatment of:

- A) Cystic fibrosis
- B) Blood diseases
- C) Cancer
- D) Cystic fibrosis, Cancer & Blood diseases

**Q.38** The scientists of United States Department of Agriculture have been able to genetically engineer \_\_\_\_\_ to produce human growth hormone in their urine, instead of in milk.

- A) Cows
- B) Goats
- C) Mice
- D) Squirrels

**Q.39** Urine is preferable vehicle for a biotechnology product than milk because of following reasons, EXCEPT:

- A) Only female produce milk
- B) Females don't produce milk until maturity
- C) Each animal urinate throughout life
- D) It is less easier to extract proteins from urine than from milk

**Q.40** Although each cell contains a copy of all the genes of that genome, certain genes are:

- A) Amplified in mature specialized cells
- B) Turned off in mature specialized cells
- C) Lost in mature specialized cells
- D) Mutated in mature specialized cells

**Q.41** Insertion of genetic material into human cells for treatment of a disorder is called:

- A) Genetic engineering
- B) Gene therapy
- C) Biotechnology
- D) Gene mutation

**Q.42** Gene therapy includes procedures that give a patient healthy genes to make up for faulty genes to treat various human illnesses such as:

- A) Cancer
- B) Cardiovascular diseases
- C) Cancer and cardiovascular diseases
- D) Tetanus

**Q.43** There are two main methods used for gene therapy i.e.

- A) Ex – vivo and in vivo
- B) Ex vivo – Ex vitro
- C) Ex – vivo and in vitro
- D) In vitro – Ex vitro

**Q.44** The children suffering from SCIDS lack an enzyme called:

- A) Adenosine deaminase
- B) Homogentisic and hydroxylase
- C) Phylalanine hydroxylase
- D) Homogentisic and dehydrogenase

**Q.45** Both T and B cells get maturation by the involvement of gene called:

- A) Phenyl alanine hydroxylase
- B) ADA
- C) Homogentisic acid dehydrogenase
- D) Phospho hexokinase

**Q.46** Pick up the correct sequence:

- A) Mutation → Deficient ADA → Immature T and B cells → SCIDS
- B) SCIDS → Deficient ADA → Immature T and B cells → Mutation
- C) Mutation → Deficient ADA → SCIDS → Immature T and B cells
- D) Mutation → Immature B and T cells → Deficient ADA → SCIDS

- Q.47** For the treatment of SCIDS bone marrow stem cells are removed from the blood and are infected with a:
- A) Bacteriophage      C) Lambda virus  
B) Retrovirus          D) Bacterium
- Q.48** For treatment of SCIDS, the bone marrow stem cells are infected with a retrovirus that carries:
- A) A normal enzyme  
B) A mutant gene for the enzyme  
C) A normal gene for the enzyme  
D) A normal gene for T and B cells
- Q.49** Bone marrow stem cells are preferred for gene therapy of SCIDS, because:
- A) They are larger in size  
B) They are numerous in number  
C) They divide to produce more cells with same gene  
D) They store much enzyme inside them
- Q.50** The high levels of cholesterol make a patient subject to:
- A) Fatal heart attack at old age  
B) A curable heart attack at old age  
C) A curable heart attack at young age  
D) Fatal heart attack at young age
- Q.51** Liver cells are infected with retrovirus containing normal gene for the receptor for the treatment of:
- A) SCIDS  
B) Cystic fibrosis  
C) Hypercholesterolemia  
D) Cardio vascular disorder
- Q.52** If the patient die due to numerous infections of the respiratory tract, it means he/she suffered from:
- A) SCIDS  
B) Cystic fibrosis  
C) Hypercholesterolemia  
D) Parkinsonism

- Q.53** In vivo method of treatment is being tried in:
- A) SCIDS  
B) Cystic fibrosis  
C) Hypercholesterolemia  
D) Familial hypercholesterolemia
- Q.54** Microscopic vesicles that spontaneously form when lipoproteins are put into a solution, are called:
- A) Liposomes              C) Nucleosomes  
B) Lysosomes              D) Peroxisomes
- Q.55** In case of cystic fibrosis, the solution containing gene coated liposomes is sprayed into patients:
- A) Oral cavity              C) Thoracic cavity  
B) Nostrils                  D) Mouth
- Q.56** The in-vivo method of treatment of cystic fibrosis by gene coated liposomes, has not yet been successful due to:
- A) Non gene transfer  
B) Limited gene transfer  
C) Excessive gene transfer  
D) High cost
- Q.57** In clinical trials researchers have given genes to cancer patients, that make:
- A) Healthy cells more tolerant of chemotherapy  
B) Tumor more vulnerable to chemotherapy  
C) Healthy cells more tolerant and tumor more vulnerable to chemotherapy  
D) Healthy cells more vulnerable and tumor more tolerant to chemotherapy
- Q.58** To cure Parkinson's disease, dopamine producing cells, could be grafted directly into the brain as a:
- A) Gene therapy  
B) Transplant therapy  
C) Chemotherapy  
D) Gene therapy through transplant

**Q.59** The use of natural biological system to produce a product or to achieve an end desired by humans is called:

- A) Biotechnology
- B) Bioenergetics
- C) Genetic engineering
- D) Gene therapy

**Q.60** Nucleotides sequence that is identical to its complementary strand when each is read in the same chemical direction for example GATC i-e;

5' ... GATC ... 3'

3' ... CATG ... 5' these are called as:

- A) Flanking sequences
- B) Nucleotide order
- C) Palindromic sequences
- D) Antagonistic sequences

**Q.61** An enzyme that cleaves a DNA duplex molecule, at a particular base sequence, usually within or near a palindromic sequence, is called:

- A) Polymerase
- B) Helicase
- C) Restriction endonuclease
- D) Ligase

**Q.62** To clean up environmental pollutants, increase the fertility of the soil and kill insect pests, genetically engineered:

- A) Animals have been used
- B) Bacteria have been used
- C) Plants have been used
- D) Viruses have been used

**Q.63** A technique used for correcting defective genes responsible for disease development:

- A) Gene therapy
- B) Cloning
- C) Tissue culture
- D) Gene sequencing

**Q.64** Which one of the following technique rapidly replicates specific target fragment of DNA without cloning?

- A) DNA sequencing
- B) Genetic probe
- C) Gele electrophoresis
- D) Polymerase chain reaction



**ANSWER KEY (Worksheet-18)**

1	A	23	B	45	B
2	A	24	B	46	A
3	D	25	C	47	B
4	B	26	A	48	C
5	D	27	D	49	C
6	A	28	A	50	D
7	D	29	A	51	C
8	B	30	B	52	B
9	C	31	A	53	B
10	B	32	C	54	A
11	B	33	D	55	B
12	B	34	A	56	B
13	B	35	B	57	C
14	A	36	B	58	D
15	C	37	D	59	A
16	D	38	C	60	C
17	C	39	D	61	C
18	C	40	B	62	B
19	B	41	B	63	A
20	C	42	C	64	D
21	B	43	A		
22	B	44	A		

**EXPLANATION**

**Q.1** Answer is "Recombinant DNA is formed"

**Explanation:** Recombinant DNA (rDNA) molecules are DNA molecules formed by laboratory methods of genetic recombination (such as molecular cloning) to bring together genetic material from multiple sources, creating sequence that would not otherwise be found in the genome. Recombinant DNA is possible because DNA molecules from all organisms share the same chemical structure. However, a recombinant DNA formed by the fusion of DNAs taken from two organisms have remotest evolutionary relation is called chimeric DNA as well.

**Q.2** Answer is "cDNA"

**Explanation:** In genetics complimentary DNA (cDNA) is synthesized from a single

stranded RNA (e.g. mRNA) template in a reaction catalyzed by the enzyme reverse transcriptase.

**Q.3** Answer is "Reverse transcriptases"

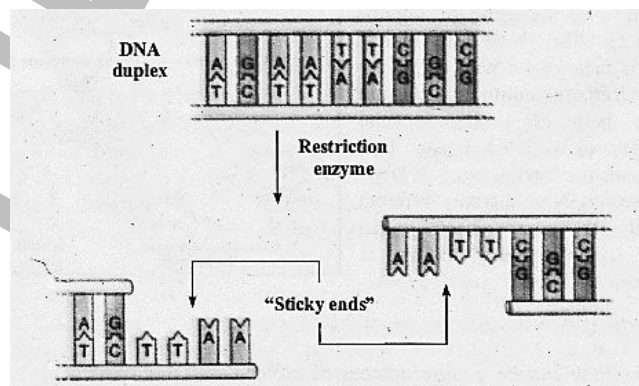
**Explanation:** Reverse transcriptases are used to synthesize cDNA from RNA (e.g. mRNA) template.

**Q.4** Answer is "Hamilton O smith"

**Explanation:** It is a historical fact.

**Q.5** Answer is "Four or six nucleotides"

**Explanation:** Restriction enzymes cut the DNA at very specific sites characterized by specific sequence of four or six nucleotides arranged symmetrically in reverse order. Such sequences are known as palindromic sequences.



**Q.6** Answer is "Symmetrically is reverse order"

**Explanation:** In palindromic sequences four or six nucleotides are arranged symmetrically in reverse order, as the cleavage occurs in zigzag sequence leaving upper longer strand and lower shorter strand on one end and upper shorter strand and lower longer strand in other end.

**Q.7** Answer is "Restriction endonucleases"

**Explanation:** So far 400 restriction endonucleases have been isolated out which about 20 are frequently used in recombinant DNA technology.

**Q.8** Answer is “They can bind by complementary base pairing”

**Explanation:** Due to base pairing affinity sticky ends can stick together, whenever brought closer to each other.

**Q.9** Answer is “Vector”

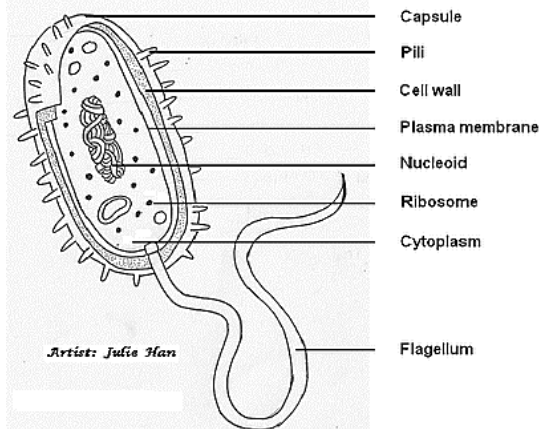
**Explanation:** To make recombinant DNA, one often begins by selecting a vector, the means by which recombinant DNA is introduced into a host cell. One common type of vector is a plasmid. Plasmids were discovered by investigators studying the sex life of the intestinal bacterium *Escherichia coli*.

**Q.10** Answer is “Intestinal”

**Explanation:** Plasmids were discovered by investigators studying the sex life of the intestinal bacterium *Escherichia coli*.

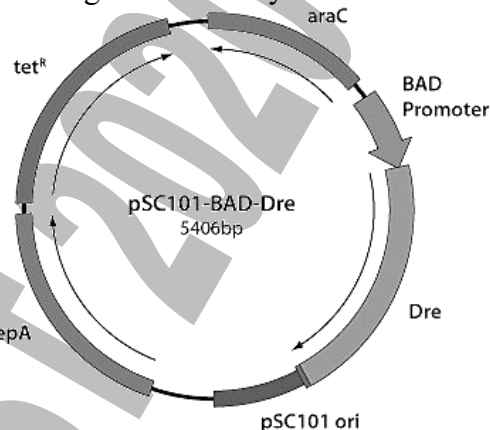
**Q.11** Answer is “Plasmids”

**Explanation:** Plasmids were discovered by investigators studying the sex life of the intestinal bacterium *Escherichia coli*.



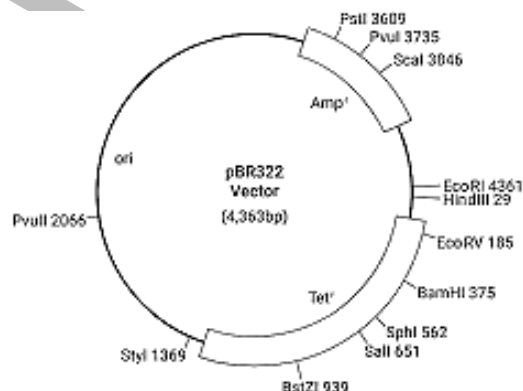
**Q.12** Answer is “pSC 101”

**Explanation:** pSC 101 has antibiotic resistant gene for tetracycline.



**Q.13** Answer is “pBR322”

**Explanation:** pBR 322 has antibiotic resistant genes for tetracycline as well as ampicillin.



**Q.14** Answer is “Isolation of gene of interest”

**Explanation:** Because restriction enzymes cut the DNA at specific sites.

**Q.15** Answer is “DNA ligase”

**Explanation:** Because it is DNA binding enzyme.

**Q.16** Answer is “Molecule, Cell and Organism”

**Explanation:** Cloning can be carried out at these three levels i.e. cell, organism and molecule (gene cloning) level.

**Q.17** Answer is “Recombinant plasmid”

**Explanation:** Aqueous calcium chloride is used in genetic transformation of cells by increasing the cell membrane permeability, inducing competence for DNA uptake (allowing DNA fragments to enter the cell more readily).

**Q.18 Answer is “DNA of bacterial viruses”**

**Explanation:** DNA of bacteriophage or phage virus or bacterial virus is also used as vector.

**Q.19 Answer is “Cooling for two minutes and adding primer”**

**Explanation:** First the DNA to be cloned is heated for one minute to break the duplex and separate the both strands.

Then it is cooled down for 2 minutes and primer is added

**Q.20 Answer is “Addition of DNA polymerase and waiting for 1.5 minutes”**

**Explanation:** In third step of PCR DNA polymerase is added and then we wait for 1.5 minutes.

**Q.21 Answer is “Millions of copies of a single gene”**

**Explanation:** As it is less time taking and more efficient method in which a chain reaction is generated.

**Q.22 Answer is “Test tube”**

**Explanation:** PCR is carried out in a laboratory test tube.

**Q.23 Answer is “Less than one part in a million”**

**Explanation:** Because it is carried out in a test tube without interruption.

**Q.24 Answer is “Millions of copies of desired DNA”**

**Explanation:** PCR can create millions of copies of a single gene or any specific piece of DNA quickly in test tube.

**Q.25 Answer is “Primers must be available”**

**Explanation:** As DNA polymerase cannot initiate a polynucleotide chain, rather it can elongate a polynucleotide chain.

**Q.26 Answer is “Target DNA”**

**Explanation:** Target DNA is a DNA to be cloned.

**Q.27 Answer is “Continue and extend the replication process”**

**Explanation:** It starts a chain reaction and keep on carrying out replication until test tube is filled.

**Q.28 Answer is “Primer binds by complementary base pairing”**

**Explanation:** In PCR both strands of DNA act as template for new strands to be synthesized.

**Q.29 Answer is “Hot springs”**

**Explanation:** As these are thermal bacteria, they are adapted to survive in high temperature.

**Q.30 Answer is “Interrupt the process to add more enzyme”**

**Explanation:** A high temperature is maintained to discourage duplex formation and chain reaction proceeds in which same enzyme is used again and again.

**Q.31 Answer is “Transgenic animal”**

**Explanation:** An animal in which we have incorporated a desired foreign gene to get produced our desired product is called transgenic animal.

**Q.32 Answer is “Manual microinjection and vertex mixing”**

**Explanation:** These are two available methods to insert a desired gene into an animal egg.

**Q.33** Answer is “Fishes, Cows, Pigs, Rabbits and sheeps”

*Explanation:* It is possible by tempering their genetic makeup.

**Q.34** Answer is “No escape to the wild”

*Explanation:* Due to their massive size and more vigour the wild flora fall easy prey to them.

**Q.35** Answer is “Antithrombin-III”

*Explanation:* It is an anti-clotting factor used in microsurguries to discourage formation of clot at site of surgery.

**Q.36** Answer is “Therapeutic and diagnostic proteins”

*Explanation:* Some proteins are used for treatment of diseases. They are called therapeutic proteins and diagnostic proteins as they are used to diagnose and treat diseases. Both are being produced as biotechnology products.

**Q.37** Answer is “Cystic Fibrosis, Cancer and blood diseases”

*Explanation:* In future it is being envisioned to get drugs prepared by transgenic animals against cystic fibrosis, cancer and blood diseases.

**Q.38** Answer is “Mice”

*Explanation:* The scientists of United States Department of Agriculture have been able to genetically engineer mice to produce human growth hormone in their urine, instead of in milk.

**Q.39** Answer is “It is less easier to extract proteins from urine than from milk”

*Explanation:* As urine normally does not contain any protein thus it is easier to extract proteins from urine than from milk.

**Q.40** Answer is “Turned off in mature specialized cells”

*Explanation:* When a cell is assigned a specialized job, only those genes remain active which are associated with that particular job, rest are turned off, however, they can be switched on again if needed.

**Q.41** Answer is “Gene therapy”

*Explanation:* Treating some genetic disorder by replacing a faulty gene with normal gene is called gene therapy.

**Q.42** Answer is “Cancer and cardiovascular diseases”

*Explanation:* Gene therapy is effective against disorders of genetic origin. Tetanus is not a genetic disease, it is infectious disease.

**Q.43** Answer is “Ex-vivo and In-vivo”

*Explanation:* In ex-vivo method cells or tissues are taken out of the body and after insersion of normal genes they are implanted in the body. However in in-vivo method genes/gene is/are inserted into the cells or at their original site in the body

**Q.44** Answer is “Adenosine deaminase”

*Explanation:* Such children lack an enzyme adenosine deaminase (ADA) that is involved in the maturation of T and B cells and therefore, they are subjected to life threatening infections.

**Q.45** Answer is “ADA”

*Explanation:* ADA (adenosine deaminase) is involved in the maturation of T and B cells and therefore, the person lacking it are subjected to life threatening infection.

**Q.46** Answer is “Mutation – Deficient ADA – immature Tand B cells → SCIDS”

*Explanation:* When that gene which is responsible for the formation of ADA



mutates, no ADA will be formed and as a result T and B cells will remain unable to acquire maturity and as a consequence severe immune deficiency will occur.

**Q.47 Answer is “Retrovirus”**

**Explanation:** The retrovirus acts as a vector for gene therapy.

**Q.48 Answer is “A normal gene for the enzyme”**

**Explanation:** Retrovirus acts a vector and carrier a normal gene for the synthesis of ADA enzyme with its DNA (recombinant DNA).

**Q.49 Answer is “They divide to produce more cells with same gene”**

**Explanation:** Stem cells keep on dividing by mitosis and in this way the number is continuously added up which gradually overcome the immune deficiency.

**Q.50 Answer is “Fatal heart attack at young man”**

**Explanation:** Otherwise at young age the tendency of heart attack is much lesser.

**Q.51 Answer is “Hypercholesterolemia”**

**Explanation:** In familial hypercholesterolemia liver cells lack specific receptor sites needed to remove cholesterol from blood.

**Q.52 Answer is “Cystic fibrosis”**

**Explanation:** Cystic fibrosis patients lack a gene that codes for trans-membrane carrier of chloride ions.

**Q.53 Answer is “Cystic fibrosis”**

**Explanation:** The gene is introduced into the nasal sinus by coating it on liposomes which are sprayed just like inhalers in the nasal sinuses.

**Q.54 Answer is “Liposomes”**

**Explanation:** Liposomes are spherical vesicles of phospholipid bilayer which are used as a vehicle for administration of nutrients and pharmaceutical drugs and for insertion of desired genes into cells or tissues.

**Q.55 Answer is “Nostrils”**

**Explanation:** For treatment of cystic fibrosis a solution containing gene coated liposomes is sprayed into patient's nostrils.

**Q.56 Answer is “Limited gene transfer”**

**Explanation:** Due to limited gene transfer, this methodology has not yet been successful.

**Q.57 Answer is “Healthy cells more tolerant and tumor more vulnerable to chemotherapy”**

**Explanation:** It will help a lot in cancer treatment.

**Q.58 Answer is “Gene therapy through transplant”**

**Explanation:** Parkinson's disease is caused by deficiency of dopamine, a neurotransmitter of brain. When its deficiency is made up it is cured.

**Q.59 Answer is “Biotechnology”**

**Explanation:** The definition have been given in glossary at page II of textbook of biology part-II.

**Q.60 Answer is “Palindromic sequences”**

**Explanation:** The definition and example have been given in glossary at page VIII of textbook of biology part-II.

**Q.61 Answer is “Restriction endonuclease”**

**Explanation:** The definition have been given in glossary at page IX of textbook of biology part-II.



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# CHEMISTRY



WORKSHEETS 1-18



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**Q.9** In geometric isomerism, the cis-isomers have all of the following properties EXCEPT:

- A) They are polar molecules
- B) They have high boiling points
- C) They are symmetrical molecules
- D) They have low melting points

**Q.10** Which of the following organic compounds does not show geometric isomerism?

- A) 2-Butene
- B) 3-Hexene
- C) 2-Pentene
- D) 1-Butene

**Q.11** Which of the following is/are basic conditions for geometric isomerism?

- A) Having Carbon Carbon double bond ( $C = C$ )
- B) Different groups are attached with carbon containing double bond
- C) Double bond involves free rotation
- D) Both A and B

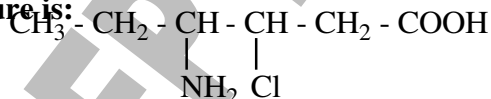
**Q.12** Which of the following is the most stable free radical?

- A)  $\begin{array}{c} R \\ | \\ R - C^{\bullet} \\ | \\ R \end{array}$
- B)  $R - C^{\bullet}H_2$
- C)  $\begin{array}{c} R \\ | \\ R - C^{\bullet}H \\ | \\ R \end{array}$
- D)  $C^{\bullet}H_3$

**Q.13** Which of the following is the least stable carbocation?

- A)  $Me_3C^+$
- B)  $CH_3^+$
- C)  $Me_2CH^+$
- D)  $MeCH_2^+$

**Q.14** The correct name according to IUPAC of the given structure is:



- A) 4-Amino-3-chlorohexanoic acid
- B) 3-Amino-4-chlorohexanoic acid
- C) 4-Amino-5-chlorohexanoic acid
- D) 2-Amino-3-chlorohexanoic acid

**Q.15** Which of the following type of cracking (pyrolysis) is used

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to increase production of petrol?

- A) Thermal cracking      C) Electrolytic cracking  
B) Catalytic cracking      D) Steam cracking

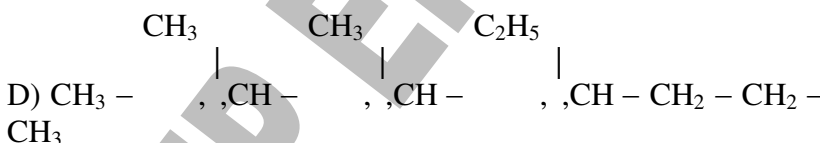
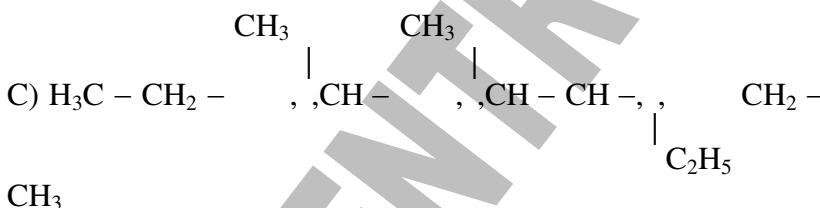
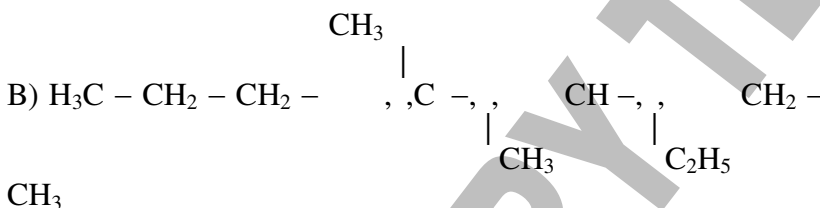
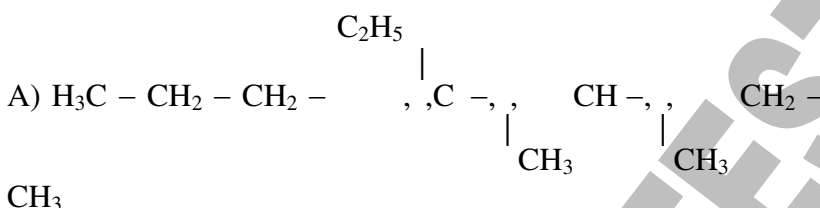
**Q.16** Consider the following condensed formula of alkane:



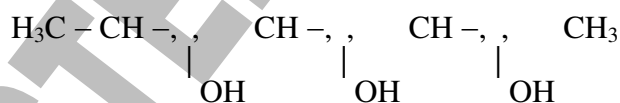
Correct name of above formula according to IUPAC is:

- A) 2,3,4-Trimethylpentane      C) 2,4,4-Trimethylpentane  
B) 2,6,6-Trimethylpentane      D) 2,2,4-Trimethylpentane

**Q.17** The structural formula of the following given compound 4-Ethyl-3,4-dimethylheptane is:



**Q.18** Consider the following structural formula of alcohol:



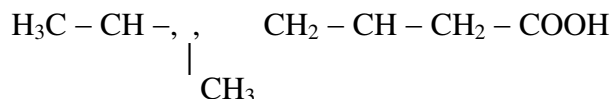
The correct name of above formula according to IUPAC is:

- A) 1,2,3-Pentanetriol      C) Pentane-2,3,4-triol  
B) 1,2,3-Propanetriol      D) Propylene-1,2,3-triol

SCRATCH WORK

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SCRATCH WORK

- Q.19** Consider the following structural formula of a carboxylic acid:



The correct name according to IUPAC is:

- A) 5-Methylhexanoic acid    C) 2-Methyl-5-hexanoic acid  
B) 2-Methylhexanoic acid    D) 5-Methylvaleric acid
- Q.20** The correct name according to IUPAC of the following alkene is:



- A) 1,3-Pentadiene    C) 2,3-Pentadiene  
B) 2,4-Pentadiene    D) 1,4-Pentadiene
- Q.21** An atom or a group of atoms or a double bond or triple bond whose presence imparts specific properties to organic compounds is called a functional group, because they are the chemically functional parts of molecules. Which of the following is functional group of carboxylic acid?
- A) -COOH    C) -CONH<sub>2</sub>  
B) -OH    D) -CHO
- Q.22** Which of the following is functional group of thioalcohol?
- A) Cyano group    C) Mercapto group  
B) Formyl group    D) Amino group
- Q.23** The type of isomerism which arises due to shifting of proton from one atom to other in the same molecule is called:
- A) Tautomerism    C) Geometric isomerism  
B) Metamerism    D) Chain isomerism
- Q.24** Which of the following class of organic compounds contains ring which has more than one kind of atoms?
- A) Aromatic    C) Non-benzenoid  
B) Heterocyclic    D) Aliphatic
- Q.25** The type of structural isomerism which arises due to the unequal distribution of carbon atoms on either side of the functional group is called:
- A) Chain isomerism    C) Tautomerism  
B) Metamerism    D) Position isomerism

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**Q.26** Which of the following pair of organic compounds shows position isomerism?

- A)  $\text{CH}_3\text{-CH}_2\text{-CHO}$  and  $\text{CH}_3\text{-CO-CH}_3$
- B)  $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-OH}$  and  $\text{CH}_3\text{-CH(OH)CH}_3$
- C)  $\text{C}_2\text{H}_5\text{-O-C}_2\text{H}_5$  and  $\text{CH}_3\text{-O-C}_3\text{H}_7$
- D)  $\text{CH}_3\text{-COOH}$  and  $\text{HCOOCH}_3$

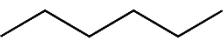
**Q.27** There are two types of isomerism i.e. structural isomerism and stereoisomerism. The two main types of stereoisomerism are: Diastereomerism (including 'cis-trans isomerism' and Optical Isomerism). Each non-superimposable mirror image structure is called a/an:

- A) Metamer
- B) Elastomer
- C) Enantiomer
- D) Tautomer

**Q.28** Which of the following is skeletal formula of hexane?

A)  $\text{C}_6\text{H}_{14}$

B)  $\text{H}_3\text{C} - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$

C) 

D)  $\begin{array}{ccccccc} & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} \\ & | & | & | & | & | & | \\ \text{H} & - \text{C} & - \text{C} & - \text{C} & - \text{C} & - \text{C} & - \text{H} \\ & | & | & | & | & | & | \\ & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} \end{array}$

**Q.29** Which of the following is structural formula of pentane?

A)  $\begin{array}{ccccccc} & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} \\ & | & | & | & | & | \\ \text{H} & - \text{C} & - \text{C} & - \text{C} & - \text{C} & - \text{C} & - \text{H} \\ & | & | & | & | & | \\ & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} \end{array}$

B)  $\text{H}_3\text{C} - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$

C)  $\text{H}_3\text{C}(\text{CH}_2)_3\text{CH}_3$

D) 

**Q.30** A reaction which results in the removal of a small molecule from a large one is called?

- A) Addition reaction
- B) Elimination reaction
- C) Substitution reaction
- D) Oxidation reaction

**Q.31** Which of the following terms is not used for organic compound?

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- A) Molecular formula      C) Skeletal formula  
B) Structural formula      D) Ionic formula

**Q.32 Mark the incorrect statement about petrol (gasoline):**

- A) Greater is octane number better is the quality of petrol  
B) Quality of petrol is increased by reforming  
C) Production of petrol is increased by cracking  
D) If octane number of petrol is 60 it is considered good quality of petrol

**Q.33 Which of the following is/are types of organic reactions mechanisms?**

- A) Polar or ionic mechanism only  
B) Free radical mechanism only  
C) Both A and B  
D) Neither A nor B

STEP ENTRY TEST 2020

## ANSWER KEY (Worksheet-1)

1	B	11	D	21	A	31	D
2	D	12	A	22	C	32	D
3	C	13	B	23	A	33	C
4	D	14	A	24	B		
5	B	15	B	25	B		
6	A	16	D	26	B		
7	B	17	A	27	C		
8	C	18	C	28	C		
9	C	19	A	29	B		
10	D	20	A	30	B		

## ANSWERS EXPLAINED

Q.1 (B) Vinyl alcohol ( $\text{CH}_2=\text{CH}-\text{OH}$ ) is not an aromatic compounds while others A, C and D are aromatic compounds.

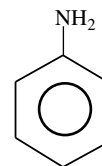
- The term aromatic was derived from Greek word “aroma” meaning fragrant and was used in organic chemistry for a special class of compounds.
- These compounds have a low hydrogen to carbon ratio in their molecular formula and have a characteristics odour.
- However, it was soon realized that many aromatic compounds are odourless where as many others are fragrant though they are not aromatic.
- Further, when aromatic compounds of higher molecular mass were subjected to various methods of degradation, they often produced benzene or derivatives of benzene.
- It was observed that almost all the aromatic compounds have a six carbon unit in their molecules like benzene.

- Hence, benzene was recognized as the simplest and the parent member of this class of compounds.
- Aromatic compounds, also known as arenes or aromatics, are chemical compounds that contain conjugated planar ring systems with delocalized pi electron clouds instead of discrete alternating single and double bonds. Typical aromatic compounds are benzene and toluene. They should satisfy Hückel's rule ( $4n + 2$ ).

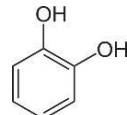
Q.2 (D) Organic compounds are in the form of gases, liquids and solids. They are volatile and highly inflammable

Q.3 (C) Carbon tetrachloride ( $\text{CCl}_4$ ) has polar carbon-chlorine bonds but the molecule is non-polar because their bond moments cancel the effect of each other. That is why its  $\mu=0$  and molecule is non-polar. But others A, B and D are polar molecules.

Q.4 (D) Aniline is not heterocyclic compound. It is aromatic compound and its structural formula is:



Q.5 (B) Catechol



also known as pyrocatechol or 1,2-dihydroxybenzene, is an organic

compound with the molecular formula  $C_6H_4(OH)_2$ .

**Q.6 (A)** Tertiary carbocation ( $R_3C^+$ ) bears positive charge and it acts as electrophile while all others B, C and D are nucleophiles.

**Q.7 (B)**  $BF_3$  is a electrophile because central atom boron is deficient one electron pair while all others A, C and D are nucleophiles.

**Q.8 (C)** In alkene there is Carbon Carbon double bond ( $C = C$ ).

- A pi-bond is weak bond as compared to a sigma-bond.
- During a reaction pi-bond breaks comparatively easily rendering alkenes as reactive group of compounds.
- Moreover, the loosely held pi electrons are more exposed to attack by the electrophilic reagents. Alkenes act as a nucleophilic reagent and they give electrophilic addition reactions. Both the above mentioned facts make the alkenes a very reactive class of compounds. The general order of reactivity is shown below:

Alkenes > Alkynes > Benzene > Alkanes

**Q.9 (C)** Since cis-form of geometric isomerism is unsymmetrical molecule so it has certain dipole moment value. It has high boiling point and low melting point.

**Q.10 (D)** 1-Butene does not fulfill the conditions of geometric isomerism. Though it has carbon carbon double bond ( $C = C$ ) but different groups are not attached with carbon containing

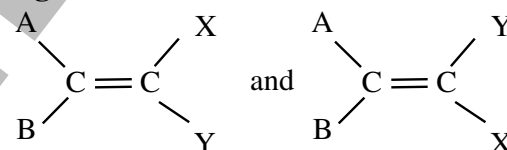
double bond, as shown in the structure  $CH_2 = CH - CH_2 - CH_3$ .

**Q.11 (D)** Basic conditions for geometric isomerism are such as:

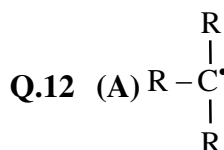
- Having Carbon Carbon double bond
- Different groups are attached with carbon containing double bond

Memorize: The presence of a double bond is not the only condition for geometrical isomerism. Each double bonded carbon atom must have two different groups attached to it.

e.g.

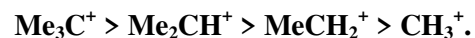


are geometrical isomers only if  $A \neq B$  and  $X \neq Y$ . A can be the same as X and Y, and B can be the same as X or Y.

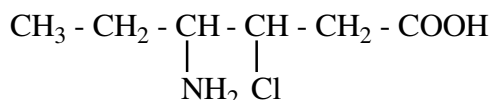


is the most stable free radical while others B, C, and D are not.

**Q.13 (B)**  $CH_3^+$  (methyl carbocation) is the least stable because of less number of alkyl groups (i.e. electron donating) are attached with it. Order of stability of carbocations is



**Q.14 (A)** The correct name according to IUPAC of the given compound is 4-Amino-3-chlorohexanoic acid.

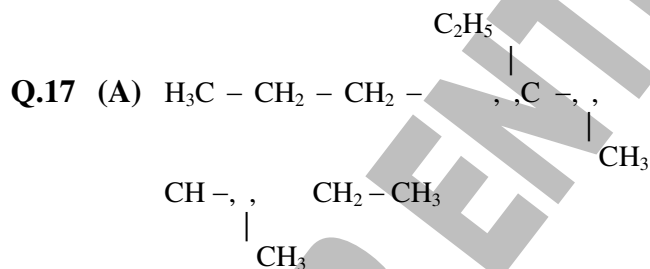
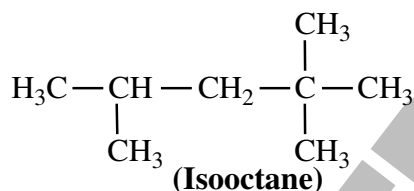


**Q.15 (B)** Catalytic cracking is used to increase production of gasoline of higher octane number and, therefore, this method is used for better quality of gasoline. Whereas thermal cracking and steam cracking are used to produce lower unsaturated hydrocarbons (e.g. ethene and propene).

**Q.16 (D)** 2,2,4-Trimethylpentane is the correct name according to IUPAC of given condensed formula

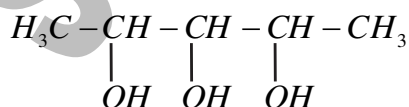


- Its structural formula is:

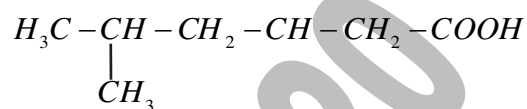


is the structural formula of 4-Ethyl-3,4-dimethylheptane.

**Q.18 (C)** Pentane-2,3,4-triol is the correct name according to IUPAC of given structural formula



**Q.19 (A)** 5-Methylhexanoic acid is the correct name according to IUPAC of given structural formula



**Q.20 (A)** 1,3-Pentadiene is the correct name according to IUPAC of given structural formula



**Q.21 (A)**  $-\text{COOH}$  is a functional group of carboxylic acid.

**Q.22 (C)** Mercapto ( $\text{SH} -$ ) is a functional group of thioalcohol.

**Q.23 (A)** The type of isomerism which arises due to shifting of proton from one atom to other in the same molecule is called tautomerism.

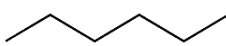
**Q.24 (B)** The compounds in which the ring consists of atoms of more than one kind are called heterocyclic compound or heterocycles. In heterocyclic compounds generally one or more atoms of elements such as N, O or S which are known as hetero atoms. e.g. Pyridine, Furan, Pyrrole and Thiophene are heterocyclic compounds.

**Q.25 (B)** The type of structural isomerism which arises due to the unequal distribution of carbon atoms on either side of the functional group is called metamerism.

**Q.26 (B)**  $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-OH}$  (1-propanol) and  $\text{CH}_3\text{-CH(OH)CH}_3$  (2-propanol) show position isomerism.



**Q.27 (C)** Optical isomers are two compounds which contain the same number and kinds of atoms, and bonds (i.e., the connectivity between atoms is the same), and different spatial arrangements of the atoms, but which have non-superimposable mirror images. Each non-superimposable mirror image structure is called an enantiomer. All  $\alpha$ -amino acids show optical isomerism except glycine.

**Q.28 (C)** 

is the skeletal formula of hexane.

**Q.29 (B)**  $\text{H}_3\text{C} - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$  is the structural formula of pentane.

**Q.30 (B)** Those reactions which involve the removal of atoms or groups of atoms from adjacent carbon atoms to form a multiple bond are called elimination reaction.

**Q.31 (D)** Ionic formula does not represent organic molecule.

**Q.32 (D)** The concept of octane number was introduced by Edgar.

- According to him n-heptane is the worst fuel and its octane number is zero and Isooctane is the best fuel its octane number is 100.
- The octane number of any fuel is the percentage by volume of isooctane in a mixture of isooctane and n-heptane.

- e.g. a petrol that burns like 90 : 10 mixture of isooctane and n-heptane is said to have an octane number of 90.
- Memorise: Good petrols have high octane number.
- The octane number of a petrol can be improved:
  - By increasing the proportion of branched chain and cyclic alkanes
  - By addition of aromatic hydrocarbons such as benzene
  - By addition of methanol or ethanol
  - By addition of tetraethyllead  $(\text{C}_2\text{H}_5)_4\text{Pb}$
- Most modern cars run on petrol with an octane number of 95 – 99
- The petrol obtained from the gasoline fraction has an octane number of only about 55 – 60.
- It needs considerable modification blending before it can be used as a motor fuel.

**Q.33 (C) 1) Polar or ionic mechanism:**

(i) The mechanism of reactions involving the attack of electrophilic or nucleophile reagents on the polar substrate molecule is referred to as polar or ionic mechanism.

e.g.



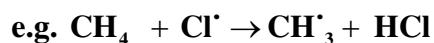
Polar substrate      nucleophile

(ii) This type of mechanism is applicable to organic reactions in which heterolytic bonds fission takes place.

(iii) In this case the substrate molecule develops polarity (positive or negative centers).

2) **Free radical mechanism:**

(i) The mechanism of reactions involving the attack of free radicals on the substrate molecule is referred to as a free radical mechanism.



<b>Substrate</b>	<b>Free radical</b>
------------------	---------------------

(ii) This type of mechanism applies to organic reactions in which homolytic bond fission takes place.

(iii) The first step is the formation of free radical ( $\text{R}^\bullet$ ) from a reagent by a homolytic fission. These free radicals can then attack the substrate to give the product.



**Worksheet-2**  
**(C. Organic Chemistry)**  
**Hydrocarbons**

**Q.1** The reaction of chlorine with methane is carried out in the presence of diffused sunlight. What is function of the light?

- A) To break up the C - H bonds in methane
- B) To break up the chlorine molecules into free radicals
- C) To heat up the mixture
- D) To break up the chlorine molecules into ions

**Q.2** Methane when burnt in the presence of metallic catalyst (Cu), at high temperature (400°C) and pressure (200atm), which of the following is the ultimate product?

- A) Methanol
- B) Ethanal
- C) Methanal
- D) Methanoic acid

**Q.3** Chlorination of methane is believed to proceed through free radical mechanism. Which of the following is propagation step?

- A)  $\text{Cl}-\text{Cl} \xrightarrow{h\nu} 2\text{Cl}^\cdot$
- B)  $\text{CH}_3^\cdot + \text{Cl}_2 \longrightarrow \text{Cl}^\cdot + \text{CH}_3-\text{Cl}$
- C)  $\text{CH}_3 + \text{HCl} \longrightarrow \text{H}^\cdot + \text{H}_3\text{C}-\text{Cl}$
- D)  $\text{H}_3\text{C}^\cdot + \text{C}^\cdot\text{H}_3 \longrightarrow \text{H}_3\text{C}-\text{CH}_3$

**Q.4** Nitrobenzene maybe prepared by reacting benzene with a mixture of conc.  $\text{H}_2\text{SO}_4$  and conc.  $\text{HNO}_3$  at 55°C. Which of the following best explains the role of conc.  $\text{H}_2\text{SO}_4$ ?

- A) It removes water
- B) It forms an unstable complex with benzene
- C) It is protonating nitric acid
- D) It acts as a solvent

**Q.5** Benzene reacts with acetyl chloride in the presence of catalyst  $\text{AlCl}_3$  to give:

- A) Aldehyde
- C) Benzyl Chloride

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- B) Acetophenone                      D) Benzophenone
- Q.6  $\beta$ -elimination is competitive to nucleophilic substitution reaction. It has all of the following conditions for reaction as compared to nucleophilic substitution reaction EXCEPT:**
- A) It takes place in the presence of less polar solvent (like alcohol)  
B) It takes place at high temperature  
C) It requires strong nucleophile (base)  
D) It takes place at low temperature
- Q.7 All of the following are dehydrating agents EXCEPTS:**
- A)  $\text{SiO}_2$                                       C)  $\text{Al}_2\text{O}_3$   
B) Conc.  $\text{H}_2\text{SO}_4$                       D)  $\text{H}_3\text{PO}_4$
- Q.8 Which of the following is correct order of ease of dehydration of alcohols?**
- A)  $1^\circ$  alcohol  $>$   $2^\circ$  alcohol  $>$   $3^\circ$  alcohol  
B)  $3^\circ$  alcohol  $>$   $2^\circ$  alcohol  $>$   $1^\circ$  alcohol  
C)  $2^\circ$  alcohol  $>$   $1^\circ$  alcohol  $>$   $3^\circ$  alcohol  
D)  $3^\circ$  alcohol  $>$   $1^\circ$  alcohol  $>$   $2^\circ$  alcohol
- Q.9 Which of the following tests is not used to distinguish between alkanes and alkenes?**
- A) Baeyer's test                              C)  $\text{Cl}_2(\text{CCl}_4)$   
B)  $\text{Br}_2(\text{CCl}_4)$                               D) Tollen's test
- Q.10 A hydrocarbon, which is a liquid at room temperature, decolourizes aqueous bromine. Which could be the molecular formula of the compound?**
- A)  $\text{C}_2\text{H}_2$                                       C)  $\text{C}_7\text{H}_{16}$   
B)  $\text{C}_2\text{H}_4$                                       D)  $\text{C}_{10}\text{H}_{20}$
- Q.11 Which of the following alkenes does not follow Markownikov's rule?**
- A) 1-Pentene                                      C) 1-Hexene  
B) 1-Butene                                      D) 2-Butene
- Q.12 Aromatic compounds burn with sooty flame because:**
- A) They have high percentage of hydrogen  
B) They have a ring structure  
C) They have high percentage of carbon

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D) They resist in reaction with air

**Q.13 Alkanes are used as fuels. We burn them for many reasons. Which of the following is not its use?**

- A) They are used to generate electricity in power stations
- B) They are used to heat our homes and cook our food
- C) They are used to provide electricity for electrolytic cell
- D) They are used to provide electricity for galvanic cell

**Q.14 Consider the following reaction:**



**The mechanism of reaction is:**

- A) Nucleophilic addition reactions
- B) Electrophilic addition reaction
- C) Free radical substitution
- D) Nucleophilic substitution reaction

**Q.15 Which property of benzene may be directly attributed to the stability associated with its delocalized pi-electrons?**

- A) It has a low boiling point
- B) Its enthalpy change formation ( $\Delta H_f$ ) is positive
- C) It is susceptible to attack by nucleophilic reagent
- D) It tends to undergo electrophilic substitution rather addition reaction

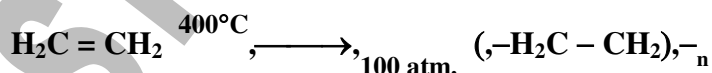
**Q.16 Among the followings the compound that can be most readily nitrated is:**

- A) Benzoic acid
- B) Benzene
- C) Phenol
- D) Chlorobenzene

**Q.17 When toluene is treated with chlorine in the presence of sunlight, which of the following is ultimate product?**

- A) Benzyl chloride
- B) Benzotrichloride
- C) Benzoyl chloride
- D) Benzal dichloride

**Q.18 The most important addition reaction of alkenes forms the basis of the plastic industry. Addition polymerization is such process in which smaller molecules (monomers) repeatedly combine to form large molecular having greater molar mass (polymer) as shown:**



Traces of  $\text{O}_2$  (0.1%)  $n = 1000$

**A good quality polythene is obtained when ethene is polymerized in the presence of:**

- A) Aluminium triethyl ( $\text{C}_2\text{H}_5$ )<sub>3</sub> only

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- B) Titanium tetrachloride ( $\text{TiCl}_4$ ) only  
C)  $\text{TiCl}_4 + \text{AlCl}_3$   
D)  $\text{TiCl}_4 + \text{Al}(\text{C}_2\text{H}_5)_3$

**Q.19 Benzene cannot undergo:**

- A) Substitution reaction      C) Addition reaction  
B) Elimination reaction      D) Oxidation reaction

**Q.20 All of the following statements are correct EXCEPT:**

- A) Introduction of R-group in the benzene ring in the presence of  $\text{AlCl}_3$  is called alkylation  
B) Introduction of acyl group in the benzene ring in the presence of  $\text{AlCl}_3$  is called acylation  
C) Benzene cannot undergo polymerization  
D) Ozonolysis of benzene results in the formation of  $(\text{COOH})_2$

**Q.21 o- and p- directing groups have all of the following properties EXCEPT:**

- A) They are electron-donating groups  
B) They increase reactivity of mono-substituted benzene ring  
C) They have all lone pair at the central atom of molecules except alkyl group  
D) Halogeno-substituted benzene is more reactive than benzene

**Q.22 All of the following methods explain stability of benzene EXCEPT:**

- A) Resonance energy  
B) Resonance method  
C) Crystal field theory  
D) Atomic orbital treatment

**Q.23 When different alkenes are treated with hot concentrated  $\text{KMnO}_4$  solution, different products are obtained. Which of the following alkenes produces two moles of ketone?**

- A)  $\text{H}_2\text{C} = \text{CH}_2$       C)  $\text{R}^1\text{R}^2\text{C} = \text{CR}^3\text{R}^4$   
B)  $\text{R} - \text{CH} = \text{CH} - \text{R}$       D)  $\text{R}^1\text{R}^2\text{C} = \text{CH}^3\text{R}^4$

**Q.24 On the oxidation of toluene by acidified  $\text{KMnO}_4$ , which of the following products is obtained?**

- A)       C)   
B)       D) 

SCRATCH WORK

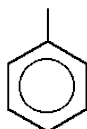
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B)

D)



**Q.25** Which of the following methods is used to prepare ethyne on the industrial scale by?

- A) Dehydrohalogenation of vic-dihalides
- B) Dehalogenation of tetrahalides
- C) Electrolysis of aqueous solution of potassium salt of unsaturated dicarboxylic acids
- D) Reaction of calcium carbide with water

**Q.26** Kolbe's electrolytic method is used to prepare ethyne. Which of the following salts of carboxylic acid is used for this purpose?

- A) Sodium acetate
- B) Sodium succinate
- C) Sodium oxalate
- D) Potassium maleate

**Q.27** On oxidation of ethyne with strong alkaline  $\text{KMnO}_4$  solution, the final product formed is:

- A) Glyoxal
- B) Glycol
- C) Acetic acid
- D) Oxalic acid

**Q.28** Acetaldehyde is prepared by the reaction of ethyne with water in the presence of  $\text{HgSO}_4 / \text{H}_2\text{SO}_4$  at  $75^\circ\text{C}$ . Number of steps involved in this reaction is:

- A) 1
- B) 4
- C) 2
- D) 3

**Q.29** When ethyne is treated with ammonical  $\text{Cu}_2\text{Cl}_2$  solution, then ppt of dicopper acetylide are formed. The colour of ppt is?

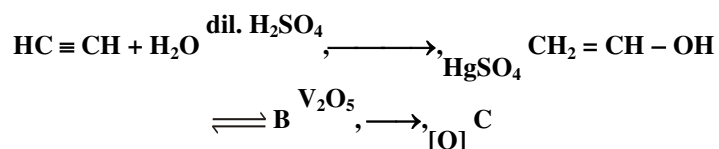
- A) White
- B) Reddish brown
- C) Yellow
- D) Violet

**Q.30** When acetylene is passed under pressure over an organo-nickel catalyst at  $70^\circ\text{C}$  \_\_\_\_\_ is formed?

- A) Vinyl acetylene
- B) Di-vinyl acetylene
- C) Neoprene
- D) Benzene

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Q.31 Consider the following reaction



Which of the following is correct sequence for the product shown as B, C?

- A)  $\text{CH}_3\text{CHO}$ ,  $\text{CH}_3\text{COOH}$
- B)  $\text{CH}_3\text{COCH}_3$ ,  $\text{CH}_3\text{COOH}$
- C)  $\text{CH}_3\text{CH}_2\text{OH}$ ,  $\text{CH}_3\text{CHO}$
- D)  $\text{CH}_3\text{CHO}$ ,  $\text{CH}_3\text{CH}_2\text{OH}$

Q.32 According to atomic orbital treatment of benzene, all of the following statements are correct about benzene EXCEPT:

- A) In it each carbon atom has  $\text{sp}^2$ -orbital hybridization
- B) It is cyclic hexagonal planar structure
- C) It has diffused or delocalized electron cloud
- D) It has 10 sigma bonds and 6 pi electrons

Q.33 Cyclohexane is an example of:

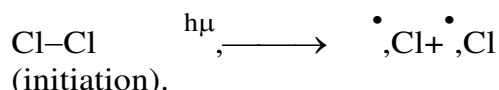
- A) Alicyclic hydrocarbons
- B) Aromatic hydrocarbon
- C) Aliphatic saturated hydrocarbon
- D) Aliphatic unsaturated hydrocarbon

## ANSWER KEY (Worksheet-02)

1	B	11	D	21	D	31	A
2	D	12	C	22	C	32	D
3	B	13	D	23	C	33	A
4	C	14	B	24	C		
5	B	15	D	25	D		
6	D	16	C	26	D		
7	A	17	B	27	D		
8	B	18	D	28	C		
9	D	19	B	29	B		
10	D	20	D	30	D		

## ANSWERS EXPLAINED

- Q.1 (B) The function of the light is to **break up** the chlorine molecules into **free radicals** such as



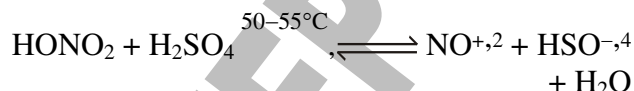
Halogenation is believed to proceed through **free radical substitution mechanism**. It involves the three steps such as **initiation, propagation and termination**.

- Q.2 (D) Ultimate product of catalytic oxidation of methane is **methanoic acid**.

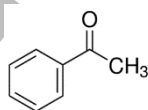
- Q.3 (B) **Propagation step** is such as



- Q.4 (C) The role of **conc. H<sub>2</sub>SO<sub>4</sub>** is **protonating nitric acid** such as



- Q.5 (B) **Acetophenone**



Acetophenone is the organic compound with the formula **C<sub>6</sub>H<sub>5</sub>COCH<sub>3</sub>** (also represented by the letters **PhAc** or **BzMe**). It is the simplest aromatic ketone. This colourless,

viscous liquid is a precursor to useful resins and fragrances.

(IUPAC 1-Phenylethan-1-one)

Other names:

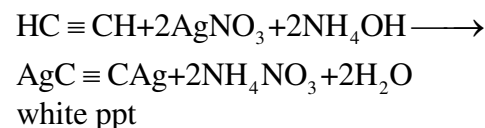
- Methyl phenyl ketone
- Phenylethanone

- Q.6 (D) **β-Elimination** does not take place at **low temperature**, however it takes place at **high temperature**, in the presence of less polar solvent and in the presence of strong nucleophile.

- Q.7 (A) **SiO<sub>2</sub>** is **not dehydrating agent** while others **B, C and D** are used as **dehydrating agent**.

- Q.8 (B) Order of reactivity of alcohols for dehydration is such as **3° alcohol > 2° alcohol > 1° alcohol**. Because the order of stability of their carbocations is as **3° carbocation > 2° carbocation > 1° carbocation**.

- Q.9 (D) **Tollen's test** is **not used** to distinguish between **alkanes and alkenes**. **Tollen's test** is used to distinguish between **alkenes and alkynes** while **alkynes** having **acidic hydrogen terminal alkynes** give this test. By passing acetylene in the **ammonical silver nitrate** white **ppt. of disilver acetylide** are obtained as shown in the reaction.



- Q.10 (D) **Decene (C<sub>10</sub>H<sub>20</sub>)** is an **alkene** with the formula **C<sub>10</sub>H<sub>20</sub>**. It is in the liquid state. It decolourizes reddish brown aqueous bromine solution because of the presence of double bond (**unsaturation**). **Decene** contains a chain of ten carbon atoms with one double bond. There are many

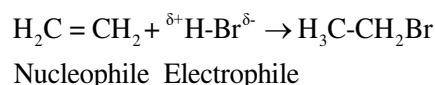
isomers of decene depending on the position and geometry of the double bond.

**Q.11 (D)** 2-Butene is a symmetrical molecule and does not follow Markownikov's rule. Its structure is shown as follow  $\text{CH}_3\text{-CH=CH-CH}_3$  (symmetrical molecule).

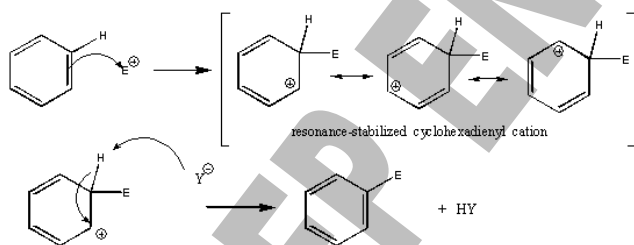
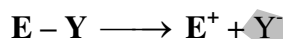
**Q.12 (C)** They have high percentage of carbon.

**Q.13 (D)** It is not used to provide electricity for galvanic cell because galvanic cell is itself the source of electricity.

**Q.14 (B)** Electrophilic addition reaction is shown as



**Q.15 (D)** Due to the extra resonance stability of the benzene ring, it does not undergo addition reaction in which the benzene ring resonance would be destroyed. Benzene ring by undergoing preferably electrophilic substitution retains the aromatic system. Other A, B, and C options do not fulfill the condition.



**Q.16 (C)** Phenol is the more reactive because OH- group is activating group, order of reactivity is as follow:

Phenol > Benzene > Chlorobenzene > Benzoic acid.  
Thus phenol can be the most readily nitrated.

**Q.17 (B)** As a result of chlorination of benzene in the presence of sunlight

mixture of products are obtained such as benzyl chloride, benzal dichloride and benzotrichloride. Benzotrichloride is the ultimate product.

**Q.18 (D)** For the better quality of polyethylene, mixture of  $\text{TiCl}_4 + \text{Al}(\text{C}_2\text{H}_5)_3$  are used as a catalyst. It is known as Ziegler-Natta catalysts.

**Q.19 (B)** Benzene does not give elimination and polymerization reaction.

**Q.20 (D)** Benzene reacts with ozone and gives glyoxal through benzene triozone but not oxalic acid.

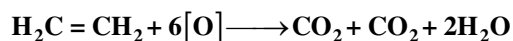
**Q.21 (D)** Halogeno-substituted benzene is less reactive than benzene because its inductive effect and resonance effect are in opposite direction. Its resonance effect is slightly greater than inductive effect, because of this reason halogen group is ortho-para-directing group but with more deactivation of benzene ring.

**Q.22 (C)** Crystal field theory doesn't explain stability of benzene. It explain color formation by the complexes of transition metal ions. It involves d-d transition.

**Q.23 (C)** When  $\text{R}^1\text{R}^2\text{C}=\text{CR}^3\text{R}^4$  is treated with concentrated with  $\text{KMnO}_4$  solution two moles of ketones are obtained.

- $\text{R}^1\text{R}^2\text{C}=\text{CR}^3\text{R}^4 + [\text{O}] \rightarrow \text{R}^1\text{R}^2\text{C}=\text{O} + \text{R}^3\text{R}^4\text{C}=\text{O}$
- Oxidation under harsh conditions using a hot, concentrated solution of  $\text{KMnO}_4$ . Three reactions take place and different products are obtained.
- If a carbon atom is bonded to two hydrogen atoms we get oxidation to a  $\text{CO}_2$  molecule



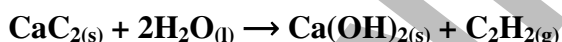


- If a carbon atom is bonded to one hydrogen atom and one alkyl group we get oxidation to a  $-\text{COOH}$  (carboxylic acid) group  
 $\text{RCH} = \text{CHR} + 2[\text{O}] \longrightarrow \text{RCHO} + \text{RCHO} \xrightarrow{2[\text{O}]} \text{RCOOH} + \text{RCOOH}$

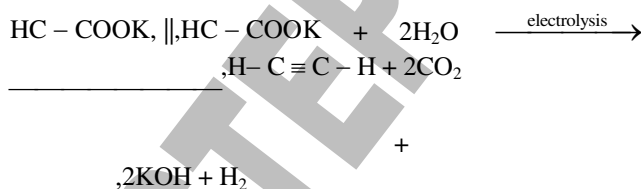
**Q.24 (C)** Alkyl benzenes are readily oxidized by acidified  $\text{KMnO}_4$  or  $\text{K}_2\text{Cr}_2\text{O}_7$ . In these reactions, the alkyl groups are oxidized keeping the benzene ring intact.

- Whatever the length of an alkyl group may be, it gives only one carboxyl group. Moreover, the colour of  $\text{KMnO}_4$  is discharged. Therefore this reactions is used as a test for alkylbenzenes.

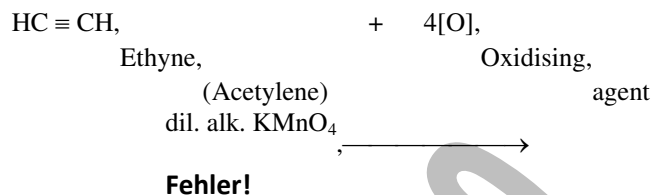
**Q.25 (D)** In the reaction between calcium carbide and water, acetylene gas is produced on the industrial scale:



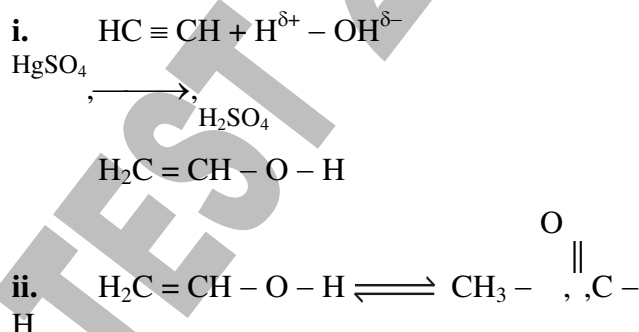
**Q.26 (D)** On the electrolysis of aqueous solution of potassium maleate results in the preparation of ethyne as shown in the reaction.



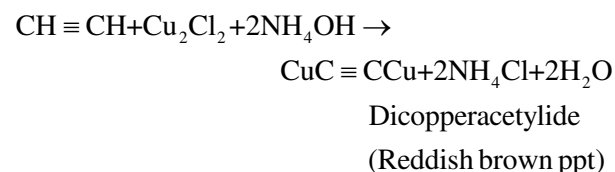
**Q.27 (D)** Ethyne on oxidation by strong alkaline  $\text{KMnO}_4$  gives glyoxal followed by its further oxidation results in the formation of oxalic acid as shown in the reaction.



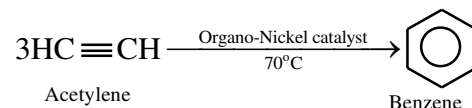
**Q.28 (C)** When acetylene is treated with water in the presence of  $\text{HgSO}_4/\text{H}_2\text{SO}_4$  at  $75^\circ\text{C}$ , No of steps involved in this reaction is 2 as shown in the reactions:



**Q.29 (B)** When ethyne is treated with ammonical  $\text{Cu}_2\text{Cl}_2$  solution, then ppt of dicopper acetylide are formed. The colour of ppt is reddish brown as shown in the reaction.

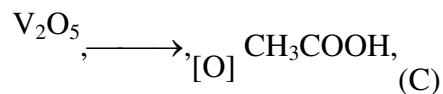
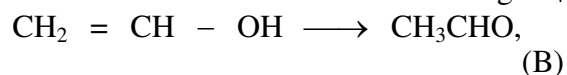
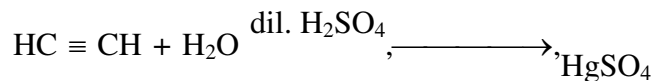


**Q.30 (D)** When acetylene is passed under pressure over an organo-nickel catalyst at  $70^\circ\text{C}$  benzene is formed as a result of addition polymerization.



**Q.31 (A)** The correct sequence for the product is as B ( $\text{CH}_3\text{CHO}$ ), C ( $\text{CH}_3\text{COOH}$ ) first of all product B (ethanal) is formed which on

further oxidation gives ethanoic acid as shown in the reaction



Q.32 (D) In fact, benzene has 12 sigma bonds and 6 pi electrons.

Q.33 (A) Cyclohexane is an example of alicyclic hydrocarbon.

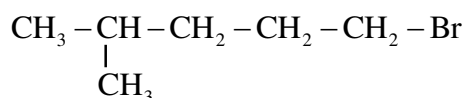
**Worksheet-3****(C. Organic Chemistry)****Alkyl Halides, Alcohols and Phenols**

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**Q.1** The type of alkyl halides in which halogen is attached with such C-atom which is further attached with two C-atoms are called?

- A) 1° alkyl halides                      C) 3° alkyl halides  
B) 2° alkyl halides                      D) 4° alkyl halides

**Q.2** Consider the following structure formula of alkyl halide:



The correct name according to IUPAC is:

- A) 1-Bromo-4-methylpentane  
B) 2-Methyl-5-bromopentane  
C) 2-Methyl-1-bromopentane  
D) 2-Methyl-2-bromopentane

**Q.3** Which of the following is the best method to prepare alkyl halides?

- A) Reaction of alcohol with HCl in the presence of catalyst  $\text{ZnCl}_2$   
B) Reaction of alcohol with  $\text{PCl}_5$   
C) Reaction of alcohol with  $\text{PCl}_3$   
D) Reaction of alcohol with  $\text{SOCl}_2$  in the presence of pyridine solvent

**Q.4** Which of the following alkyl halides cannot be prepared by the direct halogenation of alkanes?

- A)  $\text{R} - \text{Cl}$                                   C)  $\text{R} - \text{I}$   
B)  $\text{R} - \text{Br}$                                   D)  $\text{R} - \text{F}$

**Q.5** Which of the following is good leaving group?

- A)  $\text{NH}_2^-$                                       C)  $\text{OR}^-$   
B)  $\text{HSO}_4^-$                                     D)  $\text{OH}^-$

**Q.6** Which of the following statements is not correct for  $S_N2$  mechanism reaction?

- A) It is bimolecular, 2<sup>nd</sup> order reaction
- B) Order of ease of  $S_N2$  mechanism in alkyl halide is 1° alkyl halide > 2° alkyl halide > 3° alkyl halide
- C) It takes place in the presence of polar solvent
- D) It involves 100% inversion in the products

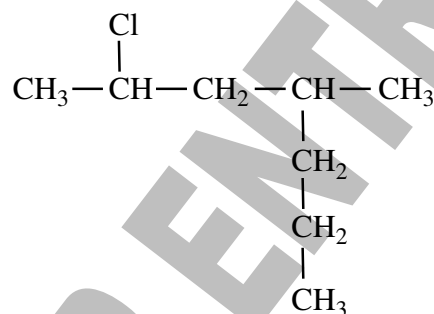
**Q.7** Mark the incorrect statement about alkyl halide:

- A) Boiling points of haloalkanes are greater than that of alkanes
- B) Order of decreasing boiling points in alkyl halides is  $R-I > R-Br > R-Cl > R-F$
- C) Alkyl halides are soluble in water
- D) Primary alkyl halides can be prepared by reaction of  $PCl_5$  or  $SOCl_2$  with alcohols but not aryl halide

**Q.8** Which of the following halide ion ( $X^-$ ) is good nucleophile and good leaving group?

- A)  $I^-$
- B)  $Cl^-$
- C)  $F^-$
- D)  $Br^-$

**Q.9** Which one of the following is the correct name according to IUPAC system for the formula given below?



- A) 4-Methyl-6-chloroheptane
- B) 2-Chloro-4-methylheptane
- C) 2-Chloro-4-n propylhexane
- D) 2-Chloro-4-n propylpentane

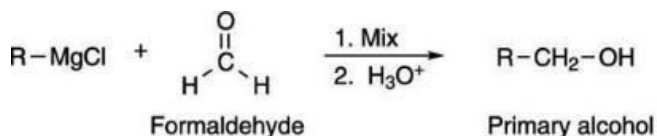
**Q.10**  $CCl_4$  has all of the following characteristic features EXCEPT:

- A) It is colourless liquid
- B) It is used as industrial solvent
- C) It is insoluble in water and soluble in alcohol for fat, oil etc
- D) It is inflammable

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**Q.11** Considered the following reaction of Grignard reagent with methanal (a carbonyl compound) followed by hydrolysis:



The mechanism of reaction before hydrolysis is:

- A) Electrophilic addition reaction  
B)  $\beta$ -elimination  
C) Nucleophilic addition reaction  
D) Nucleophilic substitution reaction
- Q.12** Which of the following product is obtained by the reaction of Grignard reagent with ketone followed by hydrolysis?
- A) 1° alcohol C) 3° alcohol  
B) 2° alcohol D) Both B and C
- Q.13** Which of the following type of alcohols is the most reactive when bond is to be broken between carbon and oxygen atoms?
- A) R - OH C) R - CH<sub>2</sub> - OH  
B)  $\begin{array}{c} \text{R} \\ | \\ \text{R}-\text{C}-\text{OH} \\ | \\ \text{R} \end{array}$  D)  $\begin{array}{c} \text{R} \\ | \\ \text{R}-\text{C}, \text{CH}-\text{OH} \end{array}$
- Q.14** Alkyl halides are considered to be very reactive compounds towards nucleophiles because:
- A) They have an electrophilic carbon  
B) They have an electrophilic carbon and a good leaving group  
C) They have an electrophilic carbon and bad leaving group  
D) They have a nucleophilic carbon and a good leaving group
- Q.15** Which of the following tests helps us to distinguish between methanol and ethanol?

SCRATCH WORK

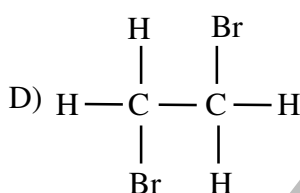
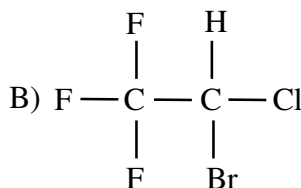
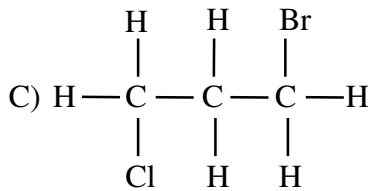
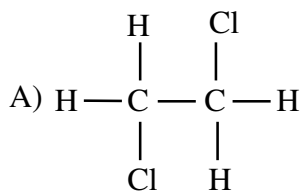
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- A) Lucas test  
B) Iodoform test
- C) Tollen's test  
D) Baeyer's test

**Q.16 Which one of the followings is Halothane?**



**Q.17 Which of the following is the weakest acid?**

- A) Carboxylic acid  
B) Ethanol
- C) Phenol  
D) Ethyne

**Q.18 All of the following statements about phenol and ethanol are correctly matched EXCEPT:**

Options	Properties	Phenol	Ethanol
A)	Bromination ( $\text{Br}_2/\text{H}_2\text{O}$ )	White ppt of 2,4,6-Tribromo phenol	No reaction
B)	$\text{H}_2/\text{Ni}$	No reaction	No reaction
C)	Action of organic acid	No reaction	Formation of ester
D)	Iodoform test	No reaction	Yellow ppt of $\text{CHI}_3$

**Q.19 Which of the following raw material is/are used to prepare ethyl alcohol?**

- A) Starch only  
B) Molasses only
- C) Both A and B  
D) Neither A nor B

**Q.20 Which of the following drying agent is used to get absolute alcohol from rectified spirit?**

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- A) Conc.  $\text{H}_2\text{SO}_4$                       C)  $\text{Al}_2\text{O}_3$   
B)  $\text{CaO}$                                   D)  $\text{H}_3\text{PO}_4$

**Q.21 Identify the incorrect statement about the use of chloroform:**

- A) It is used as an anesthetic substance  
B) It is used as a solvent for fats waxes and resins  
C) It is used in manufacturing freons  
D) It is used as preservative for anatomical specimen

**Q.22 All of the following are characteristic features of Teflon plastic EXCEPT:**

- A) It is valuable plastic which resists the action of acid and alkali  
B) It is used as coating the electrical wiring  
C) It is used as a non-stick coating for cooking pans  
D) It reacts with oxidants

**Q.23 The phenoxide is more stable than ethoxide ion as:**

- A) Lone pair on oxygen atom overlaps with the delocalized  $\pi$ -bonding system in benzene  
B) Oxygen atom is directly bonded with benzene ring in phenoxide ion  
C) The negative charge is localized on oxygen atom of phenoxide ion  
D) The negative charge is delocalized on oxygen atom of ethoxide ion

**Q.24 Which of the following is the most dangerous factor which damages ozone?**

- A) Aerosol spray  
B) Use of chlorofluorocarbons  
C) Effect of  $\text{SO}_2$  and  $\text{NO}_2$  pollutant  
D) Global warming by  $\text{CO}_2$

**Q.25 Grignard reagent is reactive due to:**

- A) The presence of halogen atom  
B) The polarity of  $\text{C} - \text{Mg}$  bond  
C) The presence of  $\text{Mg}$  atom  
D) The polarity of  $\text{C} - \text{X}$  bond

**Q.26 In which of the following reactions alcohol is produced?**

- A) Reaction of alkyl halide with aqueous  $\text{KOH}$   
B) Reaction of alkyl halide with alcoholic  $\text{KOH}$   
C) Reaction of alkyl halide with  $\text{KCN}$  followed by acidic

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hydrolysis

D) Reactions of alkyl halide with sodium alkoxide

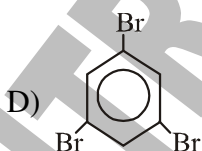
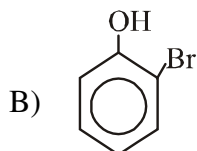
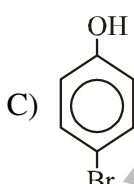
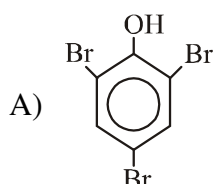
**Q.27** The type of monohydric alcohols in which  $\text{-OH}$  group is attached with such carbon atom which is further attached with three carbon atoms and no hydrogen atom is called:

- A)  $1^\circ$  alcohols                      C)  $3^\circ$  alcohols  
B)  $2^\circ$  alcohols                      D) Absolute alcohol

**Q.28** Which of the following types of alcohols on oxidation with acidified potassium dichromate gives aldehydes?

- A)  $1^\circ$  alcohols                      C)  $3^\circ$  alcohols  
B)  $2^\circ$  alcohols                      D) Neo alcohol

**Q.29** Aqueous phenol decolorizes bromine water to form white ppt. What is the structure of white ppt formed?



**Q.30** When phenol is treated with concentrated nitric acid at high temperature, which of the following product is obtained?

- A) o-nitrophenol                      C) m-nitrophenol  
B) p-nitrophenol                      D) 2,4,6-trinitrophenol

**Q.31** Which of the following reactions shows that phenol acts as an acid?

- A) Reaction with conc. nitric acid  
B) Reaction with bromine  
C) Reaction with  $\text{NaOH}$   
D) Reaction with  $\text{H}_2$

**Q.32** Which of the following is the strongest acid?

- A) Carboxyl acid                      C) Water

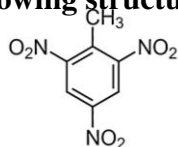
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**Your STEP Towards A Brighter Future!**

B) Phenol

D) Alcohol

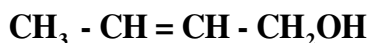
Q.33 Considered the following structure:



The correct name according to IUPAC of the above structure is:

- A) 2,4,6-Trinitrotoulene      C) 2,3,4-Trinitrotoulene  
B) 1,3,5-Trinitrotoulene      D) 1,2,3-Trinitrotoulene

Q.34 Considered the following structure of alcohol:



The correct name according to IUPAC of the above structure is:

- A) 1-Butene-2-ol      C) 2-Butene-1-ol  
B) 2-Butene-4-ol      D) 1-Butene-4-ol

Q.35 Which of the following type of alcohols is prepared by the reduction of aldehydes?

- A) 2° alcohols      C) 3° alcohols  
B) 1° alcohols      D) Both B and C

Q.36 Which of the following methods is used to prepare ethers?

- A) Williamson's synthesis  
B) Kolbe's electrolytic method  
C) Strecker synthesis  
D) Wolf Kishner's reduction reaction

Q.37 Which of the following reactions is / are possible with phenol?

- A) Reaction with sodium metal only  
B) Oxidation of phenol only  
C) Both A and B  
D) Neither A nor B

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SCRATCH WORK

**Q.38** Different methods are given to prepare phenol:

- I. By the reaction of sodium salt of benzene sulphonic acid with NaOH at 320°C followed by reaction with HCl
- II. By the reaction of Chlorobenzene with 10% NaOH at 360°C and 150 atmospheric pressure
- III. Oxidation of cumene
- IV. Hydrolysis of diazonium salt

Which of the above methods is known as Dow's process?

- A) II only
- B) I only
- C) II and III
- D) I and II

**Q.39** Which of the following reactions involves cleavage of O – H bond in alcohol?

- A)  $C_2H_5OH + SOCl_2 \xrightarrow{\text{Pyridine}} C_2H_5Cl + SO_2 + HCl$
- B)  $C_2H_5OH + CH_3COOH \xrightarrow{\text{Conc. } H_2SO_4} CH_3COOC_2H_5 + H_2O$
- C)  $C_2H_5OH + HCl \xrightarrow{ZnCl_2} C_2H_5Cl + H_2O$
- D)  $C_2H_5OH + HNH_2 \xrightarrow{ThO_2} C_2H_5NH_2 + H_2O$

**Q.40** Oxidative cleavage of 1,2-diol with periodic acid results in the formation of:

- A) Two molecules of carbonyls
- B) Two molecules of carboxylic acids
- C) Two molecules of alcohols
- D) Two molecules of ethers

**Q.41** Which of the following enzymes is involved in the conversion of sugar (molasses) into glucose and fructose?

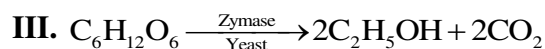
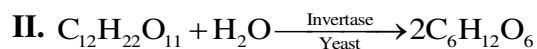
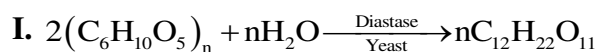
- A) Diastase
- B) Invertase
- C) Maltose
- D) Zymase

**Q.42** A biochemical process in which large molecules are broken down into smaller molecules in the presence of enzymes secreted by microorganism is called?

- A) Fermentation
- B) Cracking
- C) Polymerization
- D) Reforming



**Q.43** Consider the following steps involved in the preparation of ethanol from starch by fermentation process.



Which of the above statement is incorrect in the preparation of ethanol from starch by fermentation process?

A) 1 only

C) II and III

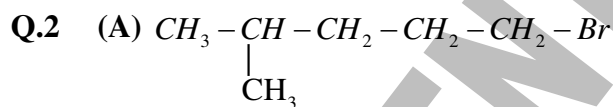
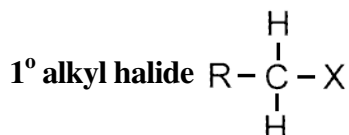
B) II only

D) I, II and III

## ANSWER KEY (Worksheet-03)

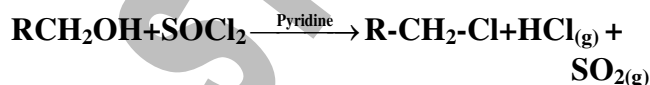
1	B	12	C	23	A	34	C
2	A	13	B	24	B	35	B
3	D	14	B	25	B	36	A
4	C	15	B	26	A	37	C
5	B	16	B	27	C	38	A
6	C	17	D	28	A	39	B
7	C	18	B	29	A	40	A
8	A	19	C	30	D	41	B
9	B	20	B	31	C	42	A
10	D	21	C	32	A	43	B
11	C	22	D	33	A		

## ANSWERS EXPLAINED



According to IUPAC the correct name of the given structure is **1-Bromo-4-methylpentane**.

Q.3 (D) This is the best method to prepare **alkyl halides** because the side products in this reaction are in the gaseous state



Q.4 (C) Order of reactivity of halogens with alkane is as follow  $\text{F}_2 > \text{Cl}_2 > \text{Br}_2 > \text{I}_2$ . This order shows that  $\text{I}_2$  is **least reactive** and it **does not react** with

alkane to form **alkyl halide**. It is clear that **R – I** cannot be prepared from alkane.

Q.5 (B)

Good Leaving Group	Poor Leaving Group
$\text{Cl}^-$ , $\text{Br}^-$ , $\text{I}^-$ and $\text{HSO}_4^-$	$\text{OH}^-$ , $\text{OR}^-$ and $\text{NH}_2^-$
Less polar	More polar
Low bond energy	Greater bond energy
Give fast reaction	Give slow reaction

Q.6 (C)  $\text{S}_{\text{N}}2$  mechanism reaction takes place in the presence of **non-polar solvent** such as **n-hexane** not in the presence of **polar solvent** (e.g.  $\text{H}_2\text{O}$ ).

Q.7 (C) Alkyl halides are soluble in **non-polar solvent**.

Q.8 (A) Leaving group ability can be explained on the basis of strength of the **C-X bond**. The **C-I bond** is the **weakest bond** hence iodide is the **best leaving group**.

- Increasing order of the leaving groups:  
 $\text{F}^- < \text{Cl}^- < \text{Br}^- < \text{I}^- \dots\dots \text{i}$

The greater the electronegativity, the more stable the halide ion (since electrons are tightly held).

- Increasing order of the nucleophiles  
 $\text{F}^- < \text{Cl}^- < \text{Br}^- < \text{I}^- \dots\dots \text{ii}$
- Since iodine is the least electronegative, it is the **least stable halide** hence the **strongest nucleophile**.
- Another important factor would be **Hard-Soft concept**. Alkyl halides are soft electrophiles so the substitution is favored by soft nucleophiles. The **softness** of the **nucleophiles increases down the group** i.e.  $\text{F}^- < \text{Cl}^- < \text{Br}^- < \text{I}^-$
- Other (B, C and D) are weak nucleophile and poor leaving group

- The relative rate at which a nucleophile (Nu:<sup>-</sup>) reacts to displace (substitute for) a leaving group is called 'nucleophilicity'. Consider the following nucleophilic substitution reactions:
- $\text{CH}_3\text{OH} + \text{HI} \rightarrow \text{CH}_3\text{I} + \text{HOH}$
- $\text{CH}_3\text{OH} + \text{HCl} \rightarrow \text{CH}_3\text{Cl} + \text{HOH}$
- The first reaction is much faster than the second because  $\text{I}^-$  is a much better Nu:<sup>-</sup> than  $\text{Cl}^-$ . The leaving group (HOH) was the same in both cases. The nucleophilicity (relative reactivity) of various Nu:<sup>-</sup>'s is listed in the following table ...

Reactivity	Nu: <sup>-</sup>	Relative Reactivity
very weak	$\text{HSO}_4^-$ , $\text{H}_2\text{PO}_4^-$ , $\text{RCOOH}$	< 0.01
weak	$\text{ROH}$	1
	$\text{HOH}$ , $\text{NO}_3^-$	100
fair	$\text{F}^-$	500
	$\text{Cl}^-$ , $\text{RCOO}^-$	$20 \times 10^3$
	$\text{NH}_3$ , $\text{CH}_3\text{SCH}_3$	$\sim 300 \times 10^3$
good	$\text{N}_3^-$ , $\text{Br}^-$	$\sim 600 \times 10^3$
	$\text{OH}^-$ , $\text{CH}_3\text{O}^-$	$2 \times 10^6$
very good	$\text{CN}^-$ , $\text{HS}^-$ , $\text{RS}^-$ , $(\text{CH}_3)_3\text{P}^-$ , $\text{I}^-$ , $\text{H}^-$	$> 100 \times 10^6$

- Note that Nu:<sup>-</sup>'s are electron donors as are Lewis bases and reducing agents. Nu:<sup>-</sup>'s are either uncharged (with non-bonded electrons) or they are anions, but they are never cations. Nu:<sup>-</sup>'s are basic, neutral, or sometimes weakly acidic, but not strongly acidic. Strong acids ( $\text{HCl}$ ,  $\text{H}_2\text{SO}_4$ ) and Lewis acids ( $\text{AlCl}_3$ ,  $\text{SnCl}_2$ ) are electrophiles ( $\text{E}^{+}$ 's), i.e., electron acceptors as are oxidizing agents.
- Within any given row of the periodic table, nucleophilicity decreases from left to right as polarizability decreases

(because electronegativity of the central atom is increasing).

$\text{CH}_3^-$	>	$\text{NH}_2^-$	>	$\text{OH}^-$	>	$\text{F}^-$
	>	$\text{NH}_3$	>	$\text{OH}_2$	>	$\text{HF}$
		$\text{PH}_2^-$	>	$\text{SH}^-$	>	$\text{Cl}^-$
		$\text{PH}_3$	>	$\text{SH}_2$	>	$\text{HCl}$

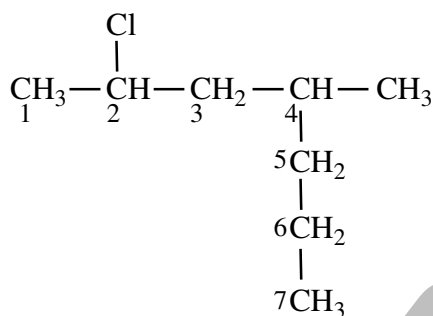
- For nucleophiles with the same attacking atom, the anion is more nucleophilic than the neutral compound.
- $\text{Cl}^- > \text{HCl}$      $\text{OH}^- > \text{HOH}$      $\text{RO}^- > \text{ROH}$   
 $\text{NH}_2^- > \text{NH}_3$      $\text{CH}_3\text{CO}_2^- > \text{CH}_3\text{CO}_2\text{H}$   
 $\text{CN}^- > \text{HCN}$
- Nucleophilicity increases down any column of the periodic table; as the polarizability of atoms increases ...

$\text{NH}_2^-$	$\text{OH}^-$	$\text{F}^-$
$\text{H}_2\text{P}^-$	$\text{HS}^-$	$\text{Cl}^-$
$\text{H}_2\text{As}^-$	$\text{HSe}^-$	$\text{Br}^-$
$\text{H}_2\text{Sb}^-$	$\text{HTe}^-$	$\text{I}^-$

- Note the similarities and differences of nucleophiles and bases.
- Nu:<sup>-</sup>'s and bases are both electron donors
- Basicity deals with equilibrium position (K<sub>eq</sub>). At equilibrium, a stronger base holds a greater proportion of  $\text{H}^+$ . Nucleophilicity deals with kinetics. A stronger Nu:- attacks faster than a weaker one.
- Basicity deals with interaction with  $\text{H}^+$  while nucleophilicity is broader and also deals with interaction with other atoms, especially, but not only C atom.
- Polarizability of Nucleophiles:
- A polarizable nucleophile, e.g.,  $\text{I}^-$ , is large and soft ('teddy bear-like') because its valence (donor) electrons are far from the nucleus (in the 5th period). The electron cloud is readily distorted during bond making and breaking which reduces the energy maximum in the transition state and thus speeds up reactions.

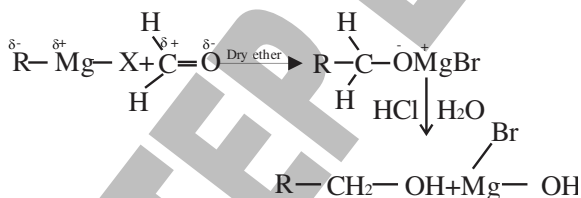
- A non-polarizable nucleophile, e.g., F<sup>-</sup> is small and hard ("golf ball-like"). Its outer valence electrons are close to the nucleus (in the 2nd period) and tightly held. F-forms strong bonds but its electron cloud is not easily distorted during bond formation and breaking so its transition state is at high energy (slow reaction) state.
- It is generally true that good nucleophiles are also good leaving groups for the same reasons.

**Q.9 (B)** The correct name according to IUPAC of the given structure is **2-Chloro-4-methylheptane**.



**Q.10 (D)** CCl<sub>4</sub> is **non-polar** and is **non-flammable**.

**Q.11 (C)** Mechanism of reaction in the formation of intermediate product **before** hydrolysis is **nucleophilic addition** reaction as shown below. Others A, B, and D are not related.



**Q.12 (C)**

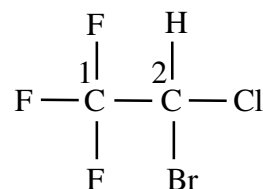
- A **3° alcohol** is formed when **ketone** is treated with **Grignard reagent** followed by acid hydrolysis.
- A **1° alcohol** is formed when **formaldehyde (methanal)** is treated with **Grignard reagent** followed by acid hydrolysis
- A **2° alcohol** is formed when **aldehyde (other than formaldehyde)** treated with Grignard reagent followed by acid hydrolysis.

**Q.13 (B)** A **3° alcohol** is more reactive because **3° carbocation** is more stable than others.

**Q.14 (B)** In alkyl halides the **α-carbon** is electrophilic in character. When nucleophile attacks the **α-carbon**, then halogen atom acts as a leaving group.

**Q.15 (B)** Iodoform test (I<sub>2</sub> + NaOH) helps us to distinguish between ethanol and methanol. When ethanol is treated with I<sub>2</sub> in the presence of NaOH yellow crystal of iodoform (CHI<sub>3</sub>) are obtained while methanol **does not** give this test as shown in the reaction (C<sub>2</sub>H<sub>5</sub>OH+4I<sub>2</sub>+6NaOH→CHI<sub>3</sub>+HCOONa+5NaI+5H<sub>2</sub>O).

**Q.16 (B)** The structure of haloethane is given below:

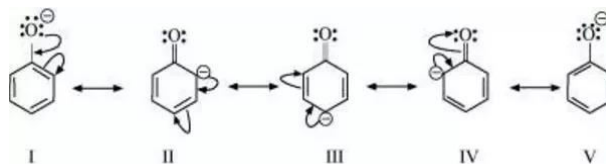


**2-Bromo-2-Chloro-1,1,1-trifluoroethane**

- Q.17 (D) From the  $K_a$  value as shown in the table, it is clear that ethyne is a weaker acid because its  $K_a$  value is smaller.

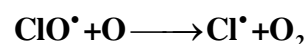
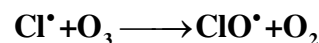
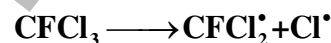
Name of compound	$K_a$ (mol dm <sup>-3</sup> )
Carboxylic acid e.g. (CH <sub>3</sub> COOH)	$1.7 \times 10^{-5}$
Phenol	$1.3 \times 10^{-10}$
Water	$10^{-16}$
Ethyne	$10^{-20}$

- Q.18 (B) In fact by hydrogenation of phenol, cyclohexanol is formed but ethanol does not react with hydrogen in the presence of Ni.
- Q.19 (C) Ethyl alcohol is obtained by fermentation from both starch and molasses.
- Q.20 (B) Absolute alcohol (almost 100% pure) can be obtained by redistillation of rectified spirit in the presence of CaO which absorbs its moisture.
- Q.21 (C) A, B and D are the uses of chloroform except C.
- Q.22 (D) Teflon plastic not only reacts with acid and alkali but also it reacts with oxidant.
- Q.23 (A) Phenol is much more acidic than alcohol but less acidic than carboxylic acid. The reason why phenol is acidic lies in the nature of the phenoxide ion. The negative charge on oxygen atom can become involved with the  $\pi$ -electron cloud on the benzene ring. The negative charge is thus delocalized in the ring and the phenoxide ion becomes relatively stable. Delocalization of negative charge in the ring of phenoxide is shown below:



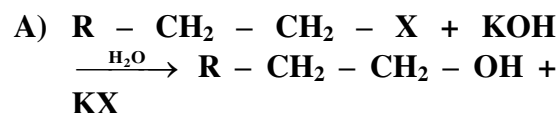
This step of delocalization is not possible with alcohols.

- Q.24 (B) Use of chlorofluorocarbons is the most dangerous for ozone layer. Chlorofluorocarbons used as refrigerants in air conditioning and in aerosol sprays are inert in the troposphere but slowly diffuse into stratosphere, where they are subjected to ultraviolet radiation generating  $Cl^\bullet$  free radicals. Chlorofluorocarbons (CFCs) play an effective role in removing  $O_3$  in the stratosphere due to following reactions.



- Q.25 (B) The greater reactivity of Grignard's reagent is due to the polarity of  $\alpha$ -carbon and Mg bond (the electronegativity of C = 2.5, Mg = 1.2 and the difference is 1.3 so C – Mg bond is polar). The  $\alpha$ -carbon develops the partial negative charge and acts as nucleophilic centre  $R^{\delta-} - Mg^{\delta+} - X$ .

- Q.26 (A) As a reaction of alkyl halide with aqueous KOH, alcohol is formed as shown in the reactions:



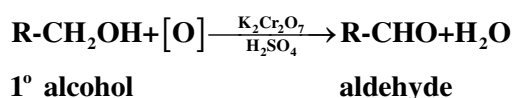
- Q.27 (C) Structure of primary secondary and tertiary alcohols are shown below:



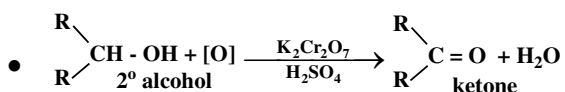
0 carbons directly attached	1 carbon directly attached	2 carbons attached	3 carbons attached
Methyl alcohol	Primary (1°) alcohol	Secondary (2°) alcohol	Tertiary (3°) alcohol

**Q.28 (A)** Detail of the other reactions are given below

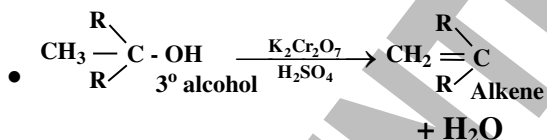
- A) On oxidation of a 1° alcohol aldehyde is obtained



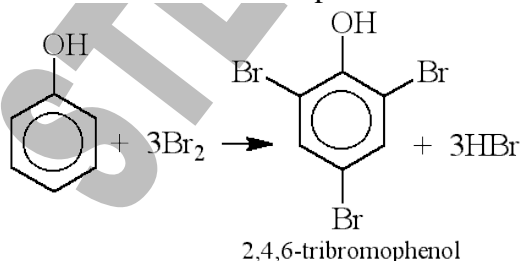
- B) On oxidation of a 2° alcohol ketone is obtained



- C) A 3° alcohols are resistant to oxidation. In the presence of acid dichromate they undergo elimination reactions to give alkenes

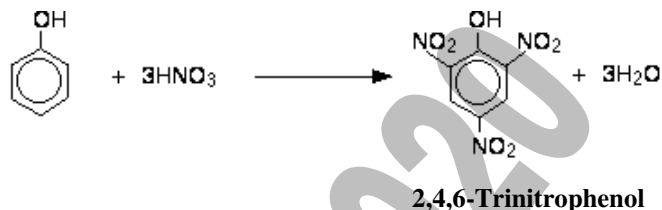


**Q.29 (A)** If **bromine** water is added to a solution of **phenol** in water, the **bromine** water is decolourised and a white precipitate is formed which smells of antiseptic. Notice the multiple substitution around the ring into all the activated positions.

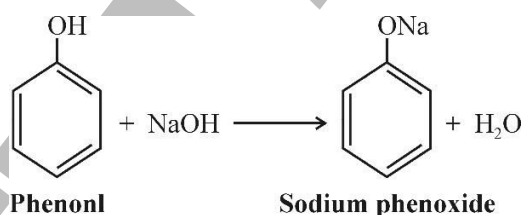


**Q.30 (D)** When phenol is treated with concentrated nitric acid at high

temperature in the presence of conc. sulphuric acid, 2,4,6-trinitrophenol is obtained as shown in the reaction:



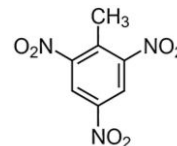
**Q.31 (C)** Reaction of phenol with alkali (NaOH) results in the formation of salt which show that it is acid base reaction



**Q.32 (A)** Relative acidic strength of alcohol, phenol, water and carboxylic acid is as follows.

Carboxylic acid > Phenol > Water > Alcohol

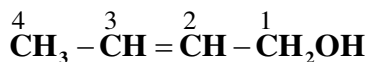
**Q.33 (A)** The correct name according to IUPAC of the given structure is 2,4,6-Tribnitrotoulene (TNT). It is an explosive material.



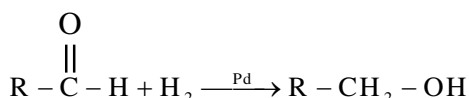
Trinitrotoluene (TNT), or more specifically 2,4,6-trinitrotoluene, is a chemical compound with the formula  $\text{C}_6\text{H}_2(\text{NO}_2)_3\text{CH}_3$ . This yellow solid is sometimes used as a reagent in chemical synthesis, but it is best known as an explosive material with convenient handling properties. The explosive yield of TNT is considered to be the standard measure of bombs and other explosives. In chemistry,

TNT is used to generate charge transfer salts.

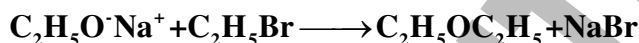
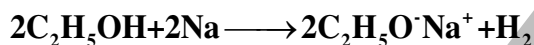
- Q.34 (C) The correct name according to IUPAC of the given structure is 2-buten-1-ol.



- Q.35 (B) 1° alcohol is prepared by the reduction of aldehyde as shown in the reaction.

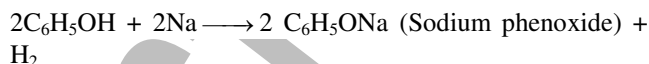


- Q.36 (A) An alcohol is treated with metallic sodium to form alkoxides. This alkoxide ion is a strong nucleophile and readily reacts with alkyl halide to produce an ether. e.g.



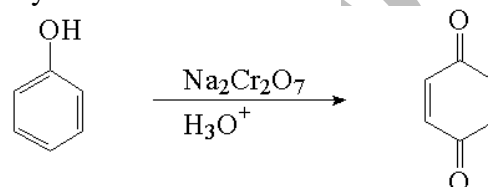
Ethoxy ethane  
(Diethyl ether)

- Q.37 (C) (1) Reaction with sodium metal:  
Phenols react with highly electropositive alkali metals such as sodium, potassium etc to yield corresponding phenoxides and hydrogen as shown in the reaction.



- (2) Oxidation of phenol:  
Phenols are rather easily oxidized despite the absence of a hydrogen atom on the hydroxyl bearing carbon. Among the colored products from the oxidation of phenol by chromic

acid is the dicarbonyl compound para-benzoquinone (also known as 1,4-benzoquinone or simply quinone); an ortho isomer is also known. Oxidation of phenol is shown by the reaction as follow:



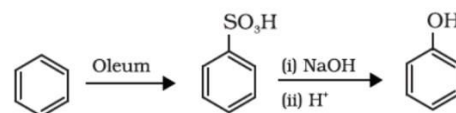
1,4-benzoquinone

- Q.38 (A) Detail of all the reactions are given below:

I. By the reaction of sodium salt of benzene sulphonic acid with NaOH at 320°C followed by reaction with HCl.

From sodium salt of Benzene sulphonic acid:

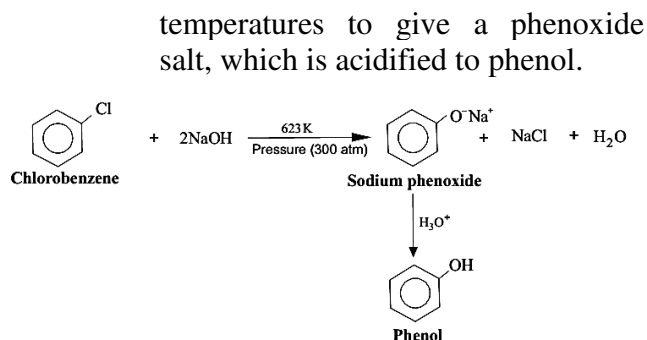
In this process, benzene sulfonic acid is reacted with aqueous sodium hydroxide. The resulting salt is mixed with solid sodium hydroxide and fused at a high temperature. The product of this reaction is sodium phenoxide, which is acidified with aqueous acid to yield phenol.



II. By the reaction of Chlorobenzene with 10% NaOH at 360°C and 150 atmospheric pressure.

Dow's Process:

Hydrolysis of chlorobenzene (the Dow's process) Benzene is easily converted to chlorobenzene by a variety of methods, one of which is the Dow's process. Chlorobenzene is hydrolyzed by a strong base at high

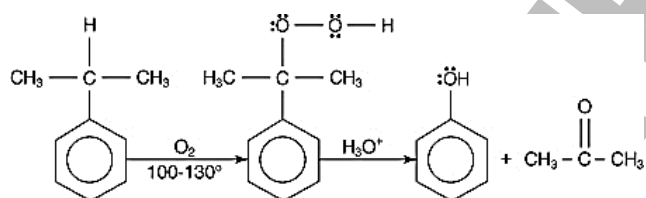


### III. Oxidation of cumene

#### Oxidation of Cumene:

**Air oxidation of cumene.** The air oxidation of cumene (isopropyl benzene) leads to the production of both phenol and acetone, as shown in the following figure. The mechanisms for the formation and degradation

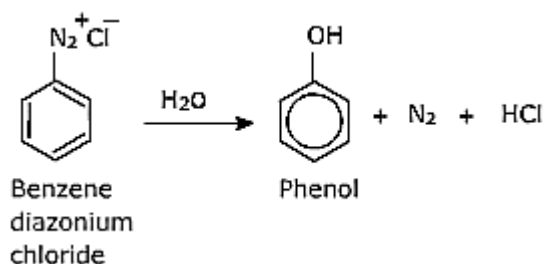
of cumene hydroperoxide require closer looks, which are provided following the figure.



### IV. Hydrolysis of diazonium salt

#### Hydrolysis of Diazonium salt:

Phenol is dissolved in sodium hydroxide solution to give a solution of sodium phenoxide. The solution is cooled in ice, and cold benzenediazonium chloride solution is added. There is a reaction between the diazonium ion and the phenoxide ion and a yellow-orange solution or precipitate is formed.

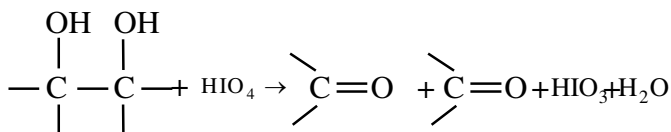


**Q.39 (B)** Reaction of alcohol with carboxylic acid in the presence of conc. H<sub>2</sub>SO<sub>4</sub> (dehydrating agent) ester is formed. This reaction involves O – H bond cleavage in alcohol as shown in the reaction.



**Q.40 (A)** Oxidative cleavage of 1,2-diol with periodic acid results in the formation of two molecules of carbonyls as shown in the reaction.

- 1,2- or vicinal diols are cleaved by periodic acid, HIO<sub>4</sub>, into two carbonyl compounds.
- The reaction is selective for 1,2-diols.
- The reaction occurs via the formation of a cyclic periodate ester.
- This can be used as a functional group test for 1,2-diols.
- The products are determined by the substituents on the diol.



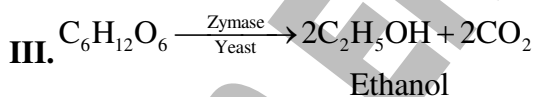
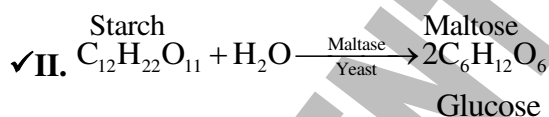
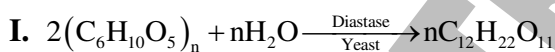
**Q.41 (B)** Invertase enzymes is used in the conversion of sugar (molasses) into glucose and fructose as shown in the reaction

- Molasses is the mother liquor left after crystallization of cane sugar from concentrated juice.
- It is dark coloured thick syrupy mass.
- Molasses contains 60% fermentable sugars mostly sucrose, glucose and fructose.
- The fermented liquor contains 8 – 10% ethanol



**Q.42 (A)** A biochemical process in which large molecules are broken down into smaller molecules in the presence of enzymes secreted by microorganism is called?

**Q.43 (B)** It is incorrect statement. The correct statement is as follow:



**Worksheet-04**  
**(C. Organic Chemistry)**  
**Aldehydes and Ketones**

**Q.1 Mark the incorrect statement about aldehydes and ketones:**

- A) They have higher boiling points than that of alkanes
- B) They have lower boiling points than that of alcohols
- C) Aldehydes are present in essential oils and ketonic group is present in camphor
- D) Aldehydes have H-bonding but ketones do not have

**Q.2 All of the following statements are correct about aldehydes and ketones EXCEPT:**

- A) Aldehydes are easily oxidized while ketones do not
- B) Aldehydes show position isomerism while ketones do not
- C) Aldehydes can be oxidized easily by Fehling's solution while ketones do not
- D) Aldehydes react with alcohols to form acetal while ketones do not

**Q.3 Which of the following reactions is not given by ketones?**

- A) Grignard reagent
- B) 2,4-DNPH
- C) Polymerization
- D) HCN

**Q.4 Which of the following tests is shown by ketones only?**

- A) Sod. nitroprusside test
- B) Tollen's reagent test
- C) Fehling solution test
- D) Benedict reagent test

**Q.5 Which one of the following organic compounds does not give iodoform test?**

- A) Ethanal
- B) Ethanol
- C) Methyl ketones
- D) Methanal

**Q.6 All of the following reagents reduce aldehydes and ketones to their respective alcohols EXCEPT:**

- A)  $H_2/Ni$
- B)  $LiAlH_4$
- C)  $N_2H_2/KOH$
- D)  $NaBH_4$

**Q.7 Which of the following aldehydes is the most reactive?**

- A) Methanal
- B) Ethanal
- C) Butanal
- D) Propanal

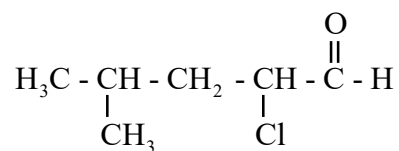
USE THIS SPACE FOR  
SCRATCH WORK



- Q.8 Which one of the following does not give iodoform test?**  
A) Butanone C) 2-Hexnone  
B) 2-Pentanone D) 3-Pentanone
- Q.9 Aldehydes and ketones show which of the following mechanism of reaction:**  
A) Electrophilic addition reaction  
B) Nucleophilic substitution reaction  
C) Nucleophilic addition reaction  
D) Acid base reaction
- Q.10 The nucleophilic addition reactions of carbonyl group are catalyzed by bases or acids. A base catalyzed reaction:**  
A) Increases nucleophilic character of attacking reagent  
B) Increases electrophilic character of carbon of carbonyl group  
C) Increases both electrophilic and nucleophilic character  
D) Has no effect on the reactivity of carbonyl groups
- Q.11 Which one of the following types of reactions is not shown by aldehydes and ketones?**  
A) Nucleophilic addition reaction  
B) Reduction reaction  
C)  $\beta$ -Elimination reaction  
D) Oxidation reaction
- Q.12 Mark the incorrect statement about Aldehydes and Ketones:**  
A) Aldehydes on reduction with  $\text{NaBH}_4/\text{H}_3\text{O}^+$  give  $1^\circ$  alcohol  
B) Ketones on reduction with  $\text{NaBH}_4/\text{H}_3\text{O}^+$  gives  $2^\circ$  alcohol  
C) Aldehydes on reduction with  $\text{N}_2\text{H}_4/\text{KOH}$  gives alkane  
D) Ketones on reduction with  $\text{N}_2\text{H}_4/\text{KOH}$  gives alkene
- Q.13 Which of the following is incorrect statement?**  
A)  $1^\circ$  alcohol on oxidation gives aldehyde  
B)  $2^\circ$  alcohol on oxidation gives ketone  
C) On dry distillation of calcium methanoate, ethanal is produced  
D) On dry distillation of calcium ethanoate, propanone is produced

USE THIS SPACE FOR  
SCRATCH WORK

Q.14 Consider the following structure of aldehyde:



The correct name according to IUPAC is:

- A) 2-Chloro-4-methylpentanal
- B) 2-Methyl-4-chloropentanal
- C) 2-Chloro-3-methylbutanol
- D) 3-Methyl-2-chloropentanal

Q.15 Aldehydes can occur:

- A) Anywhere in the carbon chain
- B) In the middle of carbon chain
- C) Only at the second carbon atom of the carbon chain
- D) Only at the terminal carbon atom of the carbon chain

Q.16 Aldehyde acts as \_\_\_\_\_ when treated with Fehling's solution.

- A) Reducing agent only
- B) Oxidizing agent only
- C) Both A and B
- D) Neither A nor B

Q.17 Aldehydes and ketones react with ammonia derivatives  $\text{G-NH}_2$  to form condensation product containing the group  $\text{C} = \text{N} - \text{G}$  and water. The reaction is:

- A) Base catalyzed only
- B) Acid catalyzed only
- C) Both A and B
- D) Neither A nor B

Q.18 Which of the following is not easily oxidized?

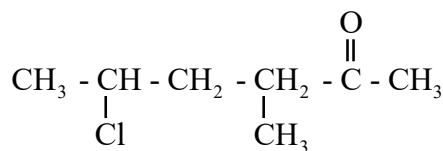
- A) Aldehyde
- B)  $1^\circ$  alcohol
- C) Ketone
- D)  $2^\circ$  alcohol

Q.19 Ketones are generally resistant to oxidation. But they can be oxidized by strong oxidizing agent such as ( $\text{K}_2\text{Cr}_2\text{O}_7 + \text{conc. H}_2\text{SO}_4$ ). On oxidation of 2-pentanone, which of the following products are possible?

- A)  $\text{CH}_3\text{CH}_2\text{COOH}$  only
- B)  $\text{CH}_3\text{-CH}_2\text{-COOH}$  and  $\text{CH}_3\text{COOH}$
- C)  $\text{CH}_3\text{COOH}$  only
- D)  $\text{CH}_3\text{COOH}$  and  $\text{HCOOH}$

USE THIS SPACE FOR  
SCRATCH WORK

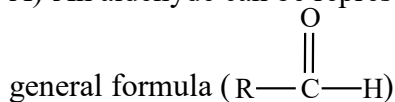
Q.20 Consider the following structure:



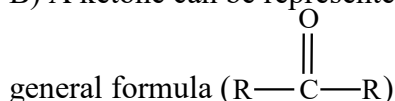
- A) 5-Chloro-3-methyl-2-hexanone  
B) 2-Chloro-3-methyl-5-hexanone  
C) 4-Methyl-5-chloro-2-hexanone  
D) 3-Methyl-2-chloro-2-hexanone

Q.21 Identify the incorrect statement about aldehydes and ketones:

- A) An aldehyde can be represented by

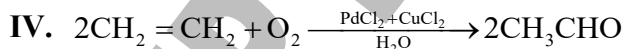
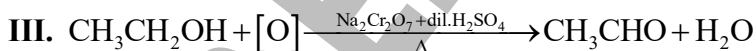
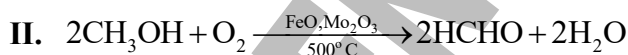
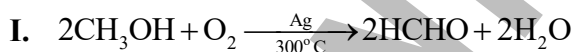


- B) A ketone can be represented by



- C) Ketone group is present in maltose, camphor and menthone  
D) The homologous series of both aldehydes and ketones have general formula  $\text{C}_n\text{H}_{2n}\text{O}$

Q.22 Preparatory methods of methanal, ethanal are given below:



Which of the following above methods is/are used for the preparation of methanal and ethanal respectively on the industrial scale?

- A) I and III  
B) II and IV  
C) I and IV  
D) III and IV

Q.23 Aldehydes and ketones show which of the following type of structural isomerism:

- A) Position isomerism  
B) Functional group isomerism  
C) Metamerism

USE THIS SPACE FOR  
SCRATCH WORK

D) Tautomerism

**Q.24** Which of the following tests is used for the identification of aldehydes only?

Options	Tests	Applications
A)	2,4-DNPH	Aldehydes and ketones form a yellow or red precipitate with 2,4-DNPH solution
B)	Addition of HCN	Aldehyde and ketone react with HCN to give cyanohydrins
C)	Benedict's solution test	Aliphatic aldehydes form a brick-red precipitate with Benedict's solution
D)	Reduction with $\text{NaBH}_4$	Aldehydes and ketones are reduced to alcohols with $\text{NaBH}_4$

**Q.25** Which of the following instruments is used in infrared spectroscopic technique?

- A) Photometer  
B) Spectrophotometer  
C) Polarimeter  
D) Refractometer

**Q.26** The infrared spectrum is divided into how many regions:

- A) 2  
B) 4  
C) 3  
D) 5

**Q.27** Which of the following techniques is used to identify functional groups of various classes of organic compounds?

- A) IR  
B) UV  
C) NMR  
D) X-rays

**Q.28** In which of the following wave number range ( $\text{cm}^{-1}$ ) the  $\text{C}=\text{O}$  (carbonyl group) is identified by using IR technique?

- A)  $3230 - 3550 \text{ cm}^{-1}$   
B)  $2500 - 3300 \text{ cm}^{-1}$   
C)  $3100 - 3500 \text{ cm}^{-1}$   
D)  $1680 - 1750 \text{ cm}^{-1}$

**Q.29** All of the following are applications of IR technique EXCEPT:

- A) It is widely used in inorganic and organic chemistry  
B) It is used in forensic analysis in criminal  
C) It is used to identify unsaturation in organic compounds  
D) It is used in measuring the degree of polymerization in polymer manufacture

**Q.30** IR spectroscopy can be applied to study and identify a substance if the sample of the substance is in the \_\_\_\_\_ state.

- A) Solid only  
B) Liquid only  
C) Solid, Liquid, Gas  
D) Both gas, Liquid

USE THIS SPACE FOR  
SCRATCH WORK

## ANSWER KEY (Worksheet-04)

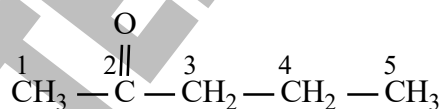
1	D	11	C	21	C
2	B	12	D	22	B
3	C	13	C	23	B
4	A	14	A	24	C
5	D	15	D	25	B
6	C	16	A	26	C
7	A	17	B	27	A
8	D	18	C	28	D
9	C	19	B	29	B
10	A	20	A	30	C

## ANSWERS EXPLAINED

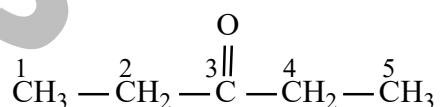
Q.1 (D) In fact, aldehydes and ketones do not show **hydrogen bonding**. They show dipole-dipole intermolecular forces.

Q.2 (B) It is incorrect statement. In fact, aldehydes **do not** show position isomerism because CHO group is always present at the terminal carbon atom of the carbon chain. However, ketones show position isomerism. It has been explained by examples:

- **Position isomerism.** The isomers having carbonyl group at different locations in the chain are called position isomers. e.g. pentanone can have carbonyl group at two different locations as shown below:



2-Pentanone



3-Pentanone

Q.3 (C) Ketones do not give polymerization whereas aldehydes such as methanal forms metaformaldehyde and ethanal form paraldehyde polymer.

Q.4 (A) Ketones produce a wine red or orange red colour on adding alkaline sodium nitroprusside solution dropwise.

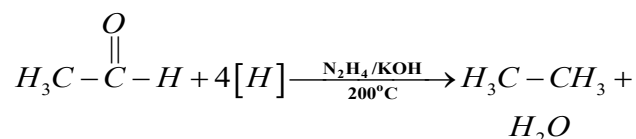
- While aldehydes do not give this test.

## ADDITIONAL INFORMATION

Alkaline sodium nitroprusside (SNP) ( $\text{Na}_2[\text{Fe}(\text{CN})_5\text{NO}]$ ) is used as a medicine to lower blood pressure. This may be done if the blood pressure is very high and resulting in symptoms, in certain types of heart failure, and during surgery to decrease bleeding. It is used by continuous injection into a vein.

Q.5 (D) Methanal does not give iodoform test while all others A, B and C give iodoform test.

Q.6 (C) The Wolff-Kishner reduction reaction is a reaction used in organic chemistry to convert carbonyl functionalities into methylene groups as shown in the reaction. In this reaction aldehyde is reduced to alkane with hydrazine in the presence of KOH.



Q.7 (A) Methanal is the most reactive aldehyde because it has no alkyl group. Since alkyl group is electron donating thus with the increase of alkyl groups, polarity of carbonyl group of carbonyl compounds decreases and



thus reactivity decreases. **Order of the reactivity of aldehyde is as shown:**

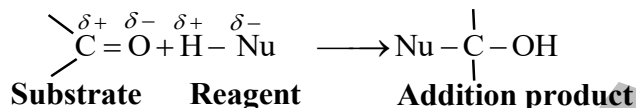
**Methanal > Ethanal > Propanal > Butanal.**

**Q.8 (D) 3-Pentanone**



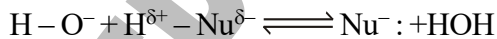
**does not** give iodoform test because **methyl ketones** can only give **iodoform test**. Other **A, B and C** give **iodoform test** they are **treated** as **methyl ketone**.

**Q.9 (C) In carbonyl compounds** carbon atom is electrophilic in nature. Therefore, most of the reactions of the carbonyl group will be considered to be nucleophilic addition reactions as shown below.



In these reactions of aldehydes and ketones, the negative part of the reagent combines with electrophilic carbon of the carbonyl group, whereas the positive part, which is usually hydrogen goes to the oxygen.

**Q.10 (A)** A base catalyzed reaction increases **nucleophilic** character of **attacking** reagent as shown in the reaction.

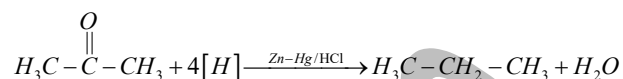


It is clear the  $Nu^-$  has more **nucleophilic character** than that of  $H^{\delta+} - Nu^{\delta-}$  because  $Nu^-$  has **more ionic character**.

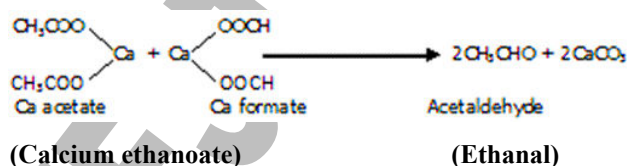
**Q.11 (C)** Aldehydes do not give  $\beta$ -elimination reaction.

**Q.12 (D)** Ketone is less reactive than aldehyde. So strong reducing agent is required for the complete reduction

of **ketone** into **alkane** as shown in the reaction

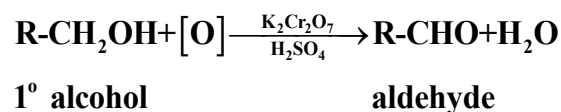


**Q.13 (C)** It is incorrect statement. In fact, on dry distillation cal.methanoate ethanal cannot be prepared. So in order to prepare ethanal dry distillation of both cal.methanoate and cal.ethanoate is done simultaneously as shown in reaction.

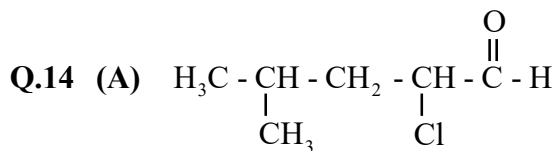
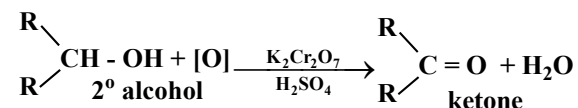


**Detail of the other reactions are given below**

A) On oxidation of  $1^\circ$  alcohol aldehyde is obtained



B) On oxidation of  $2^\circ$  alcohol ketone is obtained



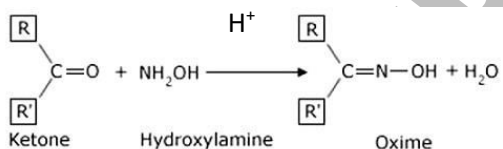
According to IUPAC the correct name of the given structure is **2-Chloro-4-methylpentanal**

**Q.15 (D)** Carbon is tetravalent. It can form **four covalent bonds**. Since in aldehyde group carbon atom forms

double bond with oxygen and **single bond** with hydrogen. So there is **one vacancy available** for making bond. That is why **aldehydes group** present at the **terminal carbon atom of carbon chain**. It cannot be placed in the **middle** of the carbon chain because in such condition carbon atom should **have two vacancies available** which is **not possible in this case**. Similarly **carboxylic acid group** ( $-\text{COOH}$ ) is always present at the **terminal carbon** of the **carbon chain**.

Q.16 (A) Aldehyde only acts as **reducing agent** when treated with **mild oxidizing agents** such as **Fehling's solution**, **Benedict reagent** and **Tollen's reagent**.

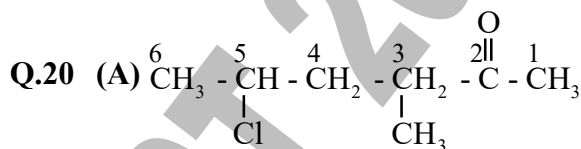
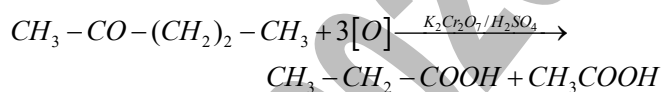
Q.17 (B) Aldehydes and ketones react with **ammonia derivative** in **acidic medium** as shown in the reaction e.g.



Q.18 (C) **Ketones** are **not easily oxidized** because the **carbonyl group** in ketones is **less polar** in nature. They show **oxidative cleavage phenomenon** rather than simple oxidation like aldehyde. That is why it **does not** react with **mild oxidizing agents** such as **Fehling's solution**, **Benedict reagent** and **Tollen's reagent**. It can only be oxidized in the presence of **strong oxidizing agent** such as  $\text{K}_2\text{Cr}_2\text{O}_7/\text{H}_2\text{SO}_4$ ,  $\text{KMnO}_4/\text{H}_2\text{SO}_4$  and **conc.  $\text{HNO}_3$** .

Q.19 (B) **2-Pentanone** on oxidation in the presence of **strong oxidizing agent** is converted into **propanoic acid** and

**ethanoic acid** as shown in the reaction. The oxidation of such ketone is in accordance to **Popoff's rule**. This rule states that in the case of ketones, the **carbonyl group** remains with the **smaller alkyl group** during oxidation.

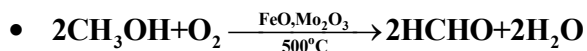


According to IUPAC the correct name of the given structure is **5-chloro-3-methyl-2-hexanone**.

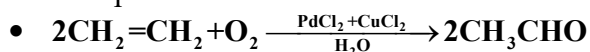
Q.21 (C) It is incorrect answer. In fact, ketone group is present only in **camphor** and **menthone** but not in **maltose**.

Q.22 (B) Following methods are used to prepare **methanal** and **ethanal** on the industrial scale as show by the reaction:

**Methanal** is manufactured on the industrial scale by passing mixture of **methanol vapours** and **air** over **iron oxide-molybdenum oxide** at **500°C**.



**Ethanal** is manufactured on the industrial scale by air oxidation of **ethene** using  **$\text{PdCl}_2$**  with  **$\text{CuCl}_2$**  promoter.



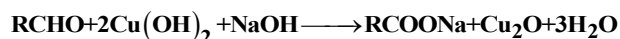
Ethene

Ethanal

Q.23 (B) Aldehydes and ketones show **functional group isomerism** e.g.

Propanal ( $\text{CH}_3\text{-CH}_2\text{-CHO}$ ) and propanone ( $\text{CH}_3\text{-CO-CH}_3$ ) show functional group isomerism.

- Q.24 (C) **Benedict's solution test:** (An alkaline solution containing a cupric citrate complex ion) aliphatic aldehydes form a brick-red precipitate with Benedict's solution. To an aldehyde solution, add Benedict's solution and boil, a brick-red precipitate of cuprous oxide are formed.



- Q.25 (B) Spectrophotometry is a method to measure how much a chemical substance absorbs light by measuring the intensity of light as a beam of light passes through sample solution. The basic principle is that each compound absorbs or transmits light over a certain range of wavelength.

A spectrophotometer measures either the amount of light reflected from a sample object or the amount of light that is absorbed by the sample object.

- Q.26 (C) The infrared portion of the electromagnetic spectrum is usually divided into three regions the near,

mid – and far – infrared named for their relation to the visible spectrum.

- Q.27 (A) **Infrared Spectroscopy** is the analysis of infrared light interacting with a molecule. This can be analyzed in three ways by measuring absorption, emission and reflection. The main use of this technique is in organic and inorganic chemistry. It is used by chemists to determine functional groups in molecules.

- Q.28 (D)

Bond	Functional Alcohols	Wave number / $\text{cm}^{-1}$
O – H	Alcohols	3230 – 3550
N – H	Amines	3100 – 3500
O – H	H – bonded in carboxylic acid	2500 – 3300
$\text{>C=O}$	Aldehydes ketone	1680 – 1750

- Q.29 (B) **IR-spectroscopy** has been successfully used in analysis and identification of pigments in paintings and other art objects such as illuminated manuscripts except it is used in forensic analysis in criminal.

- Q.30 (C) **IR spectroscopy** can be used to identify and study a substance. Sample of the substance can be in the solid, liquid or in the gaseous state.

## Worksheet-05

## (C. Organic Chemistry)

## Carboxylic Acid and Amino Acids

- Q.1** Which of the following is the weakest acid?  
A)  $\text{CH}_3\text{COOH}$  C)  $\text{Cl}_2\text{CHCOOH}$   
B)  $\text{ClCH}_2\text{COOH}$  D)  $\text{Cl}_3\text{COOH}$
- Q.2** Which of the following acids cannot be prepared directly from carboxylic acid?  
A) Acid halide C) Ester  
B) Acid amide D) Acid anhydride
- Q.3** All of the following methods are used to prepare carboxylic acids EXCEPT:  
A) By the oxidation of alcohol  
B) By acid hydrolysis of alkane nitrile  
C) By the reaction  $\text{R-Mg-Br}$  with  $\text{CO}_2$  followed by acid hydrolysis  
D) By the reduction of aldehydes
- Q.4** Which one of the following methods is used to prepare acid anhydride?  
A) Dehydration of carboxylic acid with  $\text{P}_2\text{O}_5$   
B) Reaction of carboxylic acid with  $\text{SOCl}_2$   
C) Reaction of carboxylic acid with  $\text{NH}_3$   
D) Reaction of carboxylic acid with alcohol in the presence of conc.  $\text{H}_2\text{SO}_4$
- Q.5** Which one of the following organic acids is the most reactive and the strongest acid?  
A)  $\text{HCOOH}$  C)  $\text{CH}_3\text{CH}_2\text{COOH}$   
B)  $\text{CH}_3\text{COOH}$  D)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$
- Q.6** Which of the following halosubstituted carboxylic acids is the strongest acid?  
A)  $\text{FCH}_2\text{COOH}$  C)  $\text{BrCH}_2\text{COOH}$   
B)  $\text{ClCH}_2\text{COOH}$  D)  $\text{ICH}_2\text{COOH}$
- Q.7** Organic compounds X and Y react together to form organic compound (Z). What type of compounds X, Y and Z be?

Options	X	Y	Z
A)	Acid	Ester	Alcohol
B)	Alcohol	Ester	Acid
C)	Ester	Alcohol	Acid
D)	Alcohol	Acid	Ester

USE THIS SPACE FOR  
SCRATCH WORK

## Topic-6+7

**Q.8 All of the following are optically active  $\alpha$ -amino acids EXCEPT:**

A) Glycine

### C) Valine

B) Aspartic acid

### D) Alanine

**Q.9** When an alkali is added to solution of  $\alpha$ -amino acids, \_\_\_\_\_ releases the proton. Therefore, the acidic character is due to?

A) – NH<sub>2</sub>

C)  $\text{COO}^-$ 

B)  $\text{NH}_3^+$

D) – COOH

**Q.10 Which of the following is correct structural formula of lysine?**

A)  $\text{H}_3\text{C}-\text{H}_2\text{C}-(\text{CH}_2)_2-\underset{\text{NH}_2}{\text{CH}}-\text{COOH}$

B)  $\text{CH}_3\text{-CH-CH-COOH}$   
 $\quad \quad | \quad \quad |$   
 $\quad \quad \text{CH}_3 \text{ NH}_2$

C)  $\text{H}_2\text{N}-\text{CH}(\text{CH}_2)_3-\underset{\substack{| \\ \text{NH}_2}}{\text{CH}}-\text{COOH}$

D)  $\text{CH}_3\text{-CH-COOH}$   
 $\quad\quad\quad |$   
 $\quad\quad\quad \text{NH}_2$

**Q.11**  $\alpha$ -amino acids are required for the synthesis of proteins. These  $\alpha$ -amino acids are sub-classified according to how the properties of other functional groups in the side chain (R-group) influence the system. Which of the following is not justified class of  $\alpha$ -amino acid under the given condition:

A) Non-polar (side chain e.g. alkyl group)

B) Polar (side chain e.g. amide, alcohols)

C) Acidic (side chain e.g. HCl)

D) Basic (side chain e.g. amine)

**Q.12** All of the following are uses of ethanoic acid EXCEPT:

A) Used as coagulant for latex in rubber industry

B) Used as a local irritant in medicine

C) Used in the manufacture of pickles

D) Used as an antiseptic in nasal infection

**USE THIS SPACE FOR**  
**SCRATCH WORK**



**Q.13** Which of the followings has comparatively less acidic character?

- A) Ethanoic acid                      C) Phenol  
B) Ethanol                              D) Water

**Q.14** Which reaction does not produce benzoic acid?

- A) By hydrolysis of  $\text{C}_6\text{H}_5\text{CO}_2\text{C}_2\text{H}_5$   
B) By hydrolysis of  $\text{C}_6\text{H}_5\text{CN}$   
C) By oxidation of toluene  
D) By oxidation of phenol

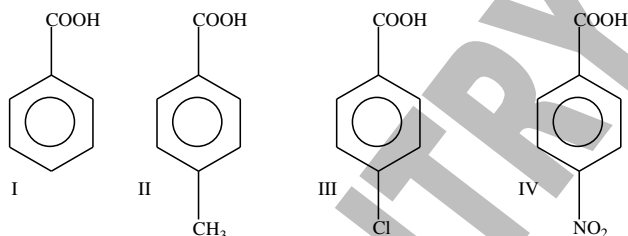
**Q.15** Which class of organic compounds is used for artificial flavorings in jams?

- A) Ester                                  C) Ketone  
B) Carboxylic acid                      D) Aldehydes

**Q.16** Which of the following compounds would react readily with NaOH?

- A)  $\text{R} - \text{NH}_2$                               C)  $\text{RCOOH}$   
B)  $\text{R} - \text{COCl}$                               D)  $\text{RCH}_2 - \text{OH}$

**Q.17** In the following carboxylic acids:



The decreasing order of acidic character is:

- A)  $\text{III} > \text{IV} > \text{I} > \text{II}$                       C)  $\text{I} > \text{IV} > \text{III} > \text{II}$   
B)  $\text{II} > \text{I} > \text{III} > \text{IV}$                       D)  $\text{IV} > \text{III} > \text{I} > \text{II}$

**Q.18** Amino acids have all of the following properties EXCEPT:

- A) They are colourless, crystalline solids  
B) They have low melting points  
C) They are soluble in water  
D) They behave like salts rather than simple amides and carboxylic acid

**Q.19** Which of the following carboxylic acids is prepared by acid hydrolysis of ethane nitrile?

- A) Methanoic acid                      C) Propanoic acid  
B) Ethanoic acid                        D) Butanoic acid

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**Q.20 Mark the incorrect statement about  $\alpha$ -amino acids:**

- A) They all have chiral carbon except glycine
- B) They are all L-amino acids
- C) 10 amino acids are called non-essential or dispensable amino acids
- D) Polypeptides act as acid only

**Q.21 Which of the following methods is used to prepare amines (mixture of amines) on the commercial scale?**

- A) Williamson's synthesis
- B) Strecker synthesis
- C) Wolf Kishner reduction reaction
- D) Hofmann's method

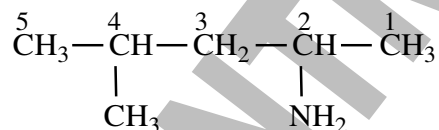
**Q.22 Dehydration of an acid amide gives:**

- A) Cyanide
- B) Isocyanide
- C) Amine
- D) Fatty acid

**Q.23 Hoffmann's bromamide reaction is used to prepare \_\_\_\_\_ amine from amides.**

- A) 1°
- B) 3°
- C) 2°
- D) 1° and 2°

**Q.24 Consider the following structure of primary amine:**



**The correct name of the above structure according to IUPAC is:**

- A) 4-Methyl pentan-2-amine
- B) 3-Methyl butan-2-amine
- C) 2-Methyl pentan-2-amine
- D) 4-Methyl pentan-3-amine

**Q.25 For which of the following type of amines carbylamine test gives positive reaction:**

- A) Prim. amine
- B) Sec. amine
- C) Tert. amines
- D) Both B and C

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SCRATCH WORK

**Q.26 The correct order of basic nature of the following:**

**$\text{CH}_3\text{NH}_2$ ,  $(\text{CH}_3)_2\text{NH}$ ,  $(\text{CH}_3)_3\text{N}$  and  $\text{NH}_3$  is:**

- A)  $(\text{CH}_3)_2\text{NH} > \text{CH}_3\text{NH}_2 > (\text{CH}_3)_3\text{N} > \text{NH}_3$
- B)  $\text{CH}_3\text{NH}_2 > (\text{CH}_3)_2\text{NH} > (\text{CH}_3)_3\text{N} > \text{NH}_3$
- C)  $(\text{CH}_3)_2\text{NH} > (\text{CH}_3)_3\text{N} > \text{NH}_3 > \text{CH}_3\text{NH}_2$
- D)  $\text{CH}_3\text{NH}_2 > (\text{CH}_3)_3\text{N} > \text{NH}_3 > (\text{CH}_3)_2\text{NH}$

**Q.27 Reaction of ethanoic acid with ammonia gives:**

- A) Ethane amide
- B) Ethane nitrile
- C) Ethyl amine
- D) Nitro methane

**Q.28 Which of the following compounds is expected to be strongest base?**

- A) Hydroxylamine
- B) Methylamine
- C) Aniline
- D) Ethylamine

**Q.29 Which of the following types of isomerism is not shown by aliphatic amines?**

- A) Chain isomerism
- B) Position isomerism
- C) Metamerism
- D) Tautomerism

**Q.30 Electrophoresis is not used for the separation of:**

- A) Nucleic acids
- B) Amino acids
- C) Proteins
- D) Lipids

**Q.31 In gel electrophoresis, how do we make the DNA migrate through the gel?**

- A) We place a negative electrode away from the walls
- B) Large fragments drift to the end of the gel
- C) We place a positive electrode away from the walls
- D) Gravity

**Q.32 In electrophoresis, the electrophoretic mobility ( $\mu$ ) determines the characteristics of migration of different biomolecules. Which of the following is not having any influence in  $\mu$ :**

- A) Stereochemistry of molecule
- B) Molecular weight
- C) Size of molecule
- D) Net charge of molecule

**Q.33 Which of the following derivatives of carboxylic acid is the most reactive?**

- A) Acid amide
- B) Acid halide
- C) Ester
- D) Acid anhydride

USE THIS SPACE FOR  
SCRATCH WORK

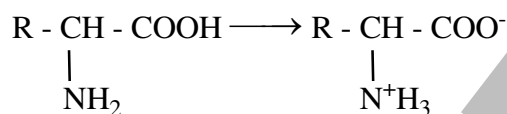
**Q.34** In which of the following reactions acid chloride produces aldehyde?

- A) Reaction with  $H_2$                       C) Hydrolysis  
B) Reaction with  $NH_3$                   D) Reaction with Alcohol

**Q.35** Which of the following method is/are not used to prepare primary amines?

- A) By the reduction of acid amide  
B) By reductive amination of aldehyde or ketones  
C) By catalytic hydrogenation  $H_2/Pt$   
D) By the reaction of Grignard reagent with  $NH_3$

**Q.36** Each molecule of  $\alpha$ -amino acid can interact within itself due to its basic  $-NH_2$  group and its acidic  $-COOH$  group. This is called zwitter ion:



Which of the following characteristics features is/are shown by zwitterion?

- A) In zwitterion the German zwei means two  
B) It is amphoteric in nature  
C) It is crystalline solid and soluble in water  
D) All of these

**Q.37**  $\alpha$ -amino acid molecules can react with each other, the acid  $-COOH$  group in one molecule reacts with the basic  $-NH_2$  group in another molecule, when two  $\alpha$ -amino acids react together, the resulting molecule is called:

- A) Peptide                                  C) Polypeptide  
B) Dipeptide                                D) Tripeptide

**Q.38** On the acid hydrolysis of acid amide, which of the following product is obtained:

- A) Alkane nitrile  
B) Sod. salt of carboxylic acid  
C) Primary amine  
D) Carboxylic acid

**Q.39** Which of the following derivatives of carboxylic acid is least reactive?

- A) Acid halide                              C) Ester  
B) Acid amide                                D) Acid anhydride

USE THIS SPACE FOR  
SCRATCH WORK

## ANSWER KEY (Worksheet-05)

1	A	11	C	21	D	31	B
2	B	12	D	22	A	32	A
3	D	13	B	23	A	33	B
4	A	14	D	24	A	34	A
5	A	15	A	25	A	35	D
6	A	16	C	26	A	36	D
7	D	17	D	27	A	37	B
8	A	18	B	28	D	38	D
9	B	19	B	29	D	39	B
10	C	20	D	30	D	40	

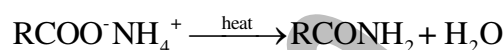
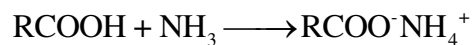
## ANSWERS EXPLAINED

- Q.1 (A) Acid strength increases by increasing a number of electron-withdrawing substituents (e.g. Cl- group) on the carbon next to the **-COOH group**. Order of decreasing acidic strength is as follow  $\text{Cl}_3\text{CCOOH} > \text{Cl}_2\text{CHCOOH} > \text{ClCH}_2\text{COOH} > \text{CH}_3\text{COOH}$

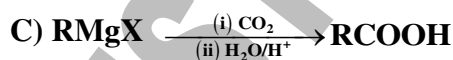
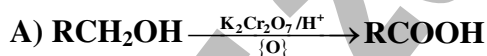
- Greater is  $K_a$  value (or less  $pK_a$  value) stronger is the acid

Carboxylic acid/Substituted carboxylic acid	$K_a$ value	$pK_a$ value
$\text{Cl}_3\text{CCOOH}$	$23200 \times 10^{-5}$	0.60
$\text{Cl}_2\text{CHCOOH}$	$5530 \times 10^{-5}$	1.26
$\text{ClCH}_2\text{COOH}$	$136 \times 10^{-5}$	2.87
$\text{CH}_3\text{COOH}$	$1.7 \times 10^{-5}$	4.76

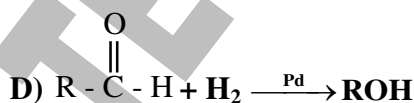
- Q.2 (B) Because when **carboxylic acid** is treated with **ammonia**, first of all ammonium salt of carboxylic acid is formed which on heating produces acid amide as shown in the reaction



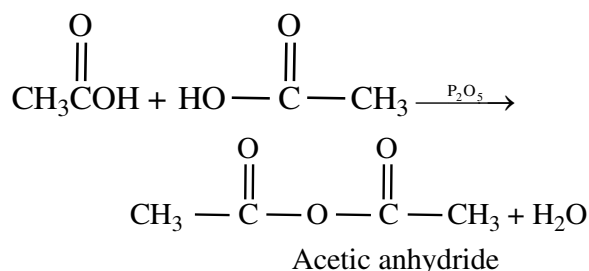
- Q.3 (D) In fact, by the reduction of aldehydes, alcohols are obtained instead of carboxylic acids. Detail of all preparatory methods of carboxylic acids are given below:



(Carbonylation reaction)



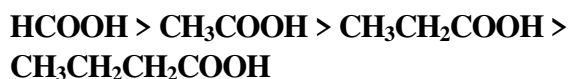
- Q.4 (A) Acid anhydride is prepared when carboxylic acids are dehydrated on heating strongly in the presence of phosphorus pentoxide as shown below in the reaction e.g.





**Q.5 (A)** Methanoic acid is very reactive and stronger acid because with the increase of alkyl group polarity of carboxyl group decreases and strength of the acid also decreases.

- Because alkyl group is electron-donating group and it decreases polarity and thus deprotonation of carboxylic acid decreases with the increase of alkyl group.
- Order of reactivity and strength of acid is given below.



- Their  $K_a$  are given as respectively.

$$1.8 \times 10^{-4} > 1.8 \times 10^{-5} > 1.34 \times 10^{-5} > 1.52 \times 10^{-5}$$

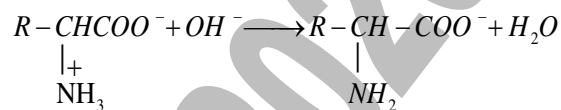
**Q.6 (A)** The electron-withdrawing tendency of a substituent depends upon its electronegativity. More electronegative substituent will have **greater electron-withdrawing** tendency.



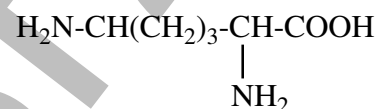
**Q.7 (D)** Compounds **X, Y and Z** stand for **Alcohol, carboxylic acid** and ester respectively. **X and Y** react with each other in the presence of **conc.  $\text{H}_2\text{SO}_4$**  to form **ester**. It is known as esterification or condensation reaction.

**Q.8 (A)** **Glycine** is not optically active compound because it **does not** contain asymmetric carbon atom (**Chiral carbon**).

**Q.9 (B)** When an **alkali** is added to an  **$\alpha$ -amino acid**, (in the form of **zwitter ion**)  **$-\text{NH}_3^+$**  group releases the proton and therefore, the acidic character is due to this group.



**Q.10 (C)** The correct structure formula of **lysine** is

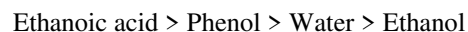


**Q.11 (C)** It is **incorrect** statement. The correct statement is as follow:

- **20  $\alpha$ -amino acids** can be sub-classified according to how the properties of other functional groups in the 'R' group influence the system.
- **Non—polar side chains** (e.g. alkyl groups)
- **Polar** (e.g. amides alcohols)
- **Acidic** (carboxylic acids, phenols)
- **Basic** (e.g. amines)

**Q.12 (D)** In fact it is used as local irritant but not as an antiseptic in nasal infection.

**Q.13 (B)** **Order of strength of acidic character** is given as follow:

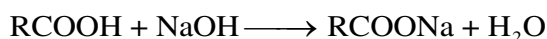


$$1.76 \times 10^{-5} > 1.3 \times 10^{-10} > 1.0 \times 10^{-14} > 10^{-16}$$

**Q.14 (D)** Benzoic acid **cannot** be prepared by oxidation of **phenol**. Others **A, B, C methods** are used to **prepare Benzoic acid**.

**Q.15 (A)** **Ester (a class of organic compounds)** is used for artificial flavorings in **jams**.

**Q.16 (C)** **Carboxylic acid (RCOOH)** would react readily with **NaOH** as shown in the reaction:



**Q.17 (D)** Their **decreasing order** of acidic character is as follow **IV > III > I > II**

- The electron releasing group **-OH, -NH<sub>2</sub>, -CH<sub>3</sub>** etc. tend to decrease strength of benzoic acid.
- The electron withdrawing groups such as **-NO<sub>2</sub>, -Cl** etc. tend to increase the strength of benzoic acid.

**Q.18 (B)** In fact, amino acid have high melting points.

**Q.19 (B)** By acid hydrolysis of ethane nitrile ethanoic acid is obtained as shown in the reaction:



**Q.20 (D)** **Polypeptides** are amphoteric because of the presence of **free -NH<sub>2</sub>** and **-COOH** groups. Therefore they can be treated as **acids** and **bases**.

**Q.21 (D)** **Hofmann's method:**

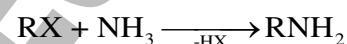
Haloalkanes when heated with an ethanolic solution of ammonia in a sealed tube at 100°C, a mixture of the three amines and some quaternary

ammonium salt are obtained. This reaction is called ammonolysis.

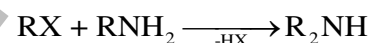
- This method is used for the industrial preparation of amines.
- The three amines so obtained can be separated from the quaternary ammonia salt by boiling with KOH, when the quaternary salt is left behind, and the three amines distil over.
- These can be separated from each other by fractional distillation:

#### Preparations of amines

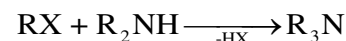
- **Primary amine:**



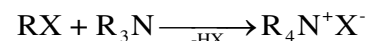
- **Secondary amine:**



- **Tertiary amine:**

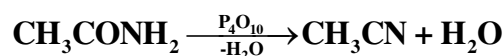


- **Quaternary salt:**



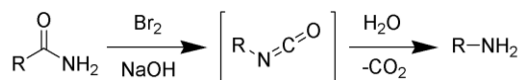
**Q.22 (A)** Amides are dehydrated by heating a solid mixture of the amide and phosphorus (V) oxide **P<sub>4</sub>O<sub>10</sub>**.

- Water is removed from the amide group to leave a nitrile group, **-CN**. The liquid nitrile is collected by simple distillation.
- e.g. on the dehydration of ethanamide, in the presence of **P<sub>2</sub>O<sub>5</sub>** ethane nitrile is obtained as shown in the reaction.



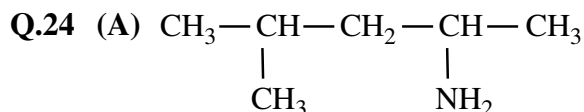
**Q.23 (A)** **Hoffmann's-bromide (or hypobromide) reaction:**

This reaction is also known as Hoffmann's rearrangement of amides. Treatment of acid amides with bromide and caustic potash gives primary amines having one carbon less than the amide.



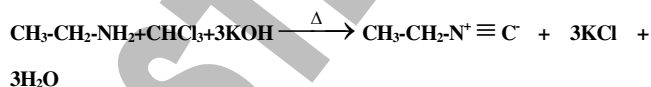
### Isocyanate

The reaction is named after its discoverer - August Wilhelm von Hofmann. This reaction is also sometimes called the Hofmann degradation or the Harmon Process.



The correct name of the above structure according to IUPAC is 4-Methyl pentan-2-amine.

Q.25 (A) The carbylamine reaction, also known as Hoffmann's isocyanide test is a chemical test for detection of primary amines. In this reaction, the analyte is heated with alcoholic potassium hydroxide and chloroform. If a primary amine is present, the isocyanide (carbylamine) is formed which are foul smelling substances.



The carbylamine test does not give a positive reaction with secondary and tertiary amines.

Q.26 (A) The basicity of amines is often discussed indirectly in terms of the acidity of their respective conjugate acids.

- Recall that the conjugate acid of a weak base (e.g. like water) is a strong acid (like hydronium ion), while the conjugate acid of a strong base (like hydroxide ion) is a weak acid (like water).
- The concept of pK<sub>a</sub> has already been developed as a measure of the acidity of Bronsted acids, and we will also see that a corresponding concept, pK<sub>b</sub> can be used as a measure of the basicity of bases and that these two quantities are very closely related.
- Consider the acid dissociation, in dilute aqueous solution, of ammonia and a representative primary, secondary, and tertiary amine.
- The correct order of basic nature of the following  $\text{CH}_3\text{NH}_2$ ,  $(\text{CH}_3)_2\text{NH}$ ,  $(\text{CH}_3)_3\text{N}$  and  $\text{NH}_3$  is  $(\text{CH}_3)_2\text{NH} > \text{CH}_3\text{NH}_2 > (\text{CH}_3)_3\text{N} > \text{NH}_3$ .
- The relative decreasing order of basic character can be justified on the basis of K<sub>b</sub> and pK<sub>b</sub> value as shown in the tabular form.

Type of amines and ammonia	K <sub>b</sub>	pK <sub>b</sub>
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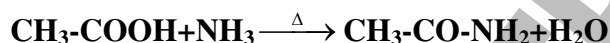
I. $(\text{CH}_3)_2\text{NH}$	$5.4 \times 10^{-4}$	3.27
II. $\text{CH}_3\text{NH}_2$	$4.5 \times 10^{-4}$	3.35
III. $(\text{CH}_3)_3\text{N}$	$0.6 \times 10^{-4}$	4.22
IV. $\text{NH}_3$	$1.8 \times 10^{-5}$	4.74

The observed order of basic strength of amines and ammonia is as follow:



- Thus the basic strength of aliphatic amines is governed by the following three factors:
- Electron-releasing tendency of the alkyl groups
- Solvation tendency of the protonated amine
- Steric effects of the alkyl groups

Q.27 (A) By the reaction of ethanoic acid with ammonia, ethane amide is obtained as shown in the reaction:



Q.28 (D) The strongest base among the following is ethylamine.

Q.29 (D) Tautomerism is not shown by aliphatic amines while chain isomerism, position isomerism and metamerism are shown by aliphatic amines.

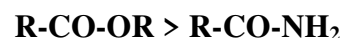
Q.30 (D) Electrophoresis is the motion of dispersed particles relative to a fluid under the influence of a spatially uniform electric field. It is used for the separation of proteins, amino acids, nucleic acids but not for lipids.

Q.31 (B) Gel electrophoresis is a laboratory method used to separate mixtures of

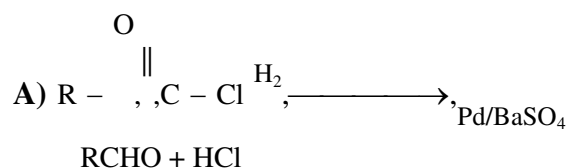
DNA, RNA, or proteins according to molecular size. In gel electrophoresis, the molecules to be separated are pushed by an electrical field through a gel that contains small pores.

Q.32 (A) In electrophoresis, the electrophoretic mobility ( $\mu$ ) determines the characteristics of migration of different biomolecules by the size of molecule, molecular weight and net charge on the molecule but stereochemistry of molecule is not involved in electrophoresis.

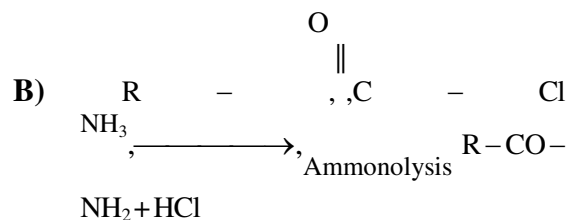
Q.33 (B) Among the derivative of carboxylic acid, acid halide is more reactive because halogen group is good leaving. Order of reactivity of derivative of carboxylic acid is given below:



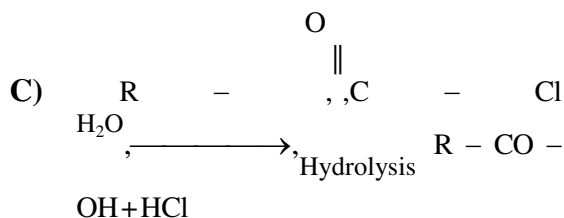
Q.34 (A) When acid chloride is treated with hydrogen, aldehyde is produced in the presence of Pd/BaSO<sub>4</sub>. Detail of all the reactions is given below:



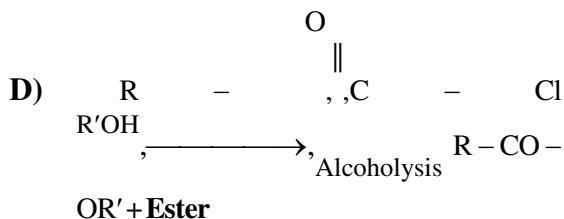
Aldehyde



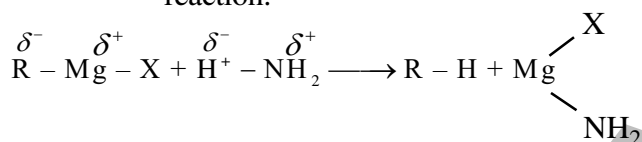
Acid amide



Carboxylic acid

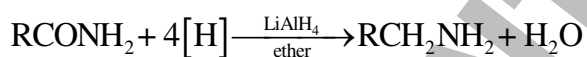


**Q.35 (D)** When Grignard reagent is treated with ammonia, alkane is produced along with side product as shown in the reaction:

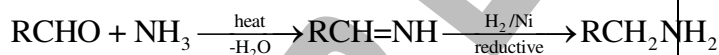


Methods which are used to prepare amine are as:

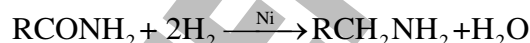
A) By the reduction of acid amide



B) Reductive amination of aldehyde or ketones



C) By catalytic hydrogenation  $\text{H}_2/\text{Pt}$



**Q.36 (D)** All are the characteristics of zwitter ion.

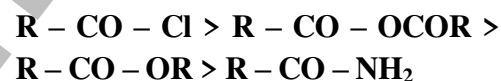
**Q.37 (B)** Amino acid molecules can react with each other, the acid  $-\text{COOH}$  group in one molecule reacts with the basic  $-\text{NH}_2$  group in another molecule. When two amino acids react

together, the resulting molecule is called dipeptide.

**Q.38 (D)** On the acidic hydrolysis of acid amide carboxylic acid is obtained along with side product as shown in the reaction:



**Q.39 (B)** The order of reactivity of derivatives of carboxylic acid is as follow:



This order clearly shows that acid amide is the least reactive.



**Worksheet-06**  
**(C. Organic Chemistry)**  
**Macromolecules**

**Q.1 Nylon-6,6 is a type of condensation polymerization. Its monomers are:**

- A) Hexane-1,6-diamine and Hexanedioic acid
- B) Hexane-1,2-diamine and Hexanedioic acid
- C) Hexane-1,4-diamine and Hexanedioic acid
- D) Hexane-1,5-diamine and Hexanedioic acid

**Q.2 Which of the following intermolecular force is dominant in Nylon-6,6?**

- A) Dipole dipole forces
- B) Hydrogen bonding
- C) Debye forces
- D) London dispersion forces

**Q.3 Nylone-6,6 has all of the followings properties EXCEPT:**

- A) It is a textile fibre
- B) It has high strength
- C) It has abrasion resistance
- D) It has very low elasticity

**Q.4 There are two types of polymerization i.e. addition and condensation. Condensation polymerization has all of the following properties EXCEPT:**

- A) It involves two different monomers
- B) It take place with the elimination of small molecules
- C) It involves catalyst
- D) It molar mass is not fixed

**Q.5 Polyester  $\left( \text{O}-\text{CH}_2-\text{CH}_2-\text{O}-\overset{\text{O}}{\parallel}{\text{C}}-\text{C}_6\text{H}_4-\overset{\text{O}}{\parallel}{\text{C}} \right)_n$  is a type of condensation polymerization. Its monomers are:**

- A) 1,2-Ethanediol and Benzene-1,4-dicarboxylic acid
- B) 1,3-Propanediol and Benzene-1,2-dicarboxylic acid
- C) 1,1-Ethanediol and Benzene-1,3-dicarboxylic acid
- D) 1,4-Butanediol and benzoic acid

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- Q.6 Polyester is also known as terylene or Darcon. Identify the incorrect statement about the uses of polyester:**
- A) It is used as summer suiting by blending with cotton
  - B) It is used as winter suiting by blending with wool
  - C) It is used to make bristles for brushes
  - D) It is used to make seat belts
- Q.7 Polymers can be classified on the basis of thermal properties i.e. thermoplastic polymers and thermosetting polymers. Thermosetting polymers show all of the following properties EXCEPT:**
- A) They are formed by condensation polymerization
  - B) They do not involve chemical change on heating
  - C) They decompose on heating
  - D) They are cross linked polymers
- Q.8 Mark the incorrect statement about thermoplastic polymers:**
- A) They are formed by addition polymerization
  - B) They melt on heating and harden again on cooling
  - C) They are more brittle and insoluble in organic solvents
  - D) They can be remoulded, recast and reshaped
- Q.9 All of the following are thermosetting polymers EXCEPT:**
- A) Polystyrene
  - B) Bakelite
  - C) Synthetic varnish
  - D) Terylene
- Q.10 All of the following are thermoplastic polymers EXCEPT:**
- A) PVC
  - B) Teflon
  - C) High density polyethylene (HDPE)
  - D) Nylon-6,6
- Q.11 Which of the following is a synthetic polymer?**
- A) Animal fat
  - C) Polyester

B) Starch

D) Cellulose

**Q.12** Plastics are pollution problem because many plastics:

A) Are made from petroleum

B) Are very in flammable

C) Burn to produce toxic fumes

D) De compose to produce products

**Q.13** A polymeric substance that is formed in the liquid state and then harden to a rigid solid is called a:

A) Animal fibre

C) Plastic

B) Mineral fibre

D) Polyamide resin

**Q.14** Polyvinylchloride (PVC) is an addition polymer obtained by polymerizing vinylchloride at 25°C and 9.0 atmospheric pressure. Which one of the following is not use of PVC?

A) It is used for floor coverings

B) It is used in pipe making

C) It is used in making gramophone recorders

D) It is used for making toys

**Q.15** Polystyrene is an addition polymer obtained by polymerization of styrene in the presence of catalyst. Which one of the following is not use of polystyrene?

A) It is used as an adhesive material

B) It is used for making cosmetic bottles

C) It is used for making packing material

D) It is used for making food containers

**Q.16** Mark the pair of macromolecules which have same type of linkage:

A) Proteins and nylon

C) Nylon and polyethylene

B) Protein and PVC

D) PVC and Bakelite

**Q.17** Which of the following polymers is formed through free radical mechanism?

A) Nylon-6,6

C) PVC

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B) Polyester

D) Bakelite

**Q.18 Which of the following is not nitrogen base?**

A) Adenine

C) Guanine

B) Caesein

D) Thymine

**Q.19 All of the following have peptide linkage EXCEPT:**

A) Nylon-6,6

C) Protein

B) Terylene

D) Nylon-6,10

**Q.20 Mark the incorrect statement about deoxyribonucleic acid (DNA):**

A) It is hereditary material

B) It is double stranded molecule

C) It is present in the nucleus and cytoplasm of a cell

D) It has the property of self-replication

**Q.21 All of the following are addition polymers EXCEPT:**

A) Polyvinyl chloride

C) Polyvinyl acetate

B) Polyethylene

D) Polyester

**Q.22 Which of the following is not correctly matched?**

Options	Polymer	Monomers
A)	Nylon-6,6	Adipic acid and Hexamethylene diamine
B)	Polyester	Terephthalic acid and Ethylene glycol
C)	Polyacrylonitrile	Acrylic acid
D)	Bakelite	Phenol and Formaldehyde

**Q.23 The sequence of the amino acids combined in a peptide chain is referred to as the \_\_\_\_\_ of protein:**

A) Primary structure

C) Tertiary structure

B) Secondary structure

D) Quaternary structure

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Q.24 The \_\_\_\_\_ structure of a protein is a regular coiling or zigzagging of polypeptide chains caused by hydrogen bonding between  $\text{>NH}$  and  $\text{C=O}$  groups of amino acids near each other in the chains.

- A) Primary structure                      C) Tertiary structure  
B) Secondary structure                  D) Quaternary structure

Q.25 Which of the following is not natural polymer?

Options	Types	Examples
A)	Polysaccharides	Starch, Cellulose and Glycogen
B)	Proteins (Polyamides)	Albumins, Globulins and enzymes
C)	Nucleic acids (Polynucleotides)	DNA and RNA
D)	Natural rubber	Neoprene

Q.26 All of the following co-factors correctly match with their respective enzyme EXCEPT:

Options	Co-factors	Enzymes
A)	$\text{Fe}^{+2}$	Chromic oxidase
B)	$\text{Zn}^{+2}$	Carbonic anhydrase
C)	$\text{Mg}^{+2}$	Glucose-6-phosphatase
D)	Vitamin B1	Thiamine glucose phosphatase

Q.27 Which of the following is not naturally occurring compounds belonging to steroids?

- A) Cholesterol                              C) Alkaloids  
B) Ergosterol                                D) Phospholipids



**Q.28** Monosaccharides, disaccharides and polysaccharides differ in the following characteristics EXCEPT:

Opt.	Property	Saccharides		
		Mono	Di	Poly
A)	Hydrolysis	No action	Yields two monosacchrides	Yields a large number of monosaccharides
B)	Solubility in water	Soluble	Soluble	Insoluble
C)	Optical activity	Non-active	Non-Active	Active
D)	Physical state	Crystalline	Crystalline	Amorphous

USE THIS SPACE FOR  
SCRATCH WORK

**Q.29** Identify the incorrect statement about oils and fats:

Opt.	Oils	Fats
A)	They are triglycerides of unsaturated fatty acids	They are triglycerides of saturated fatty acids
B)	They are liquids at room temperature	They are solids at room temperature
C)	They are obtained from plants	They are obtained from animals
D)	They are not easily digested	They are easily digested

**Q.30** Which of the following is the most abundant carbohydrates?

- A) Starch  
B) Cellulose  
C) Glycogen  
D) Raffinose

**Q.31** Which of the following is an example of derived protein?

- A) Collagen  
B) Oligopeptides  
C) Lipoprotein  
D) Lactoglobulin

**Q.32** Which of the followings are known as sugars?

- A) Monosaccharides only  
B) Disaccharides only  
C) Both monosaccharides and disaccharides  
D) Neither monosaccharides nor oligosaccharides

**Q.33** Which of the following is not reducing sugar?

- A) Glucose  
B) Maltose  
C) Sucrose  
D) Galactose

**Q.34 Mark the incorrect statement for starch and cellulose:**

Options	Starch	Cellulose
A)	Polymer of $\alpha$ -D glucose	Polymer of $\beta$ -D glucose
B)	Branched polymer	Unbranched polymer
C)	Used in the photographic film	Used in the sizing of paper
D)	Sources (Wheat, rice, maize, potatoes)	Sources (Cotton is 99% and woody parts has more than 50% cellulose)

**Q.35 The specific substance (metabolite) that fits on the enzyme surface and is converted to products is called:**

- A) Co-factor                      C) Isoenzyme  
B) Prosthetic group              D) Substrate

**Q.36 Mark the incorrect statement for acid hydrolysis of carbohydrates:**

- A) Lactose  $\xrightarrow{\text{H}_2\text{O}/\text{H}^+}$  Fructose + Galactose  
B) Sucrose  $\xrightarrow{\text{H}_2\text{O}/\text{H}^+}$  Glucose + fructose  
C) Maltose  $\xrightarrow{\text{H}_2\text{O}/\text{H}^+}$  2 Glucose units  
D) Starch  $\xrightarrow{\text{H}_2\text{O}/\text{H}^+}$  1<sup>st</sup> maltose and finally D.Glucose

**Q.37 Which is incorrectly matched?**

- A) Steroids name-perhydrocyclopentanophenanthrene  
B) Lipid – Triester  
C) Terylene – terephthalic acid and glycerol  
D) Polystyrene – styrene

**Q.38 Starch has all of the following uses EXCEPT:**

- A) As an indicator in iodimetry titration  
B) As a bread  
C) For stiffening of clothes  
D) Used as an indicator in acid base titration

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- Q.39** Trisaccharide which yields three monosaccharide on hydrolysis have molecular formula:
- A)  $C_{18}H_{32}O_{16}$                       C)  $C_{18}H_{34}O_{17}$   
B)  $C_{18}H_{36}O_{18}$                       D)  $C_{18}H_{30}O_{15}$
- Q.40** Which one of the following is not called "food factor"?
- A) Proteins                              C) Lipids  
B) Carbohydrates                      D) Nucleic acids
- Q.41** The enzyme that catalyze the transfer of groups within molecules to yield isomeric forms is called:
- A) Lyase                                  C) Hydrolase  
B) Ligase                                  D) Isomerase
- Q.42** Which one of the following is an exact composition of a carbohydrates?
- A) Carbon and hydrogen  
B) Carbon, hydrogen and oxygen  
C) Carbon and oxygen  
D) Hydrogen and oxygen
- Q.43** Amylose is soluble in water and gives deep \_\_\_\_\_ colour with iodine.
- A) Yellow                                  C) Blue  
B) Pink                                      D) Red
- Q.44** The number of milligrams of potassium hydroxide required to neutralize one gram of a fat or an oil is called:
- A) Acid number                          C) Octane number  
B) Iodine number                          D) Saponification number
- Q.45** Collagen proteins are present in \_\_\_\_\_ throughout the body.
- A) Muscles                                  C) Tendons  
B) Red blood cells                          D) Blood plasma
- Q.46** Many enzymes contain a protein part and non-protein part. The protein part of enzyme is called:
- A) Apoenzyme                              B) Holoenzyme  
C) Co-factor                                  D) Co-enzyme

USE THIS SPACE FOR  
SCRATCH WORK

**Q.47 The rate of enzymatic reaction is directly proportional:**

- A)  $[\text{Enzyme}]^2$                       C)  $\sqrt{[\text{Enzyme}]}$   
B)  $[\text{Enzyme}]^3$                       D)  $[\text{Enzyme}]$

**Q.48 Which of the following statements about glucose and sucrose is incorrect?**

- A) Both are naturally occurring  
B) Both are water soluble  
C) Both are disaccharide  
D) Both are carbohydrates

**Q.49 Extent of unsaturation in a fat or an oil is expressed in terms of:**

- A) Acid number                      C) Saponification  
B) Iodine number                      D) Rancidity

**Q.50 Fats are a type of lipid called glycerides, they are esters of long chain carboxylic acids and:**

- A) Propene-1,2,3-triol                      C) Propene-1,2,3-diol  
B) Propane-1,2,3-diol                      D) Propane-1,2,3-triol

**ANSWER KEY (Worksheet-06)**

1	A	11	C	21	D	31	B	41	D
2	B	12	C	22	C	32	C	42	B
3	D	13	C	23	A	33	C	43	C
4	C	14	D	24	B	34	C	44	A
5	A	15	A	25	D	35	D	45	C
6	C	16	A	26	D	36	A	46	A
7	B	17	C	27	C	37	C	47	C
8	C	18	B	28	C	38	D	48	C
9	A	19	B	29	D	39	A	49	B
10	D	20	C	30	B	40	D	50	D

**ANSWERS EXPLAINED**

- Q.1 (A)** Its monomers are Hexane-1,6-diamine ( $\text{NH}_2(\text{CH}_2)_6\text{NH}_2$ ) and hexanedioic acid ( $\text{HOOC}(\text{CH}_2)_4\text{COOH}$ ). As a result of condensation polymerization of monomers nylon-6,6 is formed along with side product water. Other options B, C and D are not correct names of monomers required for nylon-6,6.
- Q.2 (B)** Nylon-6,6 is also known as polyamide. Because it has peptide bond and there is hydrogen bonding in nylon-6,6.
- Other options are irrelevant.
- Q.3 (D)** It is incorrect statement.
- In fact, it has high elasticity. Other properties are shown by nylon-6,6.
- Q.4 (C)** Condensation polymerization does not involve catalyst. Catalyst is used in addition polymerization. Other properties are shown by condensation polymerization.
- Q.5 (A)** Polyester is a type of condensation polymerization. Its monomers are 1,2-ethanediol and Benzene-1,4 dicarboxylic acid. As a result of condensation of the said monomers

polyester is formed along with side product water.



- Q.6 (C)** In fact polyester is not used to make bristles for brushes. Bristles for brushes are made by nylon-6,6. All other properties (A, B, D) are shown by polyesters.
- Q.7 (B)** Thermosetting polymers become hard on heating. As a result of chemical change they cannot be re-melted. They decompose on heating.
- Q.8 (C)** In fact they are less brittle and soluble in some organic solvents. Example of thermoplastic polymers are polyethylene, Teflon, Polyacrylonitrile etc.
- Q.9 (A)** Polystyrene is not an example of thermosetting plastic because it is formed by addition polymerization. Thermosetting polymers are formed as a result of condensation polymerization.
- Q.10 (D)** In fact, nylon-6, 6 is not an example of thermoplastic polymer. Because on heating it becomes hard and then it can never be re-melted.
- Q.11 (C)** Polyester is a synthetic polymer. It is formed by condensation of 1,2-ethanediol and Benzene-1,4 dicarboxylic acid. Others animals fat, starch and cellulose are biopolymers because they are formed by living organisms.
- Q.12 (C)** Plastics are pollution problem because many plastics on burning produce toxic fumes which are very harmful and are one of the major cause of air pollution.
- Q.13 (C)** Plastic is a synthetic polymer and it is formed in the liquid state and then become hard on cooling.

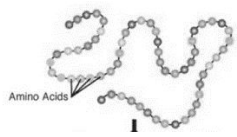
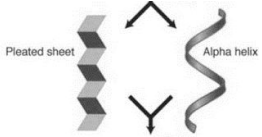


- Q.14 (D)** It is incorrect statement. In fact Polystyrene or polyethylene are used to make toys
- Q.15 (A)** Polystyrene is not used as an adhesive material. In fact polyvinyl acetate (PVA) is used an adhesive material and as a binder for emulsion paints. However other properties are shown by polystyrene.
- Q.16 (A)** Both proteins and nylons have polypeptide bonds and thus they have same type of linkage. Others do not have peptide bonds.
- Q.17 (C)** PVC polymer is formed by addition polymerization which involves free radical mechanism. Free radical is formed in the initiation step. Other are propagation and termination steps. (in other words free radical mechanism involves three steps i.e. initiation, propagation and termination.
- Q.18 (B)** Casein is not nitrogen base. In fact, it is main protein present in milk and (in coagulated form) in cheese. It is used to make buttons, food production, beverage, pharmaceutical, cosmetics, agriculture / animal feed.
- Q.19 (B)** In the formation of terylene (polyester), ethane 1,2 diol and Benzne 1,4 dicarboxylic acid are used as monomers it does not involve peptide linkage. Peptide linkage is involved in (A, B, D).
- Q.20 (C)** In fact, DNA is not present in the cytoplasm. It is a hereditary material and carries and transfers information from the parent to the offspring. Although RNA is present in both nucleus and cytoplasm.

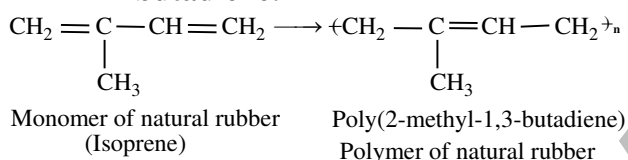
- Q.21 (D)** Polyester is condensed polymer and it is synthesized by the reaction of terephthalic acid and ethylene glycol which are used as monomers.
- Q.22 (C)** It is incorrect statement. In fact, polyacrylonitrile is an addition polymer. Its monomer is acrylonitrile ( $\text{CH}_2=\text{CH}-\text{CN}$ ) polyacrylonitrile is used for the preparation of synthetic fiber.
- Q.23 (A)** The sequence of the amino acids combined in a peptide chain is referred to as the primary structure.
- Q.24 (B)** Difference between primary and secondary of proteins.

Primary Protein	Secondary Protein
<ul style="list-style-type: none"> <li>The sequence in which amino acids are arranged in a polypeptide chain of the protein is called its primary structure.</li> <li>Proteins hydrolyze through a number of steps to form <math>\alpha</math>-amino acid</li> <li>e.g. Proteins <math>\rightarrow</math> Proteoses <math>\rightarrow</math> Peptones <math>\rightarrow</math> Polypeptides <math>\rightarrow</math> Simple peptides <math>\rightarrow</math> <math>\alpha</math>-Amino acids</li> </ul>	<ul style="list-style-type: none"> <li>The conformation (or, shape) which the polypeptide chain of a protein molecule acquires due to the secondary bonding such as, hydrogen bonding between the carbonyl and amino groups, is called the secondary structure of the protein.</li> <li>e.g. The protein molecules gain addition structural strength by coiling up the polypeptide chains to form a helix. There are two types of helix</li> <li>e.g.</li> <li>I. <math>\alpha</math>-Helix structure (coiled or spiral form)</li> <li>II. <math>\beta</math>-Flat sheet (in horizontal position) and <math>\beta</math>-pleated sheet</li> </ul>

	(in the folded form)
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Primary structure of proteins	Secondary structure of proteins
	

**Q.25 (D)** It is incorrect statement. In fact, Poly(2-methyl-1,3-butadiene is an example of natural rubber. It resembles with synthetic rubber (neoprene) it is obtained by polymerization of 2-Methyl-1,3-butadiene:



**Q.26 (D)** Also named Thiamine or Thiamine diphosphate (TPP), Vitamin B<sub>1</sub> is a cofactor for oxidative decarboxylation both in the Kreb's Cycle and in converting pyruvate to acetyl-CoA (an important molecule used in the citric acid cycle of metabolism). It is widely available in the human diet and particularly present in wheat germ and yeast. It's functionality results from a thiazole ring which stabilizes charge and electron transfer through resonance.

**Q.27 (C)** Alkaloids are plant-produced basic compounds which contain one or more nitrogen heterocyclic rings.

Name of alkaloids	Functions
Nicotine	Rising the blood pressure
Caffeine	Stimulating nerves
Atropine	Dialating the pupils of the eyes
Morphine	Relieving pain

Quinine	Cure/prevention of malaria
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**Q.28 (C)** It is incorrect statement. In fact, the correct statement is given in the tabular form:

Options	Property	Saccharides		
		Mono	Di	Poly
A)	Hydrolysis	No action	Yield two monosaccharide	Yields a large number of monosaccharide
B)	Solubility in water	Soluble	Soluble	Insoluble
C)	Optical activity	Active	Active	Non-active
D)	Physical state	Crystalline	Crystalline	Amorphous

**Q.29 (D)** It is incorrect statement. In fact, the correct statement is given in the tabular form:

Options	Oils	Fats
D)	Are easily digested because they are triglycerides of unsaturated fatty acids	Are not easily digested because they are triglycerides of saturated fatty acids

**Q.30 (B)** Cellulose is the most abundant polysaccharide.

**Q.31 (B)**

(A) Collagen (Simple protein)  
 (B) Oligopeptides (Derived proteins)  
 (C) Lipoprotein (Compound or conjugated proteins)

**Q.32 (C)** Both monosaccharides and disaccharides are known as sugars. The degree of sweetness varies widely among various sugars as shown in the tabular form:

Sugars	Sweetness value
Sucrose	100
Glucose	74
Fructose	173
Galactose	32
Maltose	32

Lactose	16
---------	----

**Conclusion:** From the table it is clear that fructose is the sweetest of sugars and it has **maximum sweetness value (173)** while **lactose has minimum sweetness value (16)**.

**Q.33 (C)** Sugars (carbohydrates) may also be classified on the basis of their chemical nature, as

- Reducing sugars
- Non-reducing sugars

Reducing sugars	Non-reducing sugars
<ul style="list-style-type: none"><li>• All sugars which contain free aldehyde or ketonic group are called reducing sugars.</li></ul>	<ul style="list-style-type: none"><li>• All sugars (carbohydrates) which do not contain free aldehyde or ketonic group are called non-reducing sugars.</li></ul>
<ul style="list-style-type: none"><li>• They can reduce Fehling's solution or Tollen's reagent.</li></ul>	<ul style="list-style-type: none"><li>• They cannot reduce Fehling's solution or Tollen's reagent.</li></ul>
<ul style="list-style-type: none"><li>• e.g. All monosaccharides, maltose, Galactose</li></ul>	<ul style="list-style-type: none"><li>• e.g. sucrose</li></ul>

**Q.34 (C)** It is incorrect statement. In fact, the correct statement is given in the tabular form:

Options	Starch	Cellulose
C)	Used in the sizing of paper	Used in the photographic film

**Q.35 (D)** The specific substance (metabolite) that fits on the enzyme surface and is converted to products is called substrate.

**Q.36 (A)** It is incorrect statement. In fact, lactose on hydrolysis gives glucose and galactose.

**Q.37 (C)** It is incorrect statement. In fact, monomers of terylene polymer are terephthalic acid and ethylene glycol.

**Q.38 (D)** It is incorrect statement. In fact, starch is used as indicator in iodimetry titration but not in acid base titration.

**Q.39 (A)** **Raffinose** ( $C_{18}H_{32}O_{16}$ ) is a trisacchride which on hydrolysis gives three monosaccharides.

**Q.40 (D)** Nucleic acid is not called food factor while carbohydrates, fats and proteins are known as major food factors which are needed for human body.

**Q.41 (D)** The enzyme that catalyze the transfer of groups within molecules to yield isomeric forms is called **isomerase**.

**Q.42 (B)** **The composition of carbohydrates is carbon, hydrogen and oxygen.**

**Q.43 (C)** Amylose is soluble in water and gives deep **blue** colour with iodine.

**Q.44 (A)** The number of milligrams of potassium hydroxide required to neutralize one gram of a fat or an oil is called **acid number**.

**Q.45 (C)** Collagen proteins are present in **tendons** throughout the body.

**Q.46 (A)** Many enzymes contain a protein part and non-protein part. The protein part of enzyme is called **apoenzyme**.

**Q.47 (C)** The rate of enzymatic reaction is directly proportional  $\sqrt{[Enzyme]}$ .

**Q.48 (C)** **It is incorrect statement. In fact, glucose is monosaccharide and sucrose is disaccharide.**

**Q.49 (B)** Extent of unsaturation in a fat or an oil is expressed in terms of **iodine number**.

**Q.50 (D)** Fats are a type of lipids called glycerides, they are esters of saturated fatty acids and **propane-1,2,3-triol**.

STEP ENTRY TEST 2020

**Worksheet-07****(B. Inorganic Chemistry)****Periods**

**Q.1** Which one of the following isoelectronic species has comparatively smaller size?

- A) Ar C)  $\text{Cl}^-$   
B)  $\text{P}^{3-}$  D)  $\text{S}^{2-}$

**Q.2** Mark the incorrect statement about ionization energy:

- A) It is an index of metallic character  
B) Elements having stable electronic configuration have greater ionization energy  
C) It is always endothermic process  
D) Elements having greater ionization energy have high electron affinity

**Q.3** Elements in the periodic table can be classified on the basis of the following EXCEPT:

- A) Acidic and basic character  
B) Valence orbital  
C) Electrical conductivity  
D) Valence shell

**Q.4** Mark the incorrect statement about the period and group in the modern periodic table:

Opt.	Period	Group
A)	It is horizontal row of elements from left to right	It is vertical column of elements from top to bottom
B)	It is the number of shells involved in the electronic configuration of an element	It is the number of electrons present in the valence shell of atom of an element
C)	There are eight periods	There are sixteen groups
D)	It is shown by Arabic numerals	It is shown by Roman numerals

**Q.5** All of the following periodic properties increase along

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the period EXCEPT:

- A) Ionization energy  
B) Atomic size  
C) Electron affinity  
D) Electronegativity

**Q.6 All of the following statements about 1<sup>st</sup> ionization energy of elements are incorrect EXCEPT:**

- A)  $O > N$   
B)  $Be > B$   
C)  $Al > Mg$   
D)  $Ne > He$

**Q.7 The periodic table provides a basic framework to study the periodic behaviour of:**

- A) Physical properties only  
B) Chemical properties only  
C) Physical and chemical properties of elements as well as their compounds  
D) Metal and non – metals

**Q.8 Magnesium (Mg) is a metal while Chlorine (Cl) is a non-metal, but even then they both:**

- A) Belong to the same period  
B) Belong to the same group  
C) Are oxidizing agent  
D) Are reducing agent

**Q.9 Atomic size of an element depends on:**

- A) Number of inner shells only  
B) Nuclear charge only  
C) Both A and B  
D) Neither A nor B

**Q.10 Which one of the following elements has less electronegativity value?**

- A) N  
B) O  
C) F  
D) C

**Q.11 Which of the following is polar molecule?**

- A)  $CO_2$   
B) NO  
C)  $BF_3$   
D)  $SO_3$

**Q.12 Which of the following periodic properties has no unit?**

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A) Ionization energy

C) Atomic radius

B) Electron affinity

D) Electronegativity

**Q.13 Mark the incorrect statement about electronegativity (E.N)?**

A) The maximum E.N is that of F element in the periodic table

B) The minimum E.N is that of Cs element in the periodic table

C) It is the property of an element in the isolated form

D) It has no unit

**Q.14 Consider the following applications of electronegativity (E.N):**

- I. If the E.N difference between two bonded atoms is zero or less than 0.5, then the bond is said to be non-polar covalent bond
- II. If the E.N difference between two bonded atoms is 1.7, then the bond is said to be 50% covalent and 50% ionic bond
- III. If the E.N difference between two bonded atoms is 1.6 or more than 0.5, then the bond is said to be polar covalent bond
- IV. If the E.N difference between two bonded atoms is greater than 1.7, then the bond is said to be covalent in nature

**Which one of the above statements is incorrect?**

A) I only

C) IV only

B) II and III only

D) I, II, III and IV

**Q.15 Which of the following statements does not match correctly for electron affinity and electronegativity?**

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Opt.	Electron Affinity	Electronegativity
A)	It is the energy released or absorbed, when an electron is added to a gaseous atom to form a negative ion	It is the power of an atom to attract shared pair of electrons in a molecule. It is concerned with the attraction for electrons of atoms in molecules
B)	It is concerned with the attraction for electrons of single gaseous atoms	It is associated with atom of element in the molecule
C)	Its unit is $\text{kJmol}^{-1}$	It has no unit
D)	It cannot be measured directly. It has relative value	It can be measured directly

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**Q.16** Which of the following transition element does not have oxidation number according to group number?

- A) Mn (VII)  
B) Cu (I)  
C) Zn (II)  
D) Cr (V)

**Q.17** Which of the following is true about Na, Si and S?

- A) Their chlorides are ionic solid  
B) Covalent bond is found in most of the compounds  
C) They are in the same period of the periodic table  
D) They are in the same group of the periodic table

**Q.18** The apparent charge that an atom would have in a compound is called oxidation state (O.S).

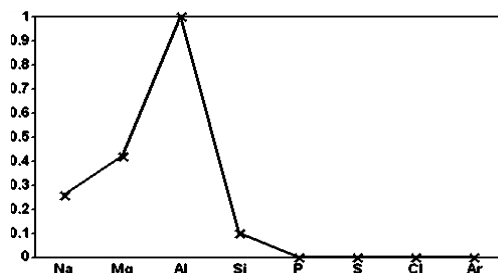
**Consider the following statements about O.S:**

- I. In ionic compounds, the number of electrons which an atom loses or gains is its O.S
- II. In a covalent compounds, the O.S of an element is decided by the difference of electronegativity between two atoms In a covalent compound, the element with greater electronegativity has negative O.S
- III. In a covalent compound, the element with less electronegativity has positive O.S

Which of the above statement about O.S is / are correct?

- A) III only  
B) II only  
C) I and II  
D) I, II and III

Q.19 The trend shown by the following graph is for:



- A) Electrical conductivity  
B) Boiling point  
C) Ionization energy  
D) Atomic size

Q.20 Electrical conductivity in metal increases down the group.

What is the correct order of conductivity in IB?

- A)  $\text{Cu} > \text{Ag} > \text{Au}$   
B)  $\text{Ag} > \text{Cu} > \text{Au}$   
C)  $\text{Cu} < \text{Ag} < \text{Au}$   
D)  $\text{Ag} > \text{Au} > \text{Cu}$

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**ANSWER KEY (Worksheet-07)**

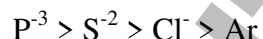
1	A	11	B
2	D	12	D
3	D	13	C
4	C	14	C
5	B	15	D
6	B	16	D
7	C	17	C
8	A	18	D
9	C	19	A
10	D	20	B

**ANSWERS EXPLAINED**

- Q.1 (A)** Argon (Ar) has comparatively smaller size as shown in the tabular form:

Species	Radius (om)
$P^{-3}$	212
$S^{-2}$	184
$Cl^{-}$	181
Ar	94

- Order of decreasing size of isoelectronic species is as follow:



- Q.2 (D)** In fact, elements having stable electronic configuration have greater ionization energy and lower electron affinity e.g. N atom has half-filled **p-subshell** electronic configuration ( ${}_{7}N = 1s^2, 2s^2, 2p^3$ ) and its  $IE_1$  is  $1402 kJmol^{-1}$  whereas its **electron affinity** is  $-7 kJmol^{-1}$ .

- Q.3 (D)** Elements in the periodic table **cannot** be classified into four blocks (**s, p, d and f**) on the basis of valence shell because valence shell is the outermost shell. The number of electrons present in the valence shell determine group of the elements.

- Elements in the periodic table can be classified into four blocks. This

classification is based upon the valence orbital of the element involved in chemical bonding.

- Q.4 (C)** It is incorrect statement. In fact, there are seven periods and eighteen groups in the modern periodic table.

- Q.5 (B)** Along the period as the **nuclear charge** increases with the **increase** in **atomic number**, electrons in the valence shell are pulled closer to the **nucleus**. Thus the overall **size** of the atom **decreases**.

- Q.6 (B)** **Be > B**. In fact first **ionization energy** ( $IE_1$ ) of **Be** is greater than that of **B** because in  ${}_4Be (1s^2, 2s^2)$  s-subshell is completely filled and has stable electronic configuration and has comparatively greater  $IE_1$  than that of  ${}_5B (1s^2, 2s^2, 2p^1)$ . **B** has one electron in 2p-subshell and is comparatively less stable and has lower  $IE_1$ .

**Be** ( $IE_1 = 900 kJmol^{-1}$ ),

**B** ( $IE_1 = 801 kJmol^{-1}$ )

- Q.7 (C)** The periodic table provides a basic framework to study the periodic behaviour of physical and chemical properties of elements as well as their compounds.

- Q.8 (A)** Both belong to the same period  
 ${}_{12}Mg (2,8,2)$  number of shells involved  
= 3 (period = 3)  
 ${}_{17}Cl (2,8,7)$  number of shells involved  
= 3 (period = 3)

- Q.9 (C)** With the increase of number of inner shells, atomic size of an atom increases because nucleus hold on the valence electrons decreases. e.g. in IIA group size of Mg is greater



than that of Be. This happens in a group.

With the increase of nuclear charge, size of atom decreases e.g. size of Be is smaller than that Li. This happens in a period.

**Q.10 (D)** Carbon has less electronegativity value as shown in the tabular form.

Elements	E.N
N	3.0
O	3.5
F	4.0
C	2.5

**Q.11 (B)** NO is a polar molecule because it has electronegativity difference 0.5 (O = 3.5, N = 3.0).

**Q.12 (D)** Electronegativity has no unit.

**Q.13 (C)** It is the property of an element in the associated form (i.e. in the molecular form).

**Q.14 (C)** It is incorrect statement. The correct statement is as follow.

- If the E.N difference between two bonded atoms is greater than 1.7, then the bond is said to be ionic in nature

**Q.15 (D)** It is incorrect statement.

The correct statement is as follow:

Opt.	Electron Affinity	Electronegativity
D)	It can be measured directly	It cannot be measured directly. It has relative value

**Q.16 (D)**

Elements	Groups	Examples	O.S per atom
Mn	VIIB	$K^{+7}MnO_4$	Mn (VII)
Cu	IB	$Cu^{+2}_2O^{-2}$	Cu (I)
Zn	IIB	$Zn^{+2}O^{-2}$	Zn (II)
Cr	VIB	$K^{+2}_2Cr^{+12}_2O^{-14}_7$	Cr (VI)

**Q.17 (C)** They are in the same period of the periodic table.

**Q.18 (D)**

- In ionic compounds, the number of electrons which an atom loses or gains is its O.S
- In a covalent compounds, the O.S of an element is decided by the difference of electronegativity between two atoms In a covalent compound, the element with greater electronegativity has negative O.S
- In a covalent compound, the element with less electronegativity has positive O.S

**Q.19 (A)**

- Electrical conductivity increases from Na to Al because it depends on number of free electrons.
- From Na to Al number of free electrons increase and thus electrical conductance increases upto Al.

Prop.	Metals	Metalloid	Non-metals
Examples	Na, Mg and Al	Si	P, S, Cl and Ar
Conductor/Non-conductor	Good conductor	Poor conductor	Non-conductor
Electrical Conductance ( $\text{ohm}^{-1} \text{cm}^{-4}$ )	$10^{-3}$	$10^{-5}$	$10^{-10}$
Effect of increase in temperature	Conductivity slowly falls	Conductivity usually increase	No effect

**Q.20 (B)** The correct order of conductivity of IB is as follow:  $\text{Ag} > \text{Cu} > \text{Au}$

## Worksheet-08

## (B. Inorganic Chemistry)

## Groups

Q.1 Which one of the following properties of IIA group elements increases down the group?

- A) Melting points and boiling points C) Reducing power  
B)  $\Delta H_{\text{hyd}}$  D) Electron affinity

Q.2 Which of the following elements of IIA group is so reactive that it must be stored under oil to keep it out of contact with air?

- A) Mg C) Sr  
B) Ca D) Ba

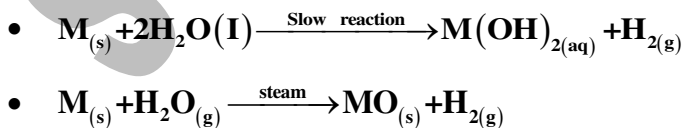
Q.3 Which of the following statements is incorrect about IIA and VIIA group elements?

Opt.	IIA group elements	VIIA group elements
A)	They are metals	They are non-metals
B)	They form acidic oxide	They form basic oxides
C)	They have tendency to lose electrons	They have tendency to gain electrons
D)	They have general electronic configuration in the valence shell $ns^2$	They have general electronic configuration in the valence shell $ns^2, np^5$

Q.4 Which of the following elements of IIA group does not react with water even at red hot temperature?

- A) Mg C) Ca  
B) Be D) Ba

Q.5 Which of the following elements reacts with cold water slowly but reacts with steam vigorously. General reaction of a metal is shown in the given equations?



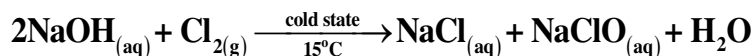
- A) Mg C) Sr

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- B) Ca D) Ba
- Q.6 Which of the following elements of IIA forms amphoteric oxide when treated with oxygen at 800°C?**
- A) Be C) Sr  
B) Ca D) Mg
- Q.7 Which one of the following halogens cannot displace all the other halogens in redox reactions?**
- A) F<sub>2</sub> C) Br<sub>2</sub>  
B) Cl<sub>2</sub> D) I<sub>2</sub>
- Q.8 In which of the following pair of halogens, first halogen is least volatile and second is the most volatile?**
- A) I<sub>2</sub>, F<sub>2</sub> C) Br<sub>2</sub>, Cl<sub>2</sub>  
B) F<sub>2</sub>, Br<sub>2</sub> D) I<sub>2</sub>, Br<sub>2</sub>
- Q.9 Mg is a metal while chlorine is a non-metal, but even then they have a common property. Which of the following is that property?**
- A) Both are reducing agents  
B) Both belong to the same period  
C) Both are oxidizing agents  
D) Both belong to the same group
- Q.10 Halogens show all of the following properties EXCEPT:**
- A) Among the halogens, F<sub>2</sub> is the strongest oxidizing agent  
B) Among the halogens acids, HI is the strongest acid  
C) Among the oxyacids of Cl, HClO<sub>4</sub> is the strongest acid  
D) Among halogens, F has maximum electron affinity
- Q.11 All of the following are uses of halogens EXCEPT:**
- A) Chlorination of water is used to kill germs  
B) Fluoridation of water is done to stop dental decay process in human beings  
C) Flame-retardant plastics do not contain chlorine  
D) Tincture of iodine is used for dressing of wounds as an antiseptic
- Q.12 Which of the following is not use of helium (He)?**
- A) It is used to fill fluorescent tubes  
B) It is used in weather balloons  
C) A mixture of 80%, He and 20% O<sub>2</sub> is used for breathing by the sea divers  
D) It is used as a cooling medium for nuclear reactors

**Q.13** Consider the following reaction of chlorine with aqueous sodium hydroxide in the cold state:



Which of the following is type of above reaction?

- A) Acid base reaction
- B) Disproportionation reaction
- C) Elimination reaction
- D) Double displacement reaction

**Q.14** Which of the following halogens acts as a bleaching agent?

- A)  $\text{F}_2$
- B)  $\text{Cl}_2$
- C)  $\text{Br}_2$
- D)  $\text{I}_2$

**Q.15** Which one of the following is use of radon?

- A) It is used in radiotherapy for cancer treatment
- B) It is used in electric light bulb
- C) It is used in bactericidal lamps
- D) It is used in making advertising sign

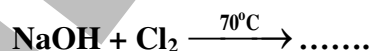
**Q.16** Which of the following oxides is unlikely to be dissolved in sodium hydroxide?

- A)  $\text{MgO}$
- B)  $\text{SiO}_2$
- C)  $\text{Al}_2\text{O}_3$
- D)  $\text{NO}_2$

**Q.17** Which of the following properties decreases down the group in case of halogens?

- A) Covalent and ionic radii
- B) Van der waal's forces
- C) Electronegativity
- D) Melting points and boiling points

**Q.18** When chlorine ( $\text{Cl}_2$ ) is heated with hot concentrated aqueous  $\text{NaOH}$  solution at  $70^\circ\text{C}$ , a disproportionation reaction takes place as shown below?



Which of the following products are formed?

- A)  $\text{NaCl}$ ,  $\text{NaClO}$
- B)  $\text{NaClO}_3$ ,  $\text{H}_2\text{O}$
- C)  $\text{NaClO}_3$ ,  $\text{NaCl}$ ,  $\text{H}_2\text{O}$
- D)  $\text{NaClO}_3$ ,  $\text{NaClO}$

**Q.19** Identify the incorrect statements about IIA group

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elements:

- A) They are known as alkaline earth metals
- B) They have two electrons in the outermost shell and occupy s sub-shell
- C) Their atomic radii increase down the group
- D) Ionization energy of Ca is higher than that of Mg

**Q.20** When small amount of chlorine is added to water supply, it will kill bacteria and make water safe to drink. As a result of reaction of  $\text{Cl}_2$  with water  $\text{HOCl}$  and  $\text{HCl}$  are produced. One theory suggests that  $\text{HOCl}$  produces reactive \_\_\_\_\_ species that will kill bacteria in water.

- A)  $[\text{H}]$
- B)  $[\text{Cl}]$
- C)  $[\text{O}]$
- D)  $[\text{HCl}]$

**Q.21** Which of the following halogen acids is the least stable thermally?

- A)  $\text{HF}$
- B)  $\text{HCl}$
- C)  $\text{HBr}$
- D)  $\text{HI}$

**Q.22** Beryllium becomes passive on reaction with conc.  $\text{HNO}_3$  because:

- A) It is non-reactive metal
- B) It forms stable layer of oxide
- C) It has non-reactive nature with the acid
- D) It has small size

**Q.23** Oxidizing power of halogens does not depend on:

- A) Electron affinity of atom
- B) Hydration energies of ions
- C) Energy of dissociation
- D) Density

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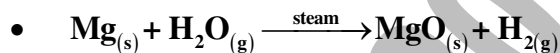
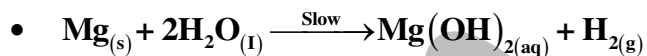
**ANSWER KEY (Worksheet-08)**

1	C	11	C	21	D
2	D	12	A	22	B
3	B	13	B	23	D
4	B	14	B		
5	A	15	A		
6	A	16	A		
7	D	17	C		
8	A	18	C		
9	B	19	D		
10	D	20	C		

**ANSWERS EXPLAINED**

- Q.1 (C)** Reducing power of IIA group elements increases down the group because down the group number of inner shells increase, atomic radii increase, and shielding effect increases. As a result ionization energy decreases and metallic character increases and thus reducing power of IIA group elements increases.
- Q.2 (D)** In IIA group chemical reactivity of elements increases because atomic size increases with the increase of shielding effect. As a result, nucleus hold on the valence electrons decreases. That is why Ba element of IIA group is so reactive that it must be stored under oil to keep it out of contact with air.
- Q.3 (B)** It is incorrect statement. In fact,
- The elements of IIA group form basic oxide e.g. MgO, CaO.
  - The elements of VIIA group form acidic oxide e.g. Cl<sub>2</sub>O<sub>7</sub>.
- Q.4 (B)** This is because Be has smaller size, stronger nucleus hold on the valence shell electrons and thus has less chemical reactivity.

**Q.5 (A)** Mg reacts with cold water slowly but reacts vigorously with steam as shown in the reaction:

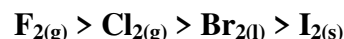


**Q.6 (A)** In IIA group, beryllium is the least reactive metal. It is resistant to complete oxidation and stable in air at ordinary temperature but oxidizes rapidly at about 800°C and forms amphoteric oxide as shown in the reaction:



- BeO is amphoteric in nature

**Q.7 (D)** I<sub>2</sub> is the weakest oxidizing agent among all the halogens because it has smaller standard reduction potential (+0.54V) value and smaller electronegativity (2.5). So it cannot displace all the halogens such as F<sub>2</sub>, Cl<sub>2</sub> and Br<sub>2</sub> in the redox reactions. Order of decreasing oxidizing power of halogens is as follow:



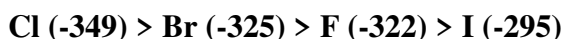
**Q.8 (A)** There are only weak van der waal's forces between their diatomic halogen molecules. These forces increase as the number of electrons in the molecules increases with increasing atomic number. Greater is the number of electrons greater are the opportunities for instantaneous dipole arising within molecules, and for induced dipole to be produced on neighboring molecules. So the larger the molecular size, stronger the van der waal's forces between molecules and thus making iodine the least volatile and fluorine the most volatile of the halogens.

**Q.9 (B)** Mg and Cl have only common property that they belong to the same period i.e. **3<sup>rd</sup> period** as shown by their electronic configuration:

- $_{12}\text{Mg}$  ( $1s^2, 2s^2, 2p^6, 3s^2$ )
- $_{17}\text{Cl}$  ( $1s^2, 2s^2, 2p^6, 3s^2, 3p^5$ )

This configuration clearly shows that these two elements belong to same period (i.e. 3<sup>rd</sup> period).

**Q.10 (D)** In fact, among the halogens, **chlorine** element has **greater electron affinity**. **Order of decreasing** electron affinity in halogens is as follow (unit of electron affinity  $\text{kJmol}^{-1}$ ).



**Q.11 (C)** In fact, flame-retardant plastics often contain **bromine and chlorine**.

**Q.12 (A)** In fact, **Krypton (Kr)** is used to fill fluorescent tubes and in flash lamps for high speed photography not **Helium (He)**.

**Q.13 (B)** It is self-oxidation reduction reaction. One Cl-atom is reduced from  **$\text{Cl}^0$  to  $\text{Cl}^-$**  (such as in  $\text{Na}^+\text{Cl}^-$ ) and other atom of Cl is oxidized from  **$\text{Cl}^0$  to  $\text{Cl}^{+1}$**  (such as in  $\text{Na}^+\text{Cl}^{+1}\text{O}^{-2}$ ) in the redox reaction.

**Q.14 (B)**  $\text{Cl}_2$  gas acts as a **bleaching agent**.

- Other bleaching agents are  $\text{O}_3$ ,  $\text{ClO}_2$ ,  $\text{H}_2\text{O}_2$ ,  $\text{NaOCl}$  and  $\text{SO}_2$  (temporary bleaching agent)

**Q.15 (A)** **Radon** being radioactive is used in **radiotherapy for cancer and for earth quake prediction**.

**Q.16 (A)** **MgO** is basic in nature and it **does not dissolve in NaOH solution**. A is **amphoteric** while B and D are **acidic in nature**. They (A, B and D) can react with NaOH except MgO.

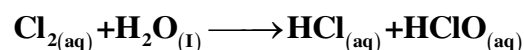
**Q.17 (C)** **Electronegativity of halogens decreases down the group, because atomic size and shielding effect increase.**

Property	F	Cl	Br	I
Electronegativity	4.0	3.0	2.8	2.5

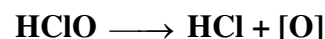
**Q.18 (C)**  $6\text{NaOH} + 3\text{Cl}_2 \xrightarrow{70^\circ\text{C}} 5\text{NaCl} + \text{NaClO}_3 + \text{H}_2\text{O}$ . The reaction **clearly shows** that the **product formed** are **NaCl,  $\text{NaClO}_3$ ,  $\text{H}_2\text{O}$** .

**Q.19 (D)** Ionization energy of Ca is **lower** than that of Mg (**first ionization energy  $738\text{kJmol}^{-1}$** ) because the size of Ca (**first ionization energy  $595\text{kJmol}^{-1}$** ) is **greater** than that of Mg. **Greater** is the **size**, **smaller** is the **ionization energy**.

**Q.20 (C)** When  $\text{Cl}_2$  is added in water then as a result of reaction **HCl and HOCl** are produced as shown in the equation

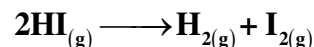


**HOCl is unstable and decomposes slowly in solution. One theory suggests that it produces reactive oxygen atoms that can kill bacteria in water as shown in the equation.**



**Q.21 (D)** The halogen acids get less thermally stable going down the group as explained below.

- The hydrogen halides formed differ in their thermal stability.
- Hydrogen iodide can be decomposed by inserting a red-hot wire into a sample of hydrogen iodide gas. The purple fumes seen are iodine vapour:



- By contrast, **HF and HCl** are not decomposed in temperatures upto  **$1500^\circ\text{C}$** .

- Hydrogen bromide is not as stable as HF and HCl, but it is more resistant to decomposition than hydrogen iodide. At 430°C in a closed container, 10% of a sample of HBr will decompose, whereas around 20% of HI decompose at that temperature.
- Order of thermal stability of hydrides of halogens (halogen acids):**
- HF > HCl > HBr > HI**
- We can explain this by looking at the bond energies of the hydrogen-halogen bonds as shown in the tabular form.

Halogen acids	Bond energy (kJmol <sup>-1</sup> )
HF	566
HCl	431
HBr	366
HI	299

- Conclusion:**  
From the bond energy value it is clear thermal stability decreases downward.
- Reason:** HI decomposes because of low bond energy
- On the other hand HF and HCl have high bond energy so they cannot decompose easily.

Bond energy decreases downward

Most thermally stable HF  
↓  
Least thermally stable HI

HCl  
HBr

Q.22 (B) Beryllium becomes passive on reaction with conc. HNO<sub>3</sub> because it forms stable layer of oxide.

Q.23 (D) If a halogen has a low energy of dissociation, a high electron affinity and a higher hydration energy of its ions, it will have a high oxidizing power.

- Oxidizing power of halogens does not depend upon density.



## Worksheet-09

## (B. Inorganic Chemistry)

## Transition Elements

**Q.1** Which of the following is correct formula for general electronic configuration of d-block elements?

- A)  $(n-1)d^{1-10} ns^{1-2}$  C)  $(n-1)d^{1-5} ns^{1-2}$   
B)  $(n-1)d^{10} ns^2$  D)  $(n-1)d^{1-10} ns^2$

**Q.2** All of the following transition elements show variable oxidation state EXCEPT:

- A) Fe C) Zn  
B) Cr D) Cu

**Q.3** Mark the incorrect statement about transition elements of 3d-series:

- A) All the elements show +2 oxidation state  
B) They show variable oxidation because of the involvement of the unpaired d-electrons in addition to s-electrons  
C)  $Fe^{+3}$  ion is more stable than  $Fe^{+2}$  ion  
D) First four elements in the highest oxidation state use all of the s and d electrons for bonding

**Q.4** Which of the following is the correct electronic configuration of gold (atomic number of Au = 79)?

- A)  $[_{54}Xe]4f^{14}5d^{10}6s^1$  C)  $[_{54}Xe]4f^{14}5d^96s^2$   
B)  $[_{54}Xe]4f^{14}5d^96s^1$  D)  $[_{54}Xe]4f^{14}5d^{10}6s^2$

**Q.5** Transition elements show all of the following characteristic properties EXCEPT:

- A) They are good conductor of heat and electricity  
B) Those metals which form coloured compounds must have at least one unpaired electron in d-sub shell  
C) Their ions and compounds are coloured in the solid state only  
D) They act as a catalyst

**Q.6** Which of the following complex ions shows tetrahedral geometry?

- A)  $[MnCl_4]^{-2}$  C)  $[Fe(CN)_6]^{-4}$   
B)  $[Cu(NH_3)_4]^{+2}$  D)  $[PtF_6]^{-2}$

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SCRATCH WORK

**Q.7** Transition elements mostly show \_\_\_\_\_ geometry.

- A) Linear  
B) Trigonal bipyramid  
C) Square planar  
D) Octahedral

**Q.8** Correct name of  $[\text{Pt}(\text{OH})_2(\text{NH}_3)_4]\text{SO}_4$  is:

- A) Tetraammine dihydroxo-platinum (IV) sulphate  
B) Dihydroxo tetraammine-platinum (V) sulphate  
C) Tetra-ammine dihydroxo-platinum (II) sulphate  
D) Dihydroxo tetraammine-platinum (IV) sulphate

**Q.9** Which of the following transition elements has maximum number of unpaired electrons in its ground state?

- A) Mn  
B) Cr  
C) Fe  
D) Ni

**Q.10** In copper sulphate pentahydrate ( $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ), the number of water molecules attached with  $\text{Cu}^{+2}$  ion through coordinate covalent bond is:

- A) 2  
B) 3  
C) 4  
D) 5

**Q.11** In  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ , \_\_\_\_\_ light is absorbed, while most of the blue and red lights are transmitted, therefore the solution of  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$  ions looks violet in colour. Violet is a complementary colour of yellow:

- A) Yellow  
B) Green  
C) Blue  
D) Red

**Q.12** The catalysts used for the following processes are correctly matched EXCEPT:

Options	Catalysts	Processes	Used to prepare
A)	Fe	Haber's process	$\text{NH}_3$
B)	$\text{V}_2\text{O}_5$	Contact process	$\text{H}_2\text{SO}_4$
C)	Co	Catalytic oxidation of methane	$\text{HCOOH}$
D)	Pt + Rh	Ostwald's method	$\text{HNO}_3$

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SCRATCH WORK

**Q.13** 3d-series of transition elements contains elements in the range:

- A) Sc ----- Zn                      C) Y ----- Cd  
B) La ----- Hf                      D) Ce ----- Lu

**Q.14** Which of the following 3d-series elements shows the highest oxidation state in its compounds?

- A) Cr                      C) Zn  
B) Cu                      D) Fe

**Q.15** Which of the following transition metal ions has five unpaired electrons in 3d sub-shell?

- A)  $\text{Zn}^{+2}$                       C)  $\text{Mn}^{+2}$   
B)  $\text{Sc}^{+3}$                       D)  $\text{Cr}^{+3}$

**Q.16** The number of lone pair of electrons provided by the ligands to the central transition metal atom or ion is called:

- A) Oxidation number                      C) Effective atomic number  
B) Coordination number                      D) Coordination complex

**Q.17** All of the following are monodentate ligands EXCEPT:

- A)  $\text{OH}^-$                       C) CO  
B)  $\text{CN}^-$                       D)  $\text{N}_2\text{H}_4$

**Q.18** Geometry of the transition elements depends upon type of orbital hybridization. Which of the following type of orbital hybridization shows square planar geometry?

- A)  $\text{sp}^3$                       C)  $\text{dsp}^3$   
B)  $\text{dsp}^2$                       D)  $\text{d}^2\text{sp}^3$

**Q.19** All the elements of 3d-series show correct electronic configuration EXCEPT:

Options	Elements	Electronic configuration
A)	$_{22}\text{Ti}$	$(\text{Ar})3\text{d}^24\text{s}^2$
B)	$_{29}\text{Cu}$	$(\text{Ar})3\text{d}^94\text{s}^2$
C)	$_{24}\text{Cr}$	$(\text{Ar})3\text{d}^54\text{s}^1$
D)	$_{25}\text{Mn}$	$(\text{Ar})3\text{d}^54\text{s}^2$

**Q.20** All of the following first row of the transition elements (3d-series) show the most common oxidation states. Mark the incorrect statement:

Options	Elements	Most common oxidation states
A)	Ti	+3,+4
B)	V	+2,+3,+4,+5
C)	Mn	+3,+5,+6,+7
D)	Fe	+2,+3

**Q.21** Which of the following elements are used as a catalyst

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SCRATCH WORK

in the chemical reactions?

- A) Alkali metals
- B) Transition elements
- C) Alkaline earth metal
- D) Element which form border line compounds

**Q.22 Elements of 3d-series generally show which of the following stable oxidation states?**

- A) +1, +2
- B) +2, +3
- C) +4, +5
- D) +6, +7

**Q.23 The correct formula of Tetraammine aqua bromocobalt (III) nitrate is:**

- A)  $\text{Co}[\text{Br}(\text{NH}_3)_4(\text{H}_2\text{O})](\text{NO}_3)_2$
- B)  $\text{Co}[\text{Br}(\text{NH}_3)_4(\text{H}_2\text{O})\text{Br}](\text{NO}_3)_2$
- C)  $\text{Co}[\text{Br}(\text{H}_2\text{O})(\text{NH}_3)_4](\text{NO}_3)_2$
- D)  $\text{Co}[(\text{NO})(\text{NH}_3)_4(\text{H}_2\text{O})\text{Br}](\text{NO}_3)_2$

**Q.24 Pair of transition elements which show abnormal electronic configuration in the first 3d-series are:**

- A) Cr and Ni
- B) Fe and Ni
- C) Cr and Cu
- D) Cu and Co

**Q.25 Scandium has atomic number 21. Which one of the following will be its electronic configuration?**

- A)  $1s^2 2s^2 2p^6 3s^2 3p^6 3d^3$
- B)  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 4p^1$
- C)  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^1$
- D)  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 4p^2$

**Q.26 The central transition metal atom along with ligands is called:**

- A) Complex ion
- B) Ligand
- C) Coordination sphere
- D) Complex compound

**Q.27 All of the following are typical transition elements EXCEPT:**

- A) Cr
- B) Fe
- C) Cu
- D) Zn

**Q.28 Transition elements show all of the following properties EXCEPT:**

- A) They are all metals in true sense
- B) They show variable oxidation state
- C) They have high melting and boiling points
- D) Their ionization energy is less than that of IIA group elements

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- Q.29** Which of the following statements is correct about covalent radii in 3d-series of transition elements?
- A) It decreases continuously  
B) First it decreases then increases rapidly  
C) First it decreases in the start, constant in the middle and then increases at the end of series  
D) It remains almost constant in the series
- Q.30** In moving from left to right in any transition series, the number of unpaired electrons increases upto groups:
- A) IIB and IIIB                      C) VB and VIB  
B) IVB and VB                      D) VIB and VIIB
- Q.31** Which groups of transition elements are known as non-typical transition elements?
- A) IIB and IIIB                      C) IVB and VB  
B) IB and IVB                      D) VIB and VIIB
- Q.32** All of the following non-metals enter in the interstices of transition metals and impart useful features to them EXCEPT:
- A) H                                      C) N  
B) B                                      D) Br
- Q.33** Mark the incorrect statement about the general characteristic features of 3d-series of transition metals:
- A) Binding energy ..... depends on unpaired electrons  
B) M.Ps and B.Ps ..... show irregular trend in 3d-series  
C) Diamagnetic substances ..... are weakly repelled by the strong magnetic field  
D) Ionic radii ..... changes in the ionic radii along the series are regular
- Q.34** Which of the following transition metal ions shows the strongest paramagnetic behaviour?
- A)  $\text{Fe}^{+3}$                                   C)  $\text{Ti}^{+3}$   
B)  $\text{Cr}^{+3}$                                   D)  $\text{Cu}^{+2}$
- Q.35** In alloy steels (substitutional alloys), which of the following transition metal cannot be substituted in place of iron:
- A) Cr                                      C) Mn  
B) Ni                                      D) Ti

USE THIS SPACE FOR  
SCRATCH WORK



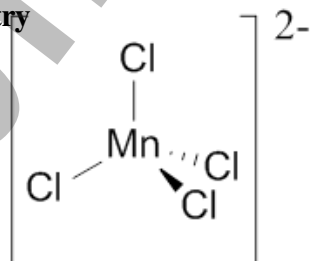
- Q.36** The type of structural isomerism which occurs when the counter ion (the ion outside the square bracket) is itself a potential ligand:
- A) Ionization isomerism      C) Linkage coordination  
B) Coordination isomerism    D) Solvate isomerism
- Q.37** \*\*In an octahedral geometry having coordination number 6, which of the following shows trans-position:
- A) 1 – 2                              C) 3 – 4  
B) 1 – 3                              D) 1 – 4
- Q.38** Coordination compounds show which of the following principal types of isomerism:
- A) Stereoisomerism              C) Both A and B  
B) Structural isomerism        D) Neither A nor B

## ANSWER KEY (Worksheet-09)

1	A	11	A	21	B	31	A
2	C	12	C	22	B	32	D
3	D	13	A	23	A	33	D
4	A	14	A	24	C	34	A
5	C	15	C	25	C	35	D
6	A	16	B	26	C	36	A
7	D	17	D	27	D	37	D
8	A	18	B	28	D	38	C
9	B	19	B	29	C		
10	C	20	C	30	C		

## ANSWERS EXPLAINED

- Q.1 (A) d-block are the elements of groups 3, 4, 5, 6, 7, 8, 9, 10, 11 and 12. They are also known as outer transition elements. Their general electronic configuration is  $(n-1)d^{1-10} ns^{1-2}$ .
- Q.2 (C) Zn shows +2 oxidation state only because  $Zn^{+2}$  has completely filled 3d-sub-shell while other elements of A, B, and D show variable oxidation state. Such as Fe ( $Fe^{+2}$ ,  $Fe^{+3}$ ), Cr ( $Cr^{+3}$ ,  $Cr^{+6}$ ), Cu ( $Cu^{+1}$ ,  $Cu^{+2}$ ).
- Q.3 (D) In fact first five elements are in the highest oxidation state and use all of the s and d electrons for bonding not first four elements.
- Q.4 (A)  $^{79}Au$  (gold) shows the correct electronic configuration as  $[_{54}Xe]4f^{14}, 5d^{10}, 6s^1$ .
- Q.5 (C) Transition metal ions and their compounds are not only coloured in the solid state but they also show colour in the aqueous solution.
- Q.6 (A)  $[MnCl_4]^{-2}$  shows tetrahedral geometry



while others B) square planar C), tetrahedral and D) shows trigonal bipyramidal geometry.

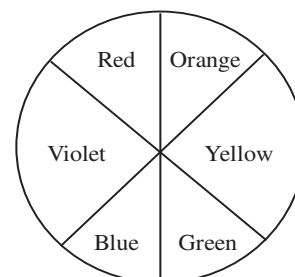
- Q.7 (D) Transition elements mostly show octahedral geometry. The concept of octahedral geometry was developed by Alfred Werner to explain the stoichiometries and isomerism in coordination compounds.
- Q.8 (A)  $[Pt(OH)_2(NH_3)_4]SO_4$  correct name is Tetraammine dihydroxo-platinum (IV) sulphate. Other options B, C and D are incorrect.

- Q.9 (B)  $^{24}Cr$  (Ar)  $\uparrow\uparrow\uparrow\uparrow\uparrow\uparrow$   $3d$   $\uparrow$   $4s$

From the electronic configuration of Cr it is clear that it has maximum 6 unpaired electrons.

- Q.10 (C) The number of water molecules attached with  $Cu^{+2}$  ions through coordinate covalent bond is 4 because it follows effective atomic number rule (EAN rule) and one water molecule is bonded with sulphate ion as shown  $Cu.4H_2O.SO_4.H_2O$ .
- Q.11 (A) Transition elements show complementary colours as shown in the diagram.  $[Ti(H_2O)_6]^{3+}$  absorbs yellow colour and in return transmits violet colour. So yellow and violet are complementary colours.

- Complementary colours of each other are shown in the figure.



Complementary Colours:

- Q.12 (C) In fact, Cu is used as a catalyst for oxidation of methane not cobalt. Lower alkanes when burnt in the

presence of metallic catalyst copper, at **high** temperature and pressure, results in the formation of useful product. Catalytic oxidation of alkanes is used industrially to prepare **higher fatty acids** which are used in **soap** and **vegetable oil industries**.

**Q.13 (A)** 3d-series lies in the 4<sup>th</sup> period of the periodic table. It contains 10 elements ranges from  $_{21}\text{Sc} \dots \text{}_{30}\text{Zn}$ .

In the first row of the transition metals, the ten elements that can be found are: Scandium (Sc), Titanium (Ti), Vanadium (V), Chromium (Cr), Manganese (Mn), Iron (Fe), Cobalt (Co), Nickel (Ni), Copper (Cu), and Zinc (Zn).

**Q.14 (A)** Cr shows highest oxidation state in its compound such as in  $\text{K}_2\text{Cr}_2\text{O}_7$

- In  $\text{K}_2\text{Cr}_2\text{O}_7$ , Cr shows +6 oxidation state.

**Q.15 (C)**  $_{25}\text{Mn}^{+2}$  (Ar)  $\uparrow\uparrow\uparrow\uparrow\uparrow\uparrow$   $\uparrow$   $\uparrow$ . From the electronic configuration of  $\text{Mn}^{+2}$ , it is clear that there are **five unpaired electrons** in 3d-orbitals.

**Q.16 (B)** Examples of Coordination number are shown below.

Type of orbital hybridization	Geometry	Coordination Number	Complex
sp	Linear	2	$[\text{Ag}(\text{NH}_3)_2]^+$ , $[\text{CuCl}_2]^-$
$\text{sp}^3$	Tetrahedral	4	$[\text{MnCl}_4]^{2-}$
$\text{dsp}^2$	Square planar	4	$[\text{Zn}(\text{NH}_3)_4]^{2+}$ , $[\text{Ni}(\text{CN})_4]^{2-}$
$\text{dsp}^3$	Trigonal bipyramidal	5	$[\text{Ni}(\text{CN})_5]^{3-}$ , $\text{Fe}(\text{CO})_5$
$\text{d}^2\text{sp}^3$	Octahedral	6	$[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ ,

			$[\text{Fe}(\text{CN})_6]^{3-}$
--	--	--	---------------------------------

**Q.17 (D)**  $\text{N}_2\text{H}_4$  (hydrazine)  $\text{NH}_2\text{-NH}_2$ . It is bidentate ligand. It can donate **two** lone pair of electrons.

**Q.18 (B)**  $\text{dsp}^2$  (Square planar geometry e.g.  $[\text{Cu}(\text{NH}_3)_4]^{+2}$ ).

Type of orbital hybridization	Geometry	Coordination Number	Complex
$\text{dsp}^2$	Square planar geometry	4	$[\text{Cu}(\text{NH}_3)_4]^{+2}$

**Q.19 (B)** In fact  $_{29}\text{Cu}$  shows abnormal electronic configuration such as (Ar)  $3\text{d}^{10}4\text{s}^1$ , but not (Ar)  $3\text{d}^94\text{s}^2$ .

**Q.20 (C)** Common oxidation states shown by Mn are +2, +4, +6, +7 but not +3, +5.

**Q.21 (B)** Transition elements act as a good catalyst because of

- Presence of vacant d-orbital
- The tendency to show variable oxidation states
- The tendency to form reaction intermediates with reactants
- The presence of defects in their crystal lattice

Examples:

- Most of the transition metals [Fe, Ni, Pt]
- Alloys [Fe - Mo]
- Compounds  $[\text{V}_2\text{O}_3]$ ,  $[\text{V}_2\text{O}_5]$ ,  $[\text{MnO}_2]$ ,  $\text{Co}^{+2}$  salt] are used as catalysts in various processes.

**Q.22 (B)** Elements of 3d-series generally show stable oxidation state +2 and +3. The elements in the beginning

of the 3d-series have comparatively +3 more stable oxidation state such as  $\text{Sc}^{+3}$ ,  $\text{Cr}^{+3}$  whereas the elements at the end of the series mostly show +2 stable oxidation state such as  $\text{Cu}^{+2}$ ,  $\text{Zn}^{+2}$ ,  $\text{Ni}^{+2}$  etc.

Q.23 (A) The correct formula of Tetrammine aqua bromocobalt (III) nitrate is  $\text{Co}[\text{Br}(\text{NH}_3)_4(\text{H}_2\text{O})](\text{NO}_3)_2$ .

Q.24 (C) Cr and Cu show abnormal electronic configuration just to gain stable electronic configuration in 3d-sub shell as shown in the tabular form.

Element	Atomic number	Electronic configuration
Cr	24	$[\text{Ar}]3d^5 4s^1$
Cu	29	$[\text{Ar}]3d^{10} 4s^1$

Q.25 (C) Scandium has atomic number 21. It has electronic configuration  $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^1$ .

Q.26 (C) The central transition metal atom along with ligands is called coordination sphere. It is usually placed in square bracket e.g.



In the above examples:

$[\text{Fe}(\text{CN})_6]^{4-}$ ,  $[\text{Cu}(\text{NH}_3)_4]^{2+}$ ,  $[\text{Ni}(\text{CO})_4]^0$  are anionic, cationic and neutral coordination spheres, respectively.

Q.27 (D) Zn is non-typical transition element

- It is present in IIB group
- It shows +2 oxidation only

- It does not form coloured compound
- It is diamagnetic in atomic or ionic form
- It does not give borax bead test

Q.28 (D) The elements of 3d-series are known as transition elements because they lie in between s-block elements and p-block elements. When we move from left to right in the periodic table ionization energy increases because nuclear charge increases. That is why ionization energy of 3d-series of transition elements is greater than that of s-block elements but less than that of p-block elements.

Q.29 (C) First it decreases in the start, remains constant in the middle and then increases at the end of the series.

Explanation:

- At the beginning of the 3d series of transition elements, due to smaller number of electrons in the 3d-orbitals, the effect of increased nuclear charge predominates, and the covalent radii decrease.
- Later in the series, when the number of 3d-electrons increase, the increased shielding effect and the increased repulsion between the electrons tend to increase the covalent radii. Somewhere in the middle of the series, therefore, the covalent radii almost remains constant.
- At the end of 3d-series of transition elements d-sub shell is completely filled

and nucleus hold on the valence electrons decreases. As a result atomic radii increases.

**Atomic radii of transition elements of 3d-series**

Elements	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
Atomic radii (pm)	144	132	122	118	117	117	116	115	117	125

↑ Decreases      ↑ Constant      ↑ Increases

**Q.30 (C)** In moving from left to right in any transition series, the number of unpaired electrons increase upto groups VB and VIB. After that pairing takes place and number of unpaired electrons goes on decreasing until it becomes zero at IIB.

**Q.31 (A)** The transition elements of IIB and IIIB groups are known as non-typical transition elements.

Groups	Non-typical Elements
IIB	Zn, Cd and Hg
IIIB	Sc, Y and La

**Properties:**

- They show non-variable oxidation state
- They do not form coloured compounds
- They do not give "Borax-bead Test"

**Q.32 (D)** When small non-metal atoms like (H, B, and N) enter the interstices of transition metals and impart useful features to them, they are called

interstitial compounds. But bromine (Br) cannot enter the interstices of transition metals because it has comparatively greater size.

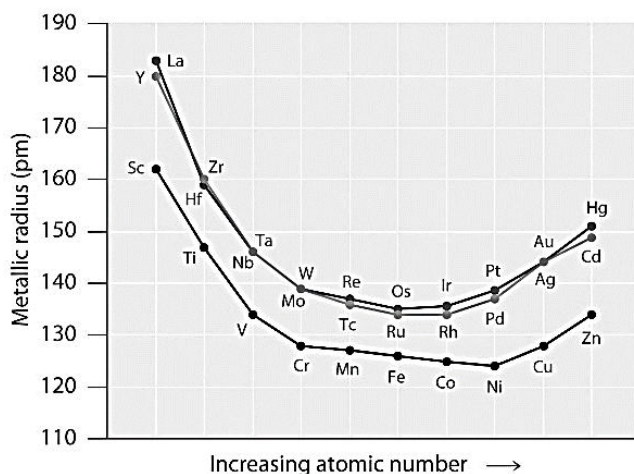


**Q.33 (D)** It is incorrect statement. In fact, the correct statement is as follow.

Changes in the ionic radii along the series are much less regular, so that periodic trends in the properties of these ions are difficult to rationalize.

**Q.34 (A)** Greater is the number of unpaired electrons in 3d-atomic orbitals of transition metal ions, greater is the paramagnetic behaviour. Since  $\text{Fe}^{+3}$  ion has maximum five unpaired electrons, so that is why it shows maximum paramagnetic behaviour. Other transition metal ions have comparatively less number of unpaired electrons.

**Q.35 (D)** In alloy steels (substitutional alloys), titanium (Ti) transition metal cannot be substituted in place of iron because it has comparatively greater size (covalent radius), as shown in the graph:



**Q.36 (A)**

• **IONIZATION ISOMERISM**

The type of structural isomerism which occurs when the counter ion (the ion outside the square bracket) is itself a potential ligand.

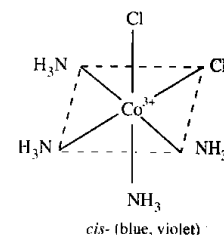
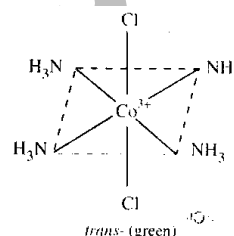


**Ion in solution  $\text{NO}_2^-$**       **Ion in solution  $\text{Cl}^-$**   
(no ppt. with  $\text{AgNO}_3$ )      (white ppt. with  $\text{AgNO}_3$ )

• **COORDINATION ISOMERISM**

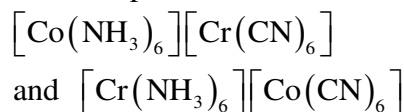
This type of isomerism is shown by the compounds which contain complex cation, and a complex anion. Coordination isomerism is caused by the

interchange



exchange of ligands between the complex cation and complex anion.

• For examples



• **LINKAGE COORDINATION**

The compounds which have the same molecular formula, but differ in the mode of attachment of ligand to the central atom / ion are called linkage isomers.

• For examples  $\text{NO}_2^-$  ion, the nitrogen atom as well as the oxygen atom can donate their lone-pairs.

$\text{NO}_2^-$  Nitro  
 $[\text{Co}(\text{NH}_3)_5\text{NO}_2]\text{Cl}_2$   
pentaamminonitrocobalt (III) chloride

and

$\text{O}-\text{NO}^-$  nitrito  
 $[\text{Co}(\text{NH}_3)_5\text{ONO}_2]\text{Cl}_2$   
pentaaminenitrocobalt (III) chloride

• **SOLVATE ISOMERISM**

Solvate isomerism is a special form of ionization isomerism. Solvate isomerism occurs when water is present in the inner coordination sphere or outside it.

- For examples  $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$  and  $[\text{CrCl}(\text{H}_2\text{O})_5]\text{Cl}_2 \cdot \text{H}_2\text{O}$

**Q.37 (D)  $\text{Ma}_4\text{b}_2$ :**

- A well known octahedral complex which shows cis-trans isomerism tetraaminedichloridecobalt (III).
- Two isomers of this complex are cis-form (violet) and trans-form (green).
- The structures of these two isomers are shown below in figure  $[\text{Co}(\text{NH}_3)_4(\text{NO}_2)_2]^+$  is example of  $[\text{Ma}_4\text{b}_2]$  type octahedral complex which shows geometrical isomerism.

**Q.38 (C):** Coordination compounds show the following principal types of isomerism

- Stereoisomerism
- Structural isomerism

## REF. QUESTION # 20

Below is a table of the oxidation states that the transition metals can or cannot form. As stated in the boxes, the “No” indicates that the elements are not found with that oxidation state. The “Rare” signifies the oxidation states that the elements are rarely found in. Lastly, the “Common” identifies the oxidation states that the elements readily found in.

Element Symbol	Atomic Number	+1	+2	+3	+4	+5	+6	+7
Sc	21	No	Rare	Common	No	No	No	No
Ti	22	No	Rare	Rare	Common	No	No	No
V	23	Rare	Common (black)	Common (green)	Common (blue)	Common (yellow)	No	No
Cr	24	Rare	Common	Common (most stable)	Rare	Rare	Common	No
Mn	25	Rare	Common (most stable pink/red)	Common (purple/red)	Common	Rare (blue)	Common (green)	Common (purple)
Fe	26	Rare	Common (ferrous)	Common (ferric)	Rare	Rare	Rare	No
Co	27	Rare	Common	Common	Rare	Rare	Rare	No
Ni	28	Rare	Common	Rare	Rare	No	No	No
Cu	29	Rare	Common (blue/green)	No	No	No	No	No
Zn	30	No	Common	No	No	No	No	No

**Worksheet-10****(B. Inorganic Chemistry)****Compounds of Nitrogen and Sulphur  
And Environmental Chemistry**

**Q.1** Contact process for the preparation of  $\text{H}_2\text{SO}_4$  on the commercial scale has following steps.

- I. Sulphur burners
- II. Drying tower
- III. Contact tower
- IV. Absorption unit

In which one of the following above steps,  $\text{SO}_2$  is oxidized to  $\text{SO}_3$ ?

- A) I only
- B) II only
- C) III only
- D) IV only

**Q.2** Which of the following is not secondary pollutant?

- A) PAN
- B) Ketones
- C) Peroxybenzoyl
- D)  $\text{SO}_2$

**Q.3** All of the following are physical properties of  $\text{NH}_3$  gas EXCEPT:

- A) It is colourless gas with pungent odour
- B) It is lighter than air
- C) When it is inhaled suddenly, it brings tears into the eye
- D) It is insoluble in water

**Q.4** Which of the following is not use of ammonia?

- A) It is used to prepare nitric acid by Birkeland and Eyde's process
- B) It is used in the manufacture of urea and rayon
- C) It is used as a refrigerant in ice plants
- D) It is used in the manufacture of  $\text{Na}_2\text{CO}_3$  by Solvay's process

**Q.5** The second most widely used fertilizer in Pakistan is:

- A) Potassium nitrate
- B) Ammonium nitrate
- C) Diammonium phosphate
- D) Urea

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**Q.6 Mark the correct statement about  $\text{SO}_2$ :**

- A) It is colorless gas with irritating smell
- B) It can act as an oxidizing as well as reducing agent
- C) Both A and B
- D) Neither A nor B

**Q.7 Which of the following is not correctly matched statement?**

Options	Name of fertilizer	%age of nitrogen
A)	Urea	46
B)	Diammonium phosphate	14
C)	Ammonium nitrate	33 – 33.5
D)	Liquid ammonia	82

**Q.8  $\text{SO}_3$  crystals on warming change directly to a gas. This is called:**

- A) Diffusion
- B) Sublimation
- C) Evaporation
- D) Decomposition

**Q.9 Which one is incorrect about  $\text{H}_2\text{S}_2\text{O}_7$ ?**

- A) It is obtained by dissolution of  $\text{SO}_3$  in water
- B) It is obtained by dissolution of  $\text{SO}_3$  in conc.  $\text{H}_2\text{SO}_4$
- C) It is called oleum (pyrosulphuric acid)
- D) It contain one O-O bond in its molecule

**Q.10 Which one of the following is not property of a good fertilizer?**

- A) It may not be stable
- B) It is not injurious to the plants
- C) It is soluble in water
- D) It is readily available to the plants

**Q.11 Which of these is not a property of dilute sulphuric acid?**

- A) It is an electrolyte
- B) It reacts with some metals to give off hydrogen gas
- C) Its sulphate salts are always soluble in water
- D) It contains ions

**Q.12 All of the following properties shown by nitrogen and other elements of group VA are correct EXCEPT:**

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Options	Nitrogen	Other elements
A)	(N <sub>2</sub> ) Gas	Solid
B)	Diatomic ( N $\equiv$ N )	Tetra atomic molecules
C)	Has no allotropic form	Have allotropic forms
D)	Low ionization energy	High ionization energy

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**Q.13 Identify the property which is not shown by sulphuric acid:**

- A) It is called oil of vitriol
- B) It is manufactured by contact process
- C) The purification unit consists of dust removers, scrubbers conc. sulphuric acid and arsenic purifier
- D) It acts as a food preservative

**Q.14 Ammonia is commercially prepared by Haber's process as shown by the reaction:**



**Which of the following is not optimum condition to get maximum yield of ammonia?**

- A) High pressure (200 – 300 atm)
- B) High temperature (500°C)
- C) Continuous withdrawal of ammonia
- D) Use of iron catalyst along with promoters MgO, Al<sub>2</sub>O<sub>3</sub> and SiO<sub>2</sub>

**Q.15 Identify the incorrect statement about anhydrides of respective acids:**

Options	Acids	Anhydrides
A)	H <sub>2</sub> SO <sub>4</sub>	SO <sub>3</sub>
B)	HNO <sub>3</sub>	N <sub>2</sub> O <sub>5</sub>
C)	H <sub>3</sub> PO <sub>4</sub>	P <sub>2</sub> O <sub>3</sub>
D)	HClO <sub>4</sub>	Cl <sub>2</sub> O <sub>7</sub>

**Q.16 Which of the following is / are uses of SO<sub>2</sub> gas?**

- A) It acts as food preservative

B) It is used to prepare  $\text{H}_2\text{SO}_4$

C) Both A and B

D) Neither A nor B

**Q.17 All of the following are the optimum conditions in order to get maximum yield of  $\text{SO}_3$  by contact process EXCEPT:**

A) High pressure (1atm)

B) Catalyst  $\text{V}_2\text{O}_5$  or Ni

C) Low temperature (400 – 500°C)

D) Continuous withdrawal of  $\text{SO}_3$  after intervals

**Q.18 Which of the following fertilizers is not useful for paddy rice?**

A) Urea

C) Ammonium nitrate

B) Ammonia in liquid form

D) Ammonium phosphate

**Q.19 When sulphuric acid is treated with glucose it acts as?**

A) Drying agent

C) Dehydrating agent

B) Oxidizing agent

D) Reducing agent

**Q.20 Sulphuric acid ( $\text{H}_2\text{SO}_4$ ) is commercially prepared by contact process. All of the following purification units with their functions are correctly matched EXCEPT:**

Options	Purification units	Uses
A)	Dust remover	Dust particles are removed from gases by steam wash
B)	Scrubber	Soluble impurities are removed by water
C)	Conc. $\text{H}_2\text{SO}_4$	Acts as drying agent to remove moisture
D)	Arsenic purifier	$\text{Fe}(\text{OH})_2$ is used to remove $\text{As}_2\text{O}_3$ as impurity

**Q.21 All of the following elements are macronutrients EXCEPT:**

A) N

C) Ca

B) S

D) Mn

**Q.22 Which of the following is pair of oxides of non-metals are the major cause of acid rain?**

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- A) CO, NO<sub>2</sub>                      C) CO<sub>2</sub>, SO<sub>2</sub>  
B) SO<sub>2</sub>, NO<sub>2</sub>                      D) NO<sub>2</sub>, O<sub>2</sub>
- Q.23 Which of the following fertilizers is used for direct application to soil in the liquid state and injected into the soil upto 6 inches?**  
A) NH<sub>3</sub>                                  C) CO(NH<sub>2</sub>)<sub>2</sub>  
B) NH<sub>4</sub>NO<sub>3</sub>                          D) (NH<sub>4</sub>)<sub>2</sub>HPO<sub>4</sub>
- Q.24 Which one of the following is not the cause of inertness of nitrogen gas?**  
A) Its smaller size                      C) Its low dissociation constant  
B) Its high bond order                  D) d-subshell is absent
- Q.25 Which of the following is raw material for the preparation of ammonia (NH<sub>3</sub>)?**  
A) Methane gas only                      C) Both A and B  
B) Nitrogen gas only                      D) Neither A nor B
- Q.26 Mark the incorrect statement:**  
A) The gases in the atmosphere absorb only cosmic rays  
B) Oxygen (O<sub>2</sub>) gas in the atmosphere is essential for sustaining life on the earth  
C) Carbon dioxide (CO<sub>2</sub>) gas is required for plant photosynthesis  
D) Nitrogen (N<sub>2</sub>) gas is used for nitrogen fixing bacteria
- Q.27 The harmful substances pollute the atmosphere. They damage which of the following:**  
**I. Damage the environment**  
**II. Human health**  
**III. Quality of life**  
A) I, II Only                                  C) I, III Only  
B) II, III Only                                  D) I, II, III
- Q.28 Which of the following is not primary pollutant?**  
A) SO<sub>2</sub>    C) O<sub>3</sub>  
B) NH<sub>3</sub>    D) CO
- Q.29 Sulphur dioxide (SO<sub>2</sub>) is the most culprit pollutant in the atmosphere. The percentage of SO<sub>2</sub> produced by volcanoes eruption is:**

- A) 67% C) 63%
- B) 65% D) 62%
- Q.30** Large quantities of hydrocarbons are emitted by different trees and plants in the atmosphere. Which of the following hydrocarbons is produced by paddy fields?
- A) Methane C) Ethene
- B) Ethane D) Ethyne
- Q.31** The residence time of NO and NO<sub>2</sub> in the atmosphere are \_\_\_\_\_ and \_\_\_\_\_ are respectively.
- A) 2 and 1 days only C) 4 and 3 days only
- B) 3 and 2 days only D) 5 and 4 days only
- Q.32** SO<sub>2</sub> and SO<sub>3</sub> have which of the following harmful effects:
- I. Are irritating
- II. Are suffocating
- III. Form sulphate aerosols which cause respiratory troubles
- IV. Are major source of acid deposition
- A) I, II C) I, II, III
- B) II, III, IV D) I, II, III, IV
- Q.33** Methane has a mean residence time of about \_\_\_\_\_ in the atmosphere.
- A) 2 – 4 Years C) 3 – 7 Years
- B) 3 – 5 Years D) 2 – 6 Years
- Q.34** Which of the following is the major source of hydrocarbons emission?
- A) Petroleum C) Automobiles
- B) Coal D) Wood
- Q.35** The pH of unpolluted water should be upto:
- A) 5.0 C) 5.4
- B) 5.6 D) 5.2
- Q.36** The acid deposition involves:

- A) Wet acidic deposition (rain, fog and snow) only
- B) Dry acid deposition only
- C) Both A and B
- D) Neither A nor B

**Q.37 All of the following statements about ozone ( $O_3$ ) layer are correct EXCEPT:**

- A) Its thickness has been decreasing over Antarctica during autumn time since the mid-1970s
- B) It ranges from 25 – 28km high in stratosphere
- C) It is a blue gas having irritating smell
- D) It is an allotropic form of oxygen

**Q.38 The stratosphere where the ozone exists is approximately at:**

- A) 10 – 30km altitudes
- B) 15 – 40km altitudes
- C) 20 – 50km altitudes
- D) 25 – 60km altitudes

**Q.39 Ozone is produced in most of the tropical regions, from where it is transported to polar region. When the concentration of ozone ( $O_3$ ) exceeds 100 ppm in the polar region, it causes all of the following health problems EXCEPT:**

- A) It damages eyes
- B) It decreases the elasticity of lung tissues
- C) It acts as reducing agent and causes fabric dyes to fade
- D) It aggravates asthma

**Q.40 Ozone is produced in most of the tropical regions by the process of:**

- A) Oxidation
- B) Reduction
- C) Redox reaction
- D) Photochemical reaction

**Q.41 The amount of ozone in atmosphere is expressed in Dobson units (DU). The normal amount of overhead ozone is about \_\_\_\_\_ in stratosphere:**

- A) 330DU
- B) 340DU
- C) 350DU
- D) 360DU

**Q.42 The region in which ozone depletes substantially in every**



year during \_\_\_\_\_ is now termed as ozone hole.

- A) Sept - Nov                      C) Sept - Oct  
B) Oct - Dec                      D) Aug – Nov

**Q.43 A single chloride free radical can destroy how many ozone molecules:**

- A) 100                                  C) 100000  
B) 10000                              D) 10

**Q.44 Mark the incorrect statement about effect of acid rain:**

- A) It can leach nutrients  
B) It can increase pH of the soil  
C) It can damage building material  
D) It can damage growth of forest

**Q.45 Temporary acid rain in some countries is due to release of \_\_\_\_\_ by volcano eruption:**

- A) HCl                                  C) H<sub>2</sub>SO<sub>4</sub>  
B) H<sub>2</sub>CO<sub>3</sub>                              D) HNO<sub>3</sub>

**Q.46 The ozone layer 25 – 28 km high in the stratosphere surrounds the globe and filters most of the harmful \_\_\_\_\_ before they reach on the earth:**

- A) UV rays                              C) Gamma rays  
B) IR rays                                D) Cosmic rays

**Q.47 Peeling of ozone layer is due to:**

- A) CO<sub>2</sub>                                  C) PAN  
B) CFCs                                D) Coal burning

**Q.48 Heavy metals (Pt, Cd, As and Hg) are highly toxic and do not have any safe limits. When ingested through food or water and cause all of the following health problems EXCEPT:**

- A) Kidney diseases                      C) Neutrons disorder  
B) Diabetes mellitus                      D) High blood pressure

**Q.49 Leather tanneries are the big source of chromium**

pollution in the environment. Which of the following oxidation state of chromium (Cr) is highly toxic and is known to cause cancer:

- A) Cr (II)                                      C) Cr (VI)  
B) Cr (III)                                      D) Cr (IV)

**Q.50** Chemical and bacterial contents in livestock waste can contaminate surface and ground waters and cause all of the following diseases EXCEPT:

- A) Dysentery                                      C) Hepatitis  
B) Typhoid                                      D) Malaria

**Q.51** Sea water gets polluted by accidental oil spills. Many petroleum products are poisonous and pose serious health problems to humans, animals and aquatic life. Which of the following petroleum products are known to be carcinogenic even at low concentration.

- A) Polycyclic aromatics                      C) Alicyclic  
B) Monocyclic aromatics                      D) Heterocyclic aromatics

**Q.52** Soaps and detergents are excessively used in industries and household as cleaning agents. Which of the following is the most dangerous pollutant:

- A) Soap only                                      C) Both A and B  
B) Detergents only                              D) Neither A nor B

**Q.53** Which of the following methods is used to remove permanent hardness of water?

- A) Aeration                                      C) Ion exchange method  
B) Coagulation                                      D) Chlorination

**Q.54** The materials which are suspended or present in the colloidal form are removed by coagulation. The

coagulant hydroxides from potash alum is precipitated and suspended particles get adsorbed over it and settle at the bottom. Which of the following is that coagulant?

- A) KOH                                      C)  $\text{Al}(\text{OH})_3$   
B)  $\text{Fe}(\text{OH})_3$                               D)  $\text{Cu}(\text{OH})_2$

**Q.55** The quality of raw water is improved by aeration. Aeration of water serves all of the following functions EXCEPT:

- A) It is used to remove the dissolved gases  
B) It oxidizes  $\text{Fe}^{+2}$  to  $\text{Fe}^{+3}$   
C) It improves the oxygen level of raw water  
D) It reduces organic matter with air

**Q.56** Pesticides have been used for the eradication of following diseases EXCEPT:

- A) Malaria                                      C) Tuberculosis  
B) Sleeping sickness                              D) Yellow fever

**Q.57** Water is considered as polluted water if it contains dissolved oxygen less than:

- A) 4ppm                                      C) 6ppm  
B) 5ppm                                      D) 8ppm

**Q.58** All of the following are harmful effect of chlorination of water EXCEPT:

- A) It produces harmful chloramines by the reaction  $\text{HOCl}$  with dissolved ammonia in water  
B) It is frequently used to disinfect water  
C) It forms  $\text{CHCl}_3$  when  $\text{HOCl}$  reacts with humic acid  
D) Risk of liver cancer increases by drinking chlorinated water

**Q.59** To avoid the formation of toxic compounds with chlorine which substance is used for disinfection of water:

- A)  $\text{KMnO}_4$                       C) Alum  
B) Chloroamine                  D)  $\text{O}_3$

**Q.60** The term greenhouse effect was first of all used by Nils Gustaf Ekholm in 1901. All of the following gases from a thick cover around the earth and it does not allow infra-red rays emitted by earth to escape EXCEPT:

- A)  $\text{CO}_2$                               C)  $\text{CH}_4$   
B)  $\text{O}_3$                                 D) CO

**Q.61** Green chemistry refers to:

- A) Chemistry of plants  
B) Development of chemical product and process is less harmful to humans  
C) Chemistry of green pigments  
D) Chemistry of greenhouse effect

**Q.62** Global warming is expected to be greatest in the:

- A) Land                                C) Arctic  
B) Oceans                              D) Antarctic

**Q.63** Global warming and climate changes are terms used for the observed century-scale rise in the average temperature of the earth's climate system. Global means surface temperature change from 1880 to 2016. An increase in average global temperature results in the following incidence of infectious diseases EXCEPT:

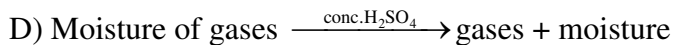
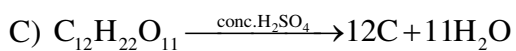
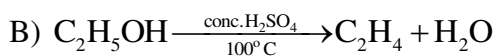
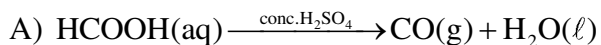
- A) Malaria                              C) Dengue, yellow fever  
B) Sleeping sickness                D) Asthma

**Q.64** The lowest region of the atmosphere extending from the earth's surface to a height of about 6 – 10 km (the lower boundary of the stratosphere) is called:

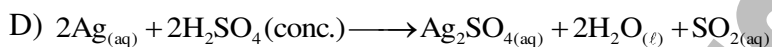
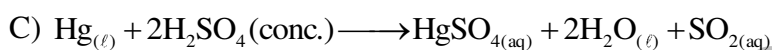
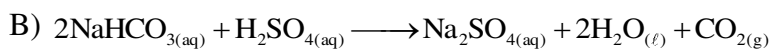
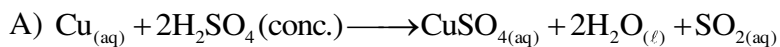
- A) Troposphere                      C) Mesosphere  
B) Stratosphere                      D) Thermosphere

**Q.65** In all of the following reactions concentrated sulphuric acid act as a dehydrating agent EXCEPT:

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**Q.66** In which of the following reactions sulphuric acid does not act as an oxidizing agent:





## ANSWER KEY (Worksheet-10)

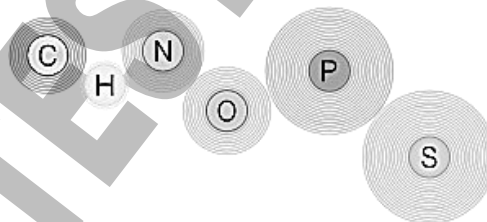
1	C	18	C	35	B	52	B
2	D	19	C	36	C	53	C
3	D	20	D	37	A	54	C
4	A	21	D	38	B	55	D
5	B	22	B	39	C	56	C
6	C	23	A	40	D	57	A
7	B	24	D	41	C	58	D
8	B	25	C	42	A	59	D
9	A	26	A	43	C	60	D
10	A	27	D	44	B	61	B
11	C	28	C	45	A	62	C
12	D	29	A	46	A	63	D
13	D	30	A	47	B	64	A
14	B	31	C	48	B	65	D
15	C	32	D	49	C	66	B
16	C	33	C	50	C		
17	B	34	C	51	A		

## STRIKING INFORMATION

- CHON is a mnemonic acronym for the four most common elements in living organisms: carbon, hydrogen, oxygen, and nitrogen.
- The acronym CHNOPS, which stands for carbon, hydrogen, nitrogen, oxygen, phosphorus, sulphur, represents the six most important chemical elements whose covalent combinations make up most biological molecules on Earth.
- Sulphur is used in the amino acids cysteine and methionine. Phosphorus is an essential element in the formation of phospholipids, a class of lipids that are a major component of all cell membranes, as they can form lipid bilayers, which keep ions, proteins, and other molecules where they are needed for cell function, and prevent them from diffusing into areas where they should not be.
- Phosphate groups are also an essential component of the backbone of nucleic acids and are required to form ATP – the

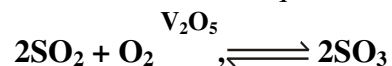
main molecule used as energy powering the cell in all living creatures.

- Carbonaceous asteroids are rich in CHON elements.
- These asteroids are the most common type, and frequently collide with Earth as meteorites.
- Such collisions were especially common early in Earth's history, and these impactors may have been crucial in the formation of the planet's oceans.
- The simplest compounds to contain all of the CHON elements are fulminic acid and isocyanic acid (the latter of which is much more stable), having one of each atom.



## ANSWERS EXPLAINED

- Q.1 (C) In contact tower preheated gases at 400-500°C are passed through vertical iron columns packed with the catalyst  $V_2O_5$ . Here  $SO_2$  is oxidized to  $SO_3$  as shown in the equation:



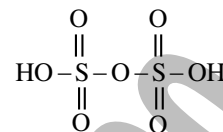
- Q.2 (D)  $SO_2$  is not secondary pollutant. In fact it is primary pollutant. Primary pollutants are given out from chimneys of industrial units and exhaust of automobiles.

- Other examples of primary pollutants  $SO_3$ ,  $(NO_x)$ , CO etc.

- Q.3 (D) It is extremely soluble in water due to hydrogen bonding. It can be easily liquefied at room temperature by applying a pressure of about 8 – 10 atmosphere.

- Q.4 (A)  $\text{NH}_3$  is used in Ostwald's method to prepare nitric acid but not in Birkeland and Eyde's process.
- Q.5 (B) Ammonium nitrate ( $\text{NH}_4\text{NO}_3$ ) is the second most widely used fertilizer in Pakistan. It is a white crystalline solid and is highly soluble in water. It is predominantly used in agriculture as a high-nitrogen fertilizer. Its other uses are component of explosive mixtures, in mining, quarrying, and in civil construction. 90%  $\text{NH}_4\text{NO}_3$  is used as fertilizer while 10% of it is used for making explosive material.
- Q.6 (C)  $\text{SO}_2$  gas has following properties:
- It is colorless gas with irritating smell.
  - It can act an oxidizing as well as reducing agent.
  - As an oxidizing agent:  
$$2\text{H}_2\text{S} + \text{SO}_2 \longrightarrow 3\text{S} + 2\text{H}_2\text{O}$$
  - As a reducing agent:  
$$\text{Cl}_2 + \text{SO}_2 + 2\text{H}_2\text{O} \longrightarrow 2\text{HCl} + \text{H}_2\text{SO}_4$$
- Q.7 (B) In fact,  $(\text{NH}_4)_2\text{HPO}_4$  contains  $\text{P}_2\text{O}_5$  16% nitrogen and 48%  $\text{P}_2\text{O}_5$ . This product contains about 75% plant nutrients and is deemed suitable for use either alone or in the mixed form with other fertilizers.
- Q.8 (B) It is such process in which a solid, when heated, vaporizes directly without passing through the liquid phase and these vapors can be condensed to form the solid again. Other examples of such solids are  $\text{NH}_4\text{Cl}$ ,  $\text{I}_2$ , naphthalene, benzoic acid.
- Q.9 (A) A dense, corrosive liquid consisting of concentrated sulphuric acid containing excess sulphur trioxide

in solution. Structure of oleum  $\text{H}_2\text{S}_2\text{O}_7$  is



- Q.10 (A) It is incorrect statement. In fact, it must be stable so that it is available for a longer time to the growing plants.
- Q.11 (C) In fact, its salts, sulphates are not always soluble in water. All the alkali metals give sulphate and they are all soluble in water. The solubilities of sulphate of alkaline earth metals, gradually decrease down the group. Because the lattice energy decreases marginally down the group whereas  $\Delta H_{\text{hyd}}$  energy decreases significantly. Because of this reason  $\text{BeSO}_4$  and  $\text{MgSO}_4$  are fairly soluble in water.  $\text{CaSO}_4$  is slightly soluble, while  $\text{SrSO}_4$  and  $\text{BaSO}_4$  are almost insoluble.
- Q.12 (D) It is incorrect statement. In fact, ionization energy of nitrogen is greater than those of other elements because of its smaller size and greater electronegativity ( $\text{I.E}_1 = 1402\text{kJmol}^{-1}$  and electronegativity 3.0).
- Q.13 (D)  $\text{H}_2\text{SO}_4$  cannot act as food preservative because it is dehydrating agent, corrosive in nature as well as poisonous in nature. It can denature the food therefore, it cannot be used for this purpose.
- Q.14 (B) It is incorrect statement. In fact, in order to get maximum yield of  $\text{NH}_3$ . Optimum conditions are:
- High pressure (200 – 300atm),

- **Low temperature:** ( $400^{\circ}\text{C}$ ), continues withdrawal of ammonia
- Use of catalyst Fe along with promoters ( $\text{MgO}$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{SiO}_2$ ).

**Q.15 (C)** Anhydrides of  $\text{H}_3\text{PO}_4$  is  $\text{P}_2\text{O}_5$  or  $\text{P}_4\text{O}_{10}$ .

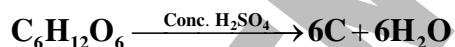
**Q.16 (C)**  $\text{SO}_2$  has all of the following properties:

- It acts as food preservative
- It is used to prepare  $\text{H}_2\text{SO}_4$

**Q.17 (B)** In contact process  $\text{V}_2\text{O}_5$  is used as a catalyst or platinum but **not** Ni.

**Q.18 (C)** It is useful for many crops except paddy rice. The microbial bacteria in flooded fields decomposes it to nitrogen gas. So in this way it is not useful for paddy rice because it is converted into free nitrogen which escapes into the atmosphere.

**Q.19 (C)** When conc.  $\text{H}_2\text{SO}_4$  is treated with glucose, carbon and water are produced. In this case  $\text{H}_2\text{SO}_4$  act as dehydrating agent as shown in the reaction.



**Q.20 (D)**  $\text{Fe}(\text{OH})_3$  (Ferric hydroxide) acts as arsenic purifier to remove  $\text{As}_2\text{O}_3$  as impurity but **not**  $\text{Fe}(\text{OH})_2$ .

**Q.21 (D)** Mn is micronutrients like Cu, Cl, B, Zn and Mo, because they are used in smaller amount ranges from 6g to 200g per acre.

**Q.22 (B)**  $\text{SO}_2$  and  $\text{NO}_2$  are worst pollutant because in atmosphere  $\text{SO}_2$  and  $\text{NO}_2$  are transformed by reactions with oxygen and water into  $\text{H}_2\text{SO}_4$  and  $\text{HNO}_3$  respectively. These acids get mixed with rain. In this

way they become major cause of harmful effect as acid rain.

**Q.23 (A)**  $\text{NH}_3$  is used for direct application to soil in the liquid state and injected into the soil upto 6 inches.

**Q.24 (D)** Absence of d-subshell has **no effect** on inertness of nitrogen gas. Nitrogen shows inert behaviour because of high bond order ( $\text{N} \equiv \text{N}$ ) and **greater bond energy** ( $941\text{kJmol}^{-1}$ ) and it has also **smaller size**.

**Q.25 (C)** Raw Material: Natural gas (methane gas) and, nitrogen gas are raw material for the preparation of ammonia.

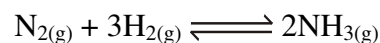
- Natural gas has 83%  $\text{CH}_4$ . A mixture of steam and methane is passed over heated nickel at  $900^{\circ}\text{C}$  to produce  $\text{CO}_2$  and  $\text{H}_2$   
$$\text{CH}_4 + 2\text{H}_2\text{O} \xrightarrow[900^{\circ}\text{C}]{\text{Ni}} \text{CO}_2 + 4\text{H}_2 :$$

- Nitrogen gas: Nitrogen gas is obtained from the air:

- Preparation of ammonia: Ammonia is prepared by Haber's process:

The Haber process is a reversible reaction:

For the synthesis of ammonia by Haber's process, nitrogen and hydrogen gases react with each other to form ammonia gas shown in the reaction.



$$\Delta H^{0,f} = -92\text{kJ}$$

$$= -46\text{kJmol}^{-1}$$

$\text{NH}_3$  is also known as queen of chemicals.

**Q.26 (A)** In fact, the gases in the atmosphere not only absorb most of the cosmic

rays but also the major portion of harmful **electromagnetic radiations coming from the sun**. The absorption of these harmful radiation protects the life of the earth.

**Q.27 (D)** The gases present in the **atmosphere** are **essential for sustaining life on the earth** i.e.  $O_2$  is required for **breathing**,  $CO_2$  is required for **plant photosynthesis**,  $N_2$  is used by **nitrogen fixing bacteria** and **water vapours** are responsible for sustaining various forms of **life on the earth**. Atmosphere also maintains the **heat balance of the earth** like **global warming and green house effect**.

**Q.28 (C)** The waste products given out from chimneys of industrial units and exhaust of automobiles may contain gases such as **sulphur dioxide ( $SO_2$ )**, sulphur trioxide ( $SO_3$ ), nitrogen oxides ( $NO_x$ ), **carbon monoxide (CO)** **ammonia ( $NH_3$ )**, hydrocarbons, compounds of fluorine, and radioactive material. All these waste products are called primary pollutant. But  $O_3$  is **secondary pollutant** because it is formed by the **photochemical reaction of oxygen** in the **polar region**.

**Q.29 (A)** **Sulphur dioxide ( $SO_2$ )** is the most culprit pollutant in the **atmosphere**. The **percentage** of  $SO_2$  produced by **volcanoes eruption is 67%**.

**Q.30 (A)** **Hydrocarbon (methane)** is produced from the **paddy fields**. **Methane** is also known as **marsh gas**.

**Q.31 (C)** The residence time of **NO** and **NO<sub>2</sub>** in the atmosphere are **4 and 3 days** respectively.

**Q.32 (D)** **SO<sub>2</sub>** and **SO<sub>3</sub>** have **harmful effects such irritating, suffocating, form sulphate aerosols which cause respiratory troubles and are major source of acid deposition**.

**Q.33 (C)** **Methane** has a mean **residence time** of about **3 – 7 years** in the **atmosphere**.

**Q.34 (C)** **Automobiles** are the major source of hydrocarbons emission.

**Q.35 (B)** **pH of unpolluted water should be upto 5.6**.

**Q.36 (C)** The **acid deposition** includes both wet (**rain, fog and snow**) and dry acidic deposition.

**Q.37 (A)** In fact, its thickness has been decreasing over Antarctica during spring time since the mid-1970s. Antarctica, the southernmost continent and site of the South Pole, is a virtually uninhabited, ice-covered landmass. Most cruises (sail about in an area without a precise destination, especially for pleasure) to the continent visit the Antarctic Peninsula, which stretches toward South America.

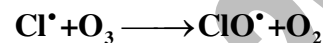
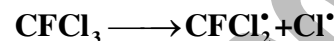
**Q.38 (B)** The stratosphere where the ozone exists is approximately at **15 – 40km altitudes**.

**Q.39 (C)** In fact, ozone ( $O_3$ ) acts as **oxidizing agent**.

**Q.40 (D)** **Ozone** is produced in most of the tropical regions by the process of **photochemical reaction of oxygen**.

- Q.41 (C)** The **normal amount** of overhead ozone is about **350DU** in stratosphere.
- Q.42 (A)** The region in which ozone depletes substantially **in every year during Sept – Nov** is **now** termed as **ozone hole**.
- Q.43 (C)** A single **chloride free** radical can destroy upto **100,000 ozone molecules**.
- Q.44 (B)** It is incorrect statement. In fact, **acid rain decreases pH of the soil**.
- Q.45 (A)** Temporary acid rain in some countries is due to release of **HCl** by volcano eruption.
- Q.46 (A)** The ozone layer **25 – 28 km** high in the stratosphere surrounds the globe and filters most of the harmful **UV rays** before they reach on the earth.
- So ozone is very useful for human being because it has useful effect to absorb harmful radiation. Harmful effect of UV radiation are as follow:
  - It is particularly effective at damaging DNA.
  - It is a cause of melanoma and other types of skin cancer.
  - Therefore, if there is substantial reduction in the ozone layer, the life on earth would be threatened.
  - In 1980's large hole in the ozone layer over Antarctic was discovered which represented a major environmental crisis.
- Q.47 (B)** Chlorofluorocarbons (CFCs) used as refrigerants in air conditioning and in aerosol sprays are inert in the troposphere but slowly diffuse into stratosphere where they are subjected to ultraviolet radiation generating  $\text{Cl}^\bullet$

free radicals. Chlorofluorocarbons (CFCs) play an effective role in removing  $\text{O}_3$  in the stratosphere due to following reactions.



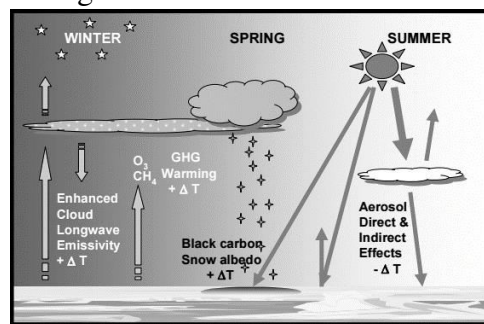
- Q.48 (B)** Diabetes, often referred to by doctors as diabetes mellitus, describes a group of metabolic diseases in which the person has high blood glucose (**blood sugar**), either because insulin production is inadequate, or because the body's cells do not respond properly to insulin, or both. Patients with high blood sugar will typically experience polyuria (**frequent urination**), they will become increasingly thirsty (**polydipsia**) and hungry (**polyphagia**).
- Q.49 (C)** **Postassium dichromate ( $\text{K}_2\text{Cr}_2\text{O}_7$ )** is largely used in leather tanneries which **Cr** has oxidation state **+6**. This chemical is very dangerous for human beings is the cause of many diseases.
- Q.50 (C)** **Hepatitis C** is a disease **caused** by a virus that infects the liver. The virus, called the **Hepatitis C** virus or **HCV** for short, is just one of the **hepatitis** viruses. The other common **hepatitis** viruses are A and B, which differ somewhat from **HCV** in the way they are spread and treated.



- Q.51 (A) Polycyclic aromatics petroleum products are known to be carcinogenic even at low concentration.
- Q.52 (B) The most dangerous pollutant is detergents because it is **non-biodegradable** while soap is not **harmful** because it is **biodegradable**.
- Q.53 (C) **Permanent hardness of water** is due to  $\text{Cl}^-$  and  $\text{SO}_4^{2-}$  of  $\text{Ca}^{+2}$  and  $\text{Mg}^{+2}$  ions. It is removed by ionic exchange method in which (Analcites) sodium zeolite  $\text{NaAl}(\text{SiO}_3)_2 \cdot \text{H}_2\text{O}$  is used in the column through which hard water is run through. Here  $\text{Ca}^{+2}$  and  $\text{Mg}^{+2}$  ions from hard water are **replaced** by  $\text{Na}^+$  ions. Which makes its **soft water**. By **ions exchange method** **permanent hardness of water is removed**.
- Q.54 (C)  $\text{Al}(\text{OH})_3$  from potash alum acts as a coagulant. It is insoluble in water and forms white gelatinous ppt on which colloidal particles (**sand and clay**) are get adsorbed over it and settle at the bottom in water.
- Q.55 (D) In fact, it **oxidizes organic** matter with **air** but **not** reduces organic matter.
- Q.56 (C) **Tuberculosis** is caused by bacteria (*Mycobacterium tuberculosis*) that spreads from person to person through microscopic droplets released into the air. This can happen when someone with the untreated,

active form of **tuberculosis** coughs, speaks, sneezes, spits, laughs or sings. Although **tuberculosis** is contagious, it's not easy to catch.

- Q.57 (A) Water is considered as polluted water if it contains dissolved oxygen less than **4ppm**. Normal amount of dissolved oxygen should be in the range from **4 – 8 ppm**.
- Q.58 (D) The risk of bladder and rectal cancer increases by drinking chlorinated water.
- Q.59 (D) To avoid the formation of toxic compounds with **chlorine, ozone** is used for the disinfection of **water**.
- Q.60 (D) **Greenhouse gases** is a **mixture** of  $\text{CO}_2$ ,  $\text{O}_3$ ,  $\text{CH}_4$ , water vapours and **CFCs but does not** contain **CO**.
- Q.61 (B) Green chemistry refers to development of chemical products and process is less harmful to humans but not related to chemistry of plants, chemistry of green pigments and chemistry of greenhouse effect.



- Q.62 (C) Arctic temperatures have increased at almost twice the global average rate over the past 100 years (IPCC, 2007). Arctic warming is primarily a manifestation of global warming, such that reducing global-average

warming will reduce Arctic warming and the rate of melting.

- Reductions in the atmospheric burden of  $\text{CO}_2$  are the backbone of any meaningful effort to mitigate climate forcing.
- But even if swift and deep reductions were made, given the long lifetime of  $\text{CO}_2$  in the atmosphere, the reductions may not be achieved in time to delay a rapid melting of the Arctic.
- Hence, the goal of constraining the length of the melt season may best be achieved by targeting shorter lived climate forcing agents.
- Addressing these species have the advantage that emission reductions will be felt immediately. These species include methane, tropospheric ozone, and tropospheric aerosols. Calculations indicate that the forcing due to these short-lived pollutants lead to a positive surface temperature response indicating the need to reduce emissions of these species within and outside the Arctic. Additional aerosol species may also lead to surface warming if the aerosol is coincident with thin, low lying clouds.

**Q.63 (D)** Asthma is a chronic disease of the airways. It cannot be cured, but can be controlled with medication. It can come on suddenly with symptoms of shortness of breath,

wheezing, and coughing, and a tight feeling of the chest.

**Q.64 (A)** The lowest region of the atmosphere, extending from the earth's surface to a height of about 6–15 km (the lower boundary of the stratosphere) is called troposphere.

**Troposphere:**

- This is the part of atmosphere in which we live. It is approximately 15km above the surface of the earth. Very small amount of ozone is present in it.

- **Stratosphere**

- This is the layer is from 15km to 50km above the surface of earth. Stratosphere has a thick layer of ozone in it, which absorbs ultraviolet radiations of the sun. Thickness of ozone layer is above 25-28km

**Mesosphere:**

- This layer is 50km to 80km above the surface of the earth.

**Thermosphere**

- This layer is 80km above the surface of the earth.

**Q.65 (D)**

- In this case sulphuric acid act as drying agent. All though moisture is removed by conc.  $\text{H}_2\text{SO}_4$  to purify  $\text{SO}_2$  gas but it is not a chemical reaction
- In first three cases (A, B and C)  $\text{H}_2\text{SO}_4$  acts as dehydrating agent because water is removed along with a chemical change.

**Q.66 (B)**

- This is acid base reaction in this reaction  $\text{H}_2\text{SO}_4$  does not act as oxidizing agent because oxidation number of sulphur in  $\text{H}_2\text{SO}_4$  does not change.
- In all other three reactions (A, C and D) sulphuric acid act as oxidizing agent while metals (Cu, Hg and Ag) act as reducing agent so these are redox reactions.

STEP ENTRY TEST 2020

## Worksheet-11

## (A. Physical Chemistry)

## Fundamental Concepts

USE THIS SPACE FOR  
SCRATCH WORK

- Q.1** Avogadro's number represents the number of:
- A) Atoms in 1g of helium gas
  - B) Atoms in 24g of Mg
  - C) Molecules in 35.5g of chlorine gas
  - D) Electrons needed to deposit 24g Mg
- Q.2** Which one of the following terms is not used for ionic compounds?
- A) Formula unit
  - B) Empirical formula
  - C) Molecular formula
  - D) Formula mass
- Q.3** 98g  $\text{H}_2\text{SO}_4$  contains number of moles of ions:
- A) 4.0 moles of ions
  - B) 1 mole of ions
  - C) 2 moles of ions
  - D) 3.0 moles of ions
- Q.4** Cationic molecular ions are produced by:
- A) Radio waves
  - B)  $\alpha$ -rays
  - C) Beam of electrons
  - D) Both B and C
- Q.5** Isotopes differ in:
- A) Properties which depend upon mass
  - B) Arrangement of electrons in orbitals
  - C) Chemical properties
  - D) The extent to which they may be affected by electromagnetic field
- Q.6** Which one of the following mathematical relationships is correct for  $(m/e)$  in connection with Dempster's mass spectrometer?
- A)  $\frac{m}{e} = \frac{H^2 r^2}{2E}$
  - B)  $\frac{H^2 r^2}{E^2}$
  - C)  $\frac{m}{e} = \frac{H^2 r}{E}$
  - D)  $\frac{H^2 r}{2E}$
- Q.7** Symbol indicates not only the name of elements but also represents all of the following EXCEPT:
- A) One atom of an element
  - B) Number of parts by mass of an element
  - C) 1 gram atom of an element
  - D) 1 amu

USE THIS SPACE FOR  
SCRATCH WORK

- Q.8 Which of the following is not mono-isotopic element?**  
A) F C) Au  
B) Cl D) As
- Q.9 Which of the following statements is incorrect?**  
A) Formation of uni-negative ion is exothermic  
B) Number of positive ions having group of atoms is less than number of negative ions having group of atoms  
C) X – rays and beam of electrons are used to produce positive ions of Ne  
D) Number of cationic molecular ions is less than number of anionic molecular ions
- Q.10 What volume of oxygen gas is required for the complete combustion of  $5\text{cm}^3$  of ethyne ( $\text{C}_2\text{H}_2$ )?**  
A)  $12.5\text{cm}^3$  C)  $13.5\text{cm}^3$   
B)  $13.0\text{cm}^3$  D)  $14.0\text{cm}^3$
- Q.11 The relative atomic mass of boron, which consists of isotopes  $^{10}_5\text{B}$  and  $^{11}_5\text{B}$  is 10.8amu. What is the percentage of  $^{10}_5\text{B}$  atoms in the isotopic mixture?**  
A) 0.8% C) 8.0%  
B) 20% D) 80%
- Q.12 How many carbon atoms are present in 34.2g of sucrose ( $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ )  $M_r = 342$ )?**  
A)  $6.0 \times 10^{22}$  C)  $7.2 \times 10^{23}$   
B)  $3.6 \times 10^{25}$  D)  $3.6 \times 10^{24}$
- Q.13 What is the number of molecules in  $1000\text{cm}^3$  of nitrogen gas under room conditions?**  
A)  $2.5 \times 10^{22}$  C)  $4.0 \times 10^{23}$   
B)  $3.5 \times 10^{22}$  D)  $4.5 \times 10^{26}$
- Q.14 Which is the correct sequence of stages in mass spectrometer?**  
A) Ionization, amplification, recording, detection, separation  
B) Ionization, amplification, detection, separation, recording  
C) Recording, detection, amplification, separation, ionization  
D) Ionization, separation, detection, amplification, recording
- Q.15 How many total number of atoms are present in 49.0g of sulphuric acid ( $\text{H}_2\text{SO}_4$ )?**  
A)  $7 \times 3 \times 10^{23}$  C)  $5 \times 6 \times 10^{23}$   
B)  $7 \times 8 \times 10^{23}$  D)  $6 \times 6 \times 10^{23}$



USE THIS SPACE FOR  
SCRATCH WORK

- Q.16** An organic compound has empirical formula  $\text{CH}_2\text{O}$ . If molar mass of the compound is 90 grams, then molecular formula of this organic compound would be ( $A_r$  of C = 12, H = 1.008 and O = 16):
- A)  $\text{C}_6\text{H}_6\text{O}_2$                       C)  $\text{C}_9\text{H}_9\text{O}_3$   
B)  $\text{C}_3\text{H}_3\text{O}$                       D)  $\text{C}_3\text{H}_6\text{O}_3$
- Q.17** How many bromine (Br) atoms are in 3 moles of bromine (Br) element?
- A)  $3 \times 6.022 \times 10^{23}$  atoms    C)  $81 \times 3 \times 10^{23}$  atoms  
B)  $79 \times 3 \times 6 \times 10^{23}$  atoms    D)  $3 \times 6.022 \times 10^{23}$  atoms
- Q.18** Carbon dioxide ( $\text{CO}_2$ ) gas produced during combustion analysis of given organic compound is absorbed in 50% of KOH solution. It is a:
- A) Chemical change only  
B) Physical change only  
C) May be physical or chemical change  
D) Neither physical nor chemical change
- Q.19** In the experimental determination of the percentage of carbon and hydrogen in an organic compound, water is absorbed by:
- A) KOH                      C)  $\text{K}_2\text{SO}_4$   
B)  $\text{MgCl}_2$                       D)  $\text{Mg}(\text{ClO}_4)_2$
- Q.20** 12g of magnesium (Mg) reacts with dilute sulphuric acid ( $\text{H}_2\text{SO}_4$ ) to produce hydrogen ( $\text{H}_2$ ) gas. The amount of hydrogen ( $\text{H}_2$ ) gas produced is:
- A) 4g                      C) 2g  
B) 3g                      D) 1g
- Q.21** 5.6g of potassium hydroxide (KOH) has been dissolved in  $100\text{cm}^3$  of aqueous solution, molarity of the solution is:
- A) 1.0M                      C) 1.5M  
B) 2.0M                      D) 2.5M
- Q.22** Which of the following units of concentration of solution change with the increase of temperature?
- I. Molality                      III. Molarity  
II. Mole Fraction                      IV. %age composition (v/v)
- A) I, II                      C) III, IV  
B) I, II, III                      D) II, III

USE THIS SPACE FOR  
SCRATCH WORK

Q.23 Mark the incorrect statement about mole fraction:

- A) It is used for three components of a solution
- B) It is independent of temperature
- C) Its value is always less than 1
- D) Sum of mole fractions is  $\geq 1$

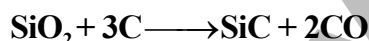
Q.24 Which of the following is unit of molarity?

- A)  $\text{mol dm}^{-3}$
- B) gram equivalent  $\text{L}^{-1}$
- C)  $\text{mol kg}^{-1}$
- D)  $\text{g cm}^{-3}$

Q.25 What is the percentage by (v/v) of ethanol, if  $5.0\text{cm}^3$  of ethanol is dissolved in  $45.0\text{cm}^3$  of water?

- A) 10%
- B) 8%
- C) 6%
- D) 4%

Q.26 Silicon carbide (SiC) is an important ceramic material. It is produced by allowing silica ( $\text{SiO}_2$ ) to react with carbon at high temperature as shown in the reaction:



When 0.3kg sand is reacted with excess of carbon, 0.1kg of silicon carbide (SiC) is produced. What is the percentage yield of silicon carbide (SiC)?

- A) 35%
- B) 40%
- C) 50%
- D) 45%

Q.27 All of the following terms are correctly matched with the given data EXCEPT:

Options	Terms	For which it is used	Example
A)	Relative atomic mass ( $A_r$ )	Element	$\text{H}=1.008\text{amu}$
B)	Relative isotopic mass	Isotopes or elements	${}^{12}_6\text{C}$ , ${}^{13}_6\text{C}$ , ${}^{15}_6\text{C}$
C)	Relative molecular mass ( $M_r$ )	Covalent compounds	$\text{H}_2\text{O}=18.0\text{amu}$
D)	Relative formula mass	Ionic compound	$\text{KCl}=74.5\text{amu}$

Q.28 All of the following terms are correctly matched w.r.t their definition EXCEPT:

USE THIS SPACE FOR  
SCRATCH WORK

Options	Term	Definition
A)	Relative atomic mass	It is the mass of one atom of an element as compared to the mass of an atom of carbon taken as 12
B)	Relative formula mass	It is sum of relative atomic mass of atoms of one formula unit of an ionic compound
C)	Relative molecular mass	It is the sum of relative atomic mass of atoms of one molecule of a covalent compound
D)	Mass number	It is sum of proton and neutrino

Q.29 Identify the incorrect statement about yield:

A) Actual yield is less than theoretical yield

B) Percentage yield =  $\frac{\text{actual yield}}{\text{theoretical yield}} \times 100$

C) Experimental error does not affect actual yield

D) Efficiency of a chemical reaction depends on the amount of product

Q.30 A solution contains three components A, B and C in the molar ratio 3 : 6 : 1. The percentage of mole fraction of component A is:

A) 20%

C) 30%

B) 25%

D) 35%

Q.31 Isotopes of an element have all of the following different properties EXCEPT

A) They have different chemical properties

B) They have difference mass number

C) They have different number of neutrons

D) They have different half life

Q.32 The combustion analysis of an organic compound shows 60% carbon, 8% hydrogen and 32% oxygen. If the molecular mass of the given organic compound is 200, then the molecular formula of the organic compound is (Ar of C = 12 amu, H = 1 amu and O = 16 amu):

A) C<sub>10</sub>H<sub>16</sub>O<sub>4</sub>

C) C<sub>10</sub>H<sub>14</sub>O<sub>4</sub>

B) C<sub>8</sub>H<sub>16</sub>O<sub>4</sub>

D) C<sub>5</sub>H<sub>8</sub>O<sub>2</sub>

USE THIS SPACE FOR  
SCRATCH WORK

**Q.33** Ascorbic acid (vitamin C) contains 48% carbon, 4% hydrogen and 48% oxygen. Which of the following is empirical formula of ascorbic acid?

- A)  $C_2H_4O_3$                       C)  $C_2H_2O_3$   
B)  $CH_2O$                         D)  $C_4H_4O_3$

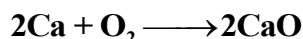
**Q.34** The number of moles of sodium hydroxide present in  $2.5dm^3$  of 0.5M aqueous solution is:

- A) 1.25                              C) 0.5  
B) 12.5                             D) 5.0

**Q.35** Molarity of pure water is:

- A) 5.55                              C) 55.5  
B) 55.0                             D) 55.1

**Q.36** Calcium reacts with excess oxygen to form calcium oxide (CaO) as shown in the equation:



The maximum mass of CaO formed when 4.0g of calcium is burnt in excess oxygen is ( $A_r$  values Ca = 40amu, O = 16amu):

- A) 3.6g                              C) 2.6g  
B) 5.6g                             D) 4.6g

**Q.37** If we know the mass of one substance, we can calculate the volume of other substance and vice versa with the help of a balanced chemical equation, which is called:

- A) Mass-mass relationship  
B) Mass-volume relationship  
C) Mole-volume relationship  
D) Mass-mole relationship

**Q.38** By using the value of Avogadro's number ( $N_A = 6.0 \times 10^{23} \text{mol}^{-1}$ ), calculate the total number of atoms in 7.1g of Cl-element ( $A_r$  value Cl = 35.5):

- A)  $1.2 \times 10^{23}$  Cl-atoms              C)  $1.0 \times 10^{23}$  Cl-atoms  
B)  $1.6 \times 10^{23}$  Cl-atoms              D)  $1.5 \times 10^{23}$  Cl-atoms

**Q.39** Which one of the followings has same number of molecules as present in 11g of  $CO_2$ ?

- A) 4g of  $O_2$                         C) 4g of O  
B) 4.5g of  $H_2O$                     D)  $\frac{1}{4}$  moles of NaCl

**Q.40** 28g of  $N_2$  gas at STP will occupy the volume of:

- A)  $22.41dm^3$                         C)  $44.82cm^3$   
B)  $44.82dm^3$                         D)  $2.241dm^3$

**ANSWER KEY (Worksheet-11)**

1	B	11	B	21	A	31	A
2	C	12	C	22	C	32	A
3	D	13	A	23	D	33	D
4	D	14	D	24	A	34	A
5	A	15	A	25	A	35	C
6	A	16	D	26	C	36	B
7	D	17	D	27	B	37	B
8	B	18	A	28	D	38	A
9	D	19	D	29	C	39	B
10	A	20	D	30	C	40	A

**ANSWERS EXPLAINED**

- Q.1 (B)** The number of particles present in one mole of a substance is called **Avogadro's number**.

( $N_A = 6.022 \times 10^{23}$ ) Statement (B) fulfills the condition of  $N_A$  such as. 24g of Mg = 1 mole

Molar mass of Mg = 24g

=  $6.022 \times 10^{23}$  Mg atoms

- Q.2 (C)** The term **molecular formula cannot** be used for ionic compounds because molecular formula term is used for covalent compounds. In fact, molecule is an aggregation of atoms whereas **ionic compounds involve ions not atoms**.

- Q.3 (D)** Given amount of  $H_2SO_4 = 98g$   
 Number of moles of  $H_2SO_4 = \frac{98}{98}$   
 = 1mole

$H_2SO_4$  on dissociation splits up into ions such as



1mole                  2mole    1mole

= 2 + 1 = 3moles of ions

**Conclusion:** From the equation it is clear that 1mole of  $H_2SO_4$  produces 3 moles of ions.

- Q.4 (D)** Cationic molecular ions can be generated by passing high energy

beam of electrons,  $\alpha$ -particles or X-rays through a gas.

- Q.5 (A)** All the isotopes of an element have same number of protons and electrons but they have different mass number. e.g. Cl element has two isotopes  $^{35}_{17}Cl$ ,  $^{37}_{17}Cl$

- Q.6 (A)** Where H stands for magnetic field, r stands for radius of circular path, E stands for strength of electric field

- If E is increased by keeping H constant then r will increase

$$\therefore E \propto r \dots i$$

and positive ion of a particular m/e will fall at a different place as compared to the first place.

- If H is increased by keeping E constant, the r will decrease

$$\therefore H \propto \frac{1}{r} \dots ii$$

$$\text{Overall equation } \frac{m}{e} = \frac{H^2 r^2}{2E} \dots iii$$

- Q.7 (D)** Symbol does not represent amu.

$$1\text{amu} = \frac{1}{6.026 \times 10^{23}} g = 1.661 \times 10^{-24} g$$

$$\therefore 1\text{amu} = 1.661 \times 10^{-24} g$$

$$= 1.661 \times 10^{-27} kg$$

$$= 1.661 \times 10^{-21} mg$$



Q.8 (B)

Opt.	Elements	No. of isotopes
A)	F	Mono-isotopic
B)	Cl	Di-isotopic
C)	Au	Mono-isotopic
D)	As	Mono-isotopic

Q.9 (D) Because **cationic molecular** ions are comparatively **more stable** than **anionic molecular ions**.

Q.10 (A)  $2\text{C}_2\text{H}_2 + 5\text{O}_2 \longrightarrow 4\text{CO}_2 + 2\text{H}_2\text{O} \dots$

Volume ratio b/w  $\text{C}_2\text{H}_2$  and  $\text{O}_2 = 2:5$

$2\text{cm}^3$  of  $\text{C}_2\text{H}_2$  requires  $\text{O}_2 = 5\text{cm}^3$

$1\text{cm}^3 \dots \dots \dots = \frac{5}{2}$

$5\text{cm}^3 \dots \dots \dots = \frac{5}{2} \times 5 = 12.5\text{cm}^3$

**Total volume of oxygen gas required for complete combustion of ethyne =  $12.5\text{cm}^3$**

Q.11 (B)  $B = 10.8$  amu (relative atomic mass of boron)

$$\begin{array}{l} \swarrow \quad \searrow \\ {}^{11}\text{B} \quad {}^{10}\text{B} \\ x \quad 100 - x \\ \hline \frac{11(x) + 10(100 - x)}{100} = 10.8 \\ 11x + 1000 - 10x = 10.8 \times 100 \\ x + 1000 = 1080 \\ x = 1080 - 1000 = x = 80\% \\ \therefore \% \text{age of } {}^{10}\text{B} = 100 - 80 = 20\% \end{array}$$

Q.12 (C) Number of C-atoms in sucrose

$$= \frac{34.2}{342} \times 6 \times 10^{23} \times 12$$

$$= 7.2 \times 10^{23}$$

Q.13 (A) Given data

Volume of nitrogen gas at

$$\text{RTP} = 1000\text{cm}^3$$

Number of nitrogen molecules ( $\text{N}_2$ )

$$= \frac{1000}{24000} \times 6 \times 10^{23}$$

$$= 2.5 \times 10^{22}$$

Q.14 (D) Sequence of stages in mass spectrometer are as:

**Ionization, separation, detection, amplification, recording**

Q.15 (A) Total numbers of atoms in  $\text{H}_2\text{SO}_4$

$$= \frac{49}{98} \times 6 \times 10^{23} \times 7$$

$$= 7 \times 3 \times 10^{23}$$

Q.16 (D) Given data:

Empirical formula mass of organic compound ( $\text{CH}_2\text{O} = 30\text{g}$ )

Molecular mass of organic compound = **90g**

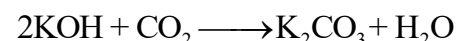
Molecular formula of organic compound = **n (Empirical formula)**

$$n = \frac{\text{molecular mass}}{\text{empirical formula mass}} = \frac{90}{30} = 3$$

**Molecular formula =  $3(\text{CH}_2\text{O}) = \text{C}_3\text{H}_6\text{O}_3$**

Q.17 (D) Number of Br-atoms =  $3 \times 6.022 \times 10^{23}$

Q.18 (A) When  $\text{CO}_2$  is absorbed in pre-weighed **50% KOH solution**, reaction, take place as shown below:



From this reaction, it is clear that the absorption of  $\text{CO}_2$  in KOH solution is a **chemical change**.

**Q.19 (D)**  $\text{Mg}(\text{ClO}_4)_2$  acts as **drying agent** and absorbs water. Conc.  $\text{H}_2\text{SO}_4$  and  $\text{CaO}$  also act as **drying agent**.

**Q.20 (D)**  $\text{Mg} + \text{H}_2\text{SO}_4 \longrightarrow \text{MgSO}_4 + \text{H}_2$

$\text{Mg} : \text{H}_2$

1 : 1

0.5 : 0.5mole

- Number of moles of  $\text{Mg} = \frac{12}{24} = 0.5$
- Amount of  $\text{H}_2$  gas = Number of moles of  $\text{H}_2$  x molar mass of hydrogen gas  
 $= 0.5 \times 2 = 1.0\text{g}$
- **Amount of  $\text{H}_2 = 1.0\text{g}$**

**Q.21 (A)**  $M = \frac{W_2 \times 1000}{M_2 \times \text{Volume of Solution (cm}^3\text{)}}$

$$M = \frac{5.6 \times 1000}{56 \times 100} = 1.0\text{M}$$

**Q.22 (C)** In fact, both **molarity** and **percentage composition (v/v)** involve **volume of solution**. Since volume changes with the **increase of temperature** ( $V \propto T$ ). Both **molarity** and **percentage composition (v/v)** change with the increase in temperature.

**Q.23 (D)** In fact, sum of mole fractions = 1

$$\text{i.e. } x_1 + x_2 + x_3 = 1$$

In general all the solutions which have concentration in terms of volume are temperature depended and all the solutions which have concentration in terms of mass are temperature independent.

**Q.24 (A)** Mathematically molarity of solution

$$= \frac{\text{Number of moles of solute}}{\text{Volume of solution in dm}^3}$$

$$= \text{mol dm}^{-3}$$

**Q.25 (A)** Volume of ethanol :  $5.0\text{cm}^3$

$$\text{Volume of water} = 45.0\text{cm}^3$$

$$\text{Volume of solution} = 5 + 45 = 50.0\text{cm}^3$$

**%age of ethanol by volume**

$$= \frac{5}{50} \times 100 = 10\% (\text{v/v})$$

**Q.26 (C)**  $\text{SiO}_2 + 3\text{C} \longrightarrow \text{SiC} + 2\text{CO}$

Mass of sand ( $\text{SiO}_2$ ) is treated with

$$\text{C} = 0.3\text{kg} = 300\text{g}$$

Mass of Silicon carbide produced (actual yield)

$$= 0.1\text{kg} = 100\text{g} \dots \text{i}$$

$$\text{Molar mass of sand (SiO}_2\text{)} = 28 + 32$$

$$= 60.0\text{gmol}^{-1}$$

$$\text{Molar mass of silicon carbide} = 28 + 12$$

$$= 40\text{gmol}^{-1}$$

$$\text{Theoretical Yield} = \frac{40}{60} \times 300 = 200\text{g} \dots$$

ii

$$\text{Percentage Yield} = \frac{\text{Actual Yield}}{\text{Theoretical Yield}} \times 100$$

$$= \frac{100}{200} \times 100 = 50\% \dots \text{iii}$$

$\therefore$  **Percentage Yield of silicon carbide ( $\text{SiC}$ ) = 50%**

**Q.27 (B)**

- Relative isotopic mass term is used only for isotopes
- Moreover, carbon element has three isotopes  ${}^{12}_6\text{C}$ ,  ${}^{13}_6\text{C}$ ,  ${}^{14}_6\text{C}$  but not  ${}^{15}_{16}\text{C}$

**Q.28 (D)** In fact, the term mass number is used for isotopes of an element. Mass number is sum of protons and

neutrons but it is not sum of protons and electrons.

**Q.29 (C)** In fact, **both** experimental error and human error **affect actual yield**.

**Q.30 (C)** Given data A = 3 mole, B = 6 mole,  
C = 1 mole

**Mole fraction (x) of component A = ?**

Percentage of mole fraction of component A =  $\frac{3}{10} \times 100 = 30\%$

**Q.31 (A)** Since all the isotopes of an element **have same proton number**, therefore, they have **same electronic configuration**. So isotopes of an element have same chemical properties but have **different** physical properties because they have different **mass numbers**.

**Q.32 (A)** Given data

C%	:	H%	:	O%
60	:	8.0	:	32
$\frac{60}{12}$	:	$\frac{8.0}{1}$	:	$\frac{32}{16}$
5	:	8	:	2
2.5	:	4	:	1
2(2.5)	:	4	:	1)
Empirical formula	= C <sub>5</sub> H <sub>8</sub> O <sub>2</sub>			
Empirical formula mass	= 100			
Molecular formula	= n(empirical formula)			

$$n = \frac{200}{100} = 2$$

**∴ Molecular formula = C<sub>10</sub>H<sub>16</sub>O<sub>4</sub>**

**Q.33 (D)**

C%	:	H%	:	O%
48	:	4	:	48
$\frac{48}{12}$	:	$\frac{4}{1}$	:	$\frac{48}{16}$
$\frac{4}{3}$	:	$\frac{4}{3}$	:	$\frac{3}{3}$
3(1.33)	:	1.33	:	1)
4	:	4	:	3

**Empirical Formula of ascorbic acid**  
**= C<sub>4</sub>H<sub>4</sub>O<sub>3</sub>**

**Q.34 (A)** Number of moles of NaOH.

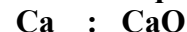
$$2.5 \times 0.5 = 1.25 \text{ moles.}$$

**Q.35 (C)** Molality of pure water

$$= \frac{\text{number of moles of solute}}{\text{volume of solution in dm}^3}$$
$$= \frac{1000/18}{1} = 55.5 \text{ mol dm}^{-3}.$$

$$\therefore \text{molarity of pure water} = 55.5 \text{ mol dm}^{-3}$$

**Q.36 (B)** From the balanced equation



**Molar ratio** 2 : 2

**0.1 : 0.1**

**Molar mass of CaO = 56 amu**

$$\text{Mass of CaO formed} = 0.1 \times 56 = 5.6 \text{ g}$$

**Q.37 (B)** If we know the mass of one substance, we can calculate the volume of other substance with the help of balanced chemical equation and this relationship is called **mass – volume relationship**.

**Q.38 (A)** Number of chlorine atoms

$$= \frac{7.1}{35.5} \times 6 \times 10^{23}$$
$$= 1.2 \times 10^{23}$$

Q.39 (B)

	CO <sub>2</sub>	:	H <sub>2</sub> O
Molar mass	44g	:	18g
According to Condition	11g	:	?
Amount of water			= 4.5g

∴ 4.5g of water has same number of water molecule as present in 11g of CO<sub>2</sub>

Q.40 (A) 1mole of N<sub>2</sub> gas = 28g  
= 22.41dm<sup>3</sup> at STP

## Worksheet-12

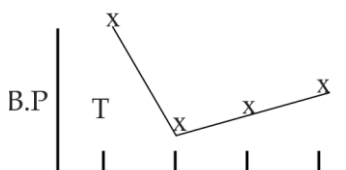
## (A. Physical Chemistry)

## States of Matter (Gaseous + Liquid)

- Q.1 When sample of a gas is compressed at constant temperature from 15 atm to 60 atm, its volume changes from  $76.0\text{cm}^3$  to  $20.5\text{cm}^3$ ?

- A) The gas behaves ideally
- B) The gas behaves non-ideally
- C) The volume of gas decreases
- D) Gas is absorbed on the vessel walls

- Q.2 The diagram shows the variation of the boiling points of hydrogen halides.



What explains the higher boiling point of HF?

- A) The high bond energy of HF
  - B) In HF there is H- bonding between HF molecules
  - C) The electronegativity difference between F and H is much higher than that of other halides
  - D) The effect of nuclear charge is much reduced in fluorine which polarizes HF molecule
- Q.3 Real gases show deviation from which of the following postulates of kinetic molecular theory (KMT) of gases:
- A) Gases exert pressure
  - B) With the increases of temperature, kinetic energy of the gas molecule increases
  - C) The collision among the gas molecules are perfectly elastic
  - D) The molecules of a gas a have no forces of attraction for each other
- Q.4 When oxygen gas volume decreases from  $4.0\text{dm}^3$  to  $2.0\text{dm}^3$ , the pressure increases from  $400\text{ kPa}$  to?
- A)  $600\text{ kPa}$
  - B)  $800\text{ kPa}$
  - C)  $200\text{ kPa}$
  - D)  $500\text{ kPa}$

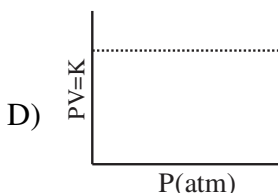
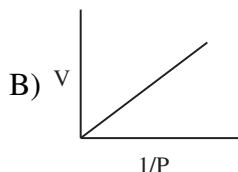
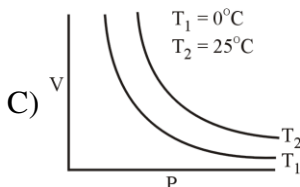
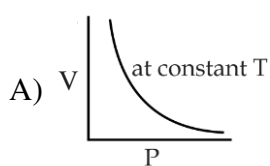
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SCRATCH WORK



- Q.5** All of the following factors affect vapour pressure of a liquid EXCEPT?
- A) Nature of liquid                      C) Surface area  
B) Temperature                          D) Intermolecular forces
- Q.6** Which one of the following gases shows more non-ideal behaviour?
- A) O<sub>2</sub>    C) N<sub>2</sub>  
B) CO<sub>2</sub>                                       D) H<sub>2</sub>
- Q.7** Which of the following equations is used for real gases?
- A)  $PV = nRT$   
B)  $PV = \frac{1}{3} mNC^2$   
C)  $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$   
D)  $\left( P_{\text{obs}} + \frac{n^2 a}{V^2} \right) (V_{\text{vessel}} - nb) = nRT$
- Q.8** The gas laws can be summarized in the ideal gas equation  $PV = nRT$ . Which of the following statements is / are incorrect?
- A) One mole of any ideal gas occupies the same volume under the same condition of temperature and pressure  
B) The density of an ideal gas at constant pressure is inversely proportional to temperature  
C) Volume of a given mass of a gas increases two times if temperature is raised from 25°C to 50°C at constant pressure  
D) Both A and B
- Q.9** Which one of the following mathematical expression does not correctly represent the behavior of an ideal gas?
- A)  $PV_m \propto T$                                   C)  $PM \propto dT$   
B)  $P \propto CT$                                       D)  $P \propto \frac{1}{d}$

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SCRATCH WORK

Q.10 In which of the following isotherms volume increases?



Q.11 Which one of the following postulates of kinetic molecular theory (KMT) of gases explains Charles's law?

- A) Gases exert pressure
- B) With the increase of temperature kinetic energy of the gas molecule increases
- C) Gas molecules show elastic collision
- D) No attractive forces among gas molecules

Q.12 Under what conditions of temperature and pressure will a real gas behave like an ideal gas?

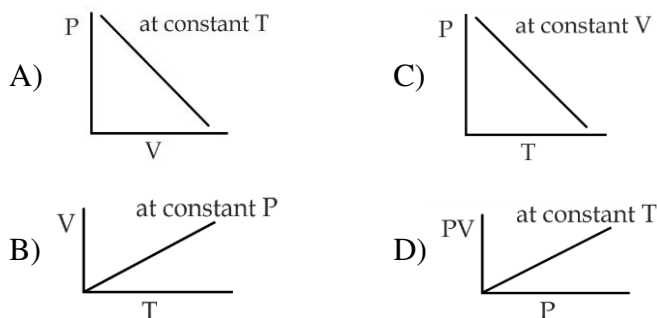
Options	Temperature	Pressure
A)	Low	Low
B)	Low	High
C)	High	High
D)	High	Low

Q.13 Which one of the following substances shows more than one kind of chemical bonding?

- A) Brass
- B) Diamond
- C) Copper
- D) Water

USE THIS SPACE FOR  
SCRATCH WORK

- Q.14 Which of the following diagram correctly describes the behavior of fixed mass of an ideal gas (T is measured in K)?



- Q.15 Which of the following liquids has greater boiling point?

- A) Acetone  
B) Water  
C) Diethyl ether  
D) Glycerol

- Q.16 Calculate the density of carbon dioxide ( $\text{CO}_2$ ) gas at  $0^\circ\text{C}$  and 1atm pressure.

A)  $= \frac{1 \times 44}{0.0821 \times 273} \text{ gdm}^{-3}$   
B)  $= \frac{1 \times 44}{0.0821 \times 298} \text{ gdm}^{-3}$   
C)  $= \frac{1 \times 44}{8.3143 \times 273} \text{ gdm}^{-3}$   
D)  $= \frac{1 \times 44}{1.987 \times 273} \text{ gdm}^{-3}$

- Q.17 Which of the following molecules cannot form hydrogen bonding with each other?

- A)  $\text{NH}_3$   
B)  $\text{CH}_3\text{NH}_2$   
C)  $\text{CH}_3\text{OH}$   
D)  $\text{CH}_3\text{COCH}_3$

- Q.18 London dispersion forces are the only forces present among the:

- A) Molecules of water in liquid state  
B) Atoms of helium in gaseous state at high temperature  
C) Molecules of solid iodine  
D) Molecules of hydrogen chloride gas

- Q.19 All of the following molecules show hydrogen bonding EXCEPT:

- A) HF molecules  
B) Acetone and chloroform molecule  
C) Water molecules  
D) HCl molecules

USE THIS SPACE FOR  
SCRATCH WORK

- Q.20** Which one of the following types of intermolecular forces is the strongest one?  
A) Hydrogen bonding C) Debye forces  
B) London dispersion forces D) Dipole dipole forces
- Q.21** According to Boyle's law, the volume of a given mass of a gas is inversely proportional to pressure at constant temperature. Mathematically  $PV = k$ . The value of  $k$  depends on all of the following factors EXCEPT:  
A) Amount of the gas C) Nature of the gas  
B) Rate of diffusion of the gas D) Temperature
- Q.22** Which one of the following gas laws can only be explained on the basis of Kelvin scale?  
A) Boyle's law C) Dalton's law  
B) Charles's law D) Avogadro's law
- Q.23** Which of the following is/are application of general gas equation. It is used to determine?  
A) Molecular mass of a gas only  
B) Density of a gas only  
C) Both A and B  
D) Neither A nor B
- Q.24** Although HF is more polar than  $H_2O$ , but even then boiling point of  $H_2O$  is greater than that of HF. It is because of:  
A) HF is in the gaseous state  
B)  $H_2O$  has two hydrogen bonds per molecule  
C) HF is a weak acid  
D) HF has one hydrogen bond per molecule
- Q.25** Which of the following is correct decreasing order of boiling point of given liquids?  
A) Water > Ethanol > HF >  $NH_3$   
B) Ethanol > HF >  $NH_3$  > Water  
C)  $NH_3$  > HF > Water > Ethanol  
D) HF >  $NH_3$  > Ethanol > Water
- Q.26** Which one of the following relationship is correct regarding van der waal's gas equation?  
A)  $a_{NH_3} > a_{N_2}$  but  $b_{NH_3} < b_{N_2}$   
B)  $a_{NH_3} < a_{N_2}$  but  $b_{NH_3} < b_{N_2}$   
C)  $a_{NH_3} < a_{N_2}$  but  $b_{NH_3} > b_{N_2}$   
D)  $a_{NH_3} > a_{N_2}$  but  $b_{N_2} \geq b_{NH_3}$

USE THIS SPACE FOR  
SCRATCH WORK

**Q.27** The spontaneous change of a liquid into its vapours is called evaporation. Identify the incorrect statement about evaporation:

- A) It is natural and continuous
- B) It is exothermic
- C) It causes cooling
- D) It is surface phenomenon

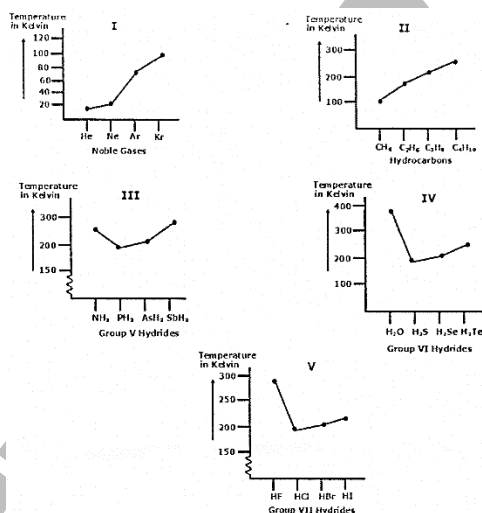
**Q.28** Equal volumes of all the ideal gases at the same temperature and pressure contain equal number of molecules. This is in accordance to:

- A) Boyle's law
- B) Avogadro's law
- C) Charles's law
- D) Dalton's law

**Q.29** Mark incorrect statement about boiling point of water:

- A) Boiling point of water is  $120^{\circ}\text{C}$  at 1489 torr pressure
- B) Boiling point of water is  $25^{\circ}\text{C}$  at 23.7 torr pressure
- C) Boiling point of water is  $98^{\circ}\text{C}$  at 700 torr pressure at the top of Murree Hills
- D) Boiling point of water is  $70^{\circ}\text{C}$  at 323 torr pressure at the top of Mount Everest

**Q.30** Study the following graphs of boiling points of some substances:



Which of the above graphs show that some members of the graph have hydrogen bonding?

- A) I + V
- B) II + IV
- C) III + IV + V
- D) I + II + III

USE THIS SPACE FOR  
SCRATCH WORK



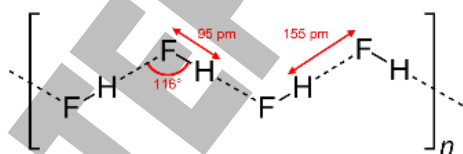
## ANSWER KEY (Worksheet-12)

1	B	11	B	21	B
2	B	12	D	22	B
3	D	13	D	23	C
4	B	14	B	24	B
5	C	15	D	25	A
6	B	16	A	26	A
7	D	17	D	27	B
8	C	18	C	28	B
9	D	19	D	29	D
10	C	20	A	30	C

## ANSWERS EXPLAINED

**Q.1 (B)** With reference to **Boyle's law** with the **increase of pressure** from **15 atm to 60 atm (4 times)**, then the volume of a gas should be **decreased  $\frac{1}{4}$  times**. But in this case the decrease in volume is not according to **Boyle's law**. Therefore, the gas behaves **non-ideally**.

**Q.2 (B)** The highly electronegative atoms responsible for making hydrogen bonding are **Fluorine, Oxygen, Nitrogen** and rarely chlorine. The **size of Fluorine is small** and it is the most electronegativity element in the periodic table. Electronegativity of Fluorine is 4. **Hydrogen bonding** in **HF** is shown below.



- Since **hydrogen bonding is stronger than dipole dipole forces** therefore, HF exists in the liquid state (**BP of HF is 19.5°C**) while other halogen acids exist in the gaseous state.

**Q.3 (D)** Real gases show deviation from the following postulates of KMT:

The molecules of a gas have no forces of attraction for each other. In fact, at high pressure and low temperature real gases deviate from above postulate as explained below:

- At high pressure** gas molecules come close to each other and in such condition effective volume of a gas molecules cannot be neglected which is against the postulates of KMT of an ideal gas (**Gases are ideal at low pressure and non-ideal at high pressure**)
- At low temperature** K.E decreases and attractive forces develop between the gas molecules which is also against the postulates of KMT (**Gases show ideal behavior at high temperature and non-ideal behavior at low temperature**)

**Q.4 (B)** According to **Boyle's law**, mathematically

$$P_1 V_1 = P_2 V_2 \text{ (at constant } n \text{ \& } T)$$

$$\therefore P_2 = \frac{P_1 V_1}{V_2}$$

$$P_2 = 4 \times \frac{400}{2} = 800 \text{ kPa}$$

**Q.5 (C)** **Vapour pressure** of a liquid is an intensive property which depends on nature of the substance and it does not depend on surface area. Other examples of intensive properties are M.P, B.P, viscosity, surface tension etc.

**Q.6 (B)** Greater is the **molar mass**, greater is the size. Therefore, greater is the **polarizability**, **stronger** are **intermolecular forces**. Thus greater is the deviation from the **ideal gas** behaviour. That is why **CO<sub>2</sub>** gas shows more **non-ideal** behaviour as its molar mass is greater as compared to other gases.

**Q.7 (D)**  $\left(P_{\text{obs}} + \frac{n^2 a}{V^2}\right)(V_{\text{vessel}} - nb)$  This equation is van der Waal's gas equation. A real gas obeys this equation because real gas shows deviation from ideal gas behaviour at low temperature and high pressure.

**Q.8 (C)** **Charles's law** can only be explained on the basis of **Kelvin scale**, not on the basis of centigrade scale. Therefore, under the given condition the volume of a given mass of a gas would not increase two times by **increasing temperature** from **25°C** to **50°C**.

**Q.9 (D)** It is **incorrect statement**. In fact, with the **increase of pressure** under the given condition **density of a gas** **also increases** i.e.  $P \propto d$ .

**Q.10 (C)** **Two isotherms** are obtained, one at **0°C** and other at **25°C** as shown in the figure. By keeping the temperature constant and again vary the pressure and volume and plot the isotherm. **It goes away from both the axes**. The reason is that at **higher temperature**, the volume of given mass of a gas increases. Similarly if we increase the temperature further, make it constant and plot another isotherm, it further goes away from the axis and thus

volume of a gas increases as the isotherms move away from the axes.

**Q.11 (B)** According to **KMT** the average kinetic energy of a gas molecules varies directly as the absolute temperature of the gas. i.e. ( $T \propto K.E$ ). This **postulates** clearly explains **Charles's law**. According to this law, the volume of the given mass of a gas is directly proportional to the absolute temperature, when the **pressure** is kept **constant**.

**Q.12 (D)** **A real gas behaves like an ideal gas under two conditions.**

**i. At high temperature** kinetic energy of gas molecules increases, and intermolecular forces become almost negligible. ( $a = 0$  i.e. "a" constant becomes insignificant) in van der waal's gas equation:

$$\left(P_{\text{obs}} + \frac{n^2 a}{V^2}\right)(V_{\text{vessel}} - nb) = nRT \quad (\text{i})$$

When  $a = 0$  then  $(P_i)(V_{\text{vessel}} - nb) = nRT$  (ii)

**ii. At low pressure** gas molecules move away from each other ( $b = 0$  i.e. "b" constant becomes insignificant) in van der Waal's gas equation:

$$(P_i)(V_{\text{vessel}} - nb) = nRT \quad (\text{iii})$$

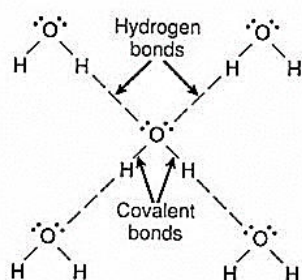
• When  $b = 0$  then  $(P_i)(V_{\text{vessel}}) = nRT$

$$(PV) = nRT \quad (\text{iv})$$

The van der Waal's gas equation approaches the ideal gas equation  $PV = nRT$  as the values of these constants approach zero. The constant "a" provides a correction for the intermolecular forces. Constant "b" is a correction for finite molecular size and its value is the volume of one mole of the atoms or molecules of a gas.

- Under these two conditions **van der Waal's gas equation** reduces to general gas equation ( $PV = nRT$ ).

**Q.13 (D)** Water molecules have **covalent bonds** and **H-bondings** as shown in figure.

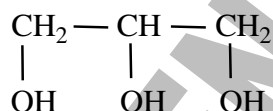


Hydrogen bonding in water.

**Q.14 (B)**  $PV = nRT$ , since **P**, **n** and **R** are **constant**, we have  $V = aT$ ,  $a = \frac{nR}{P} > 0$ .

Therefore, a plot of **V** vs **T** gives a **straight line** with a **positive gradient** ( $\frac{nR}{P}$ ) passing through the **origin**.

**Q.15 (D)** In glycerol there are three **OH-groups** attached with **three carbon** atoms as shown in the structure.



As glycerol is **highly polar molecule** due to the presence of **three OH-groups**. Thus they form stronger hydrogen bonds. So boiling point of **glycerol (290°C)** is higher than that of other liquids mentioned in the question. Boiling points of other liquids are, **acetone (56°C)**, **diethyl ether (34.5°C)** and **water (100°C)**.

**Q.16 (A)** Density of  $\text{CO}_2$  gas

$$\begin{aligned} &= \frac{1 \times 44}{0.0821 \times 273} \text{ g dm}^{-3} \\ &= 0.7138 \text{ g dm}^{-3} \end{aligned}$$

**Q.17 (D)** Propanone shows dipole dipole forces but it does not show **hydrogen bonding** because **H-atom is not bonded** directly to a small and highly electronegative atom such as **N, O, and F**. While all others **A, B and C** show **hydrogen bonding**.

**Q.18 (C)** **London dispersion forces** are **weakest forces**. They are more significant in **non-polar molecules**. The elements of **VIIA and VIIIA groups** show London dispersion forces. All the halogens are non-polar diatomic molecules, but there is a **big difference** in their **physical states** at **room temperature**. **Fluorine** is a gas and boils at **(-188.1°C)** while iodine is a solid at room temperature which **boils** at **+184.4°C**. The polarizability of iodine molecule is **much greater** than that of fluorine.

Halogens	F <sub>2</sub>	Cl <sub>2</sub>	Br <sub>2</sub>	I <sub>2</sub>
Colours	Pale Yellow	Greenish Yellow	Reddish Brown	Greyish Black
Physical State	Gas	Gas	Liquid	Solid
Melting Points (°C)	-220	-101	-7.2	114
Boiling Points (°C)	-188.0	-34.6	58.5	184.4

**Q.19 (D)** **Hydrogen bonding** is the **electrostatic force** of attraction between a highly electronegative (**N, O and F**) atom and partial positively charged hydrogen atom. e.g. **HF(ℓ)**, **H<sub>2</sub>O(ℓ)**, and in between **Acetone (ℓ)** and **Chloroform (ℓ)** exist hydrogen bonding.

However **HCl** shows dipole dipole forces.

**Q.20 (A)** Hydrogen bonding is the strongest electrostatic force of attraction among all the others except ion dipole forces.

**Q.21 (B)** Rate of diffusion does not affect the value of  $k$  (proportionality constant).

**Q.22 (B)** Charles's law can only be explained on the basis of Kelvin scale. It cannot be explained on the basis of centigrade scale.

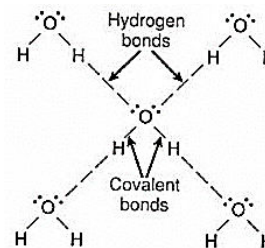
**Q.23 (C)** General gas equation in the form of ( $PM = dRT$ ) can be used to determine

- Molecular mass of the gas ( $M = \frac{dRT}{P}$ )

- Density of a gas by the formula ( $d = \frac{PM}{RT}$ ).

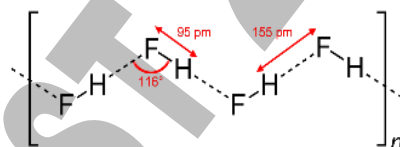
**Q.24 (B)** Greater is the number of hydrogen bondings, stronger are intermolecular forces and **greater** is the **boiling point of a liquid**. Since water molecules have **two hydrogen bonds** per molecule as **compared** to **HF** molecule (which has only one hydrogen bond), therefore the **boiling point of water (B.P = 100°C)** is **greater than that of HF liquid (B.P = 19.5°C)** as shown in the structure.

- Hydrogen bonding in water as shown below:



Hydrogen bonding in water.

- Hydrogen bonding in HF as shown below:



**Q.25 (A)** Boiling point of a liquid depends on the strength of intermolecular forces. So stronger are the intermolecular forces, **greater** is the **boiling point of a liquid**. The correct order of **decreasing boiling points of liquids** as shown in the tabular form:

Formula	Reason	Boiling point
(H <sub>2</sub> O)	<ul style="list-style-type: none"><li>• In water there are two hydrogen bonds per molecule.</li></ul>	B.P = 100°C (greater than the rest)
Ethanol C <sub>2</sub> H <sub>5</sub> OH	<ul style="list-style-type: none"><li>• Involves hydrogen bonding</li><li>• Weaker than that of water</li></ul>	B.P = 78.26°C
(HF)	<ul style="list-style-type: none"><li>• In HF there is one hydrogen bond per molecule</li></ul>	B.P = 19.5°C

(NH <sub>3</sub> )	<ul style="list-style-type: none"><li>In NH<sub>3</sub> there is one hydrogen bond per molecule</li></ul>	B.P = -33.34°C
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**Conclusion:**

The correct decreasing order of boiling point of given liquids is as follow:

Water > Ethanol > HF > NH<sub>3</sub>

**Q.26 (A)** Since there is **hydrogen bonding in ammonia** and **London dispersion forces in nitrogen gas**.

- As hydrogen bond is **stronger than** London dispersion forces, therefore, the value of “a” constant of **ammonia** is greater than that of “a” constant of **nitrogen** (a constant is a measure of strength of intermolecular forces). **Intermolecular forces develop at high pressure and low temperature in the real gases.**
- On the other hand the value of “b” constant of nitrogen is **greater than that of “b” constant of ammonia** (b constant is excluded volume at high pressure).
- As we known that in **nitrogen molecules** there are weaker London dispersion forces as compared to hydrogen bonding in **ammonia**, so that is why **value of constant “b” for ammonia is less than that of constant “b” of**

nitrogen gas as shown in the table.

Gas	“a” (atm dm <sup>6</sup> mol <sup>-2</sup> )	“b” (dm <sup>3</sup> mol <sup>-1</sup> )
NH <sub>3</sub>	4.170	0.371
N <sub>2</sub>	1.390	0.391

**Q.27 (B)** In fact, it is endothermic process, water molecules absorb energy from the surrounding. As a result higher energy molecules come on the surface of a liquid from where they change into vapours. That is why evaporation causes cooling because temperature of the environment decreases.

**Q.28 (B)** Actually it is **definition** of **Avogadro’s law**. **Mathematically it is shown as**  
 $V \propto n(\text{at constant T and P}).$

**Q.29 (D)** It is incorrect statement. In fact, **boiling point of water is 69°C at 323 torr pressure at the top of Mount Everest.**

**Q.30 (C)** There is hydrogen bonding in option **“C” denoted by Roman letter III+IV+V.**



**Worksheet-13**  
**(A. Physical Chemistry)**  
**States of Matter (Solids)**  
**Atomic Structure**

USE THIS SPACE FOR  
SCRATCH WORK

- Q.1** A phenomenon in which a compound exists in more than one crystalline forms is called:
- A) Polymorphism                      C) Isomorphism  
B) Allotropy                              D) Isomerism
- Q.2** Which of the following sets of solid elements A, B, C and D includes a giant metallic structure, a macromolecular structure and a simple molecular structure?
- A) Na, Mg, Al                              C) Al, Si, S  
B) C, Si, Sn                                D) Al, S, Si
- Q.3** Face centered cubic structure is shown by:
- A) Cd                                        C) Ag  
B) Na                                        D) Mg
- Q.4** Iodine is in the solid state and has greyish black colour. It has all of the following properties EXCEPT:
- A) It is a molecular solid  
B) It shows face centered cubic structure  
C) It has strong London dispersion forces  
D) I – I bond distance in the crystal lattice is less than that of iodine in the gaseous state
- Q.5** Mark the incorrect statement about diamond which is allotropic form of carbon:
- A) It has two dimensional structure  
B) It shows face centered cubic structure  
C) It is a type of covalent solid  
D) It is a non-conductor
- Q.6** Identify the incorrect statement about giant structure of NaCl:
- A) It shows face centered cubic structure  
B) It has four formula units per unit cell in the crystal lattice  
C) The distance between two adjacent ions of different kind in the crystal lattice is  $2.75\text{\AA}$

D) It is non-conductor in the solid state

- Q.7** All of the following pair of crystalline solids are correctly matched w.r.t type of bonding EXCEPT:

Options	Crystalline solids	Nature of bonding
A)	Diamond, SiC	Covalent bond
B)	MgO, NaCl	Ionic bond
C)	Al, Zn	Metallic bond
D)	I <sub>2</sub> , HCl	London dispersion forces

- Q.8** Which one of the following properties is not shown by molecular crystalline solids?

- A) They are soft  
B) They have low densities  
C) They all are soluble in non-polar solvents  
D) They are mostly volatile

- Q.9** Which of the following statements about ionic solids, covalent solids and molecular solids is incorrect?

Opt.	Properties	Ionic solids	Covalent solids	Molecular solids
A)	Example	NaCl, CaO	Diamond, SiC	I <sub>2</sub> , CO <sub>2</sub> , HCl, Ice
B)	Basic component	Ions	Atom	Molecule
C)	Electrical conductivity	Non-conductor in solid state	Non-conductor except graphite	Non-conductor except HCl in H <sub>2</sub> O
D)	M.P and B.P	Very high M.Ps and B.Ps	Very low M.Ps and B.Ps	High M.Ps and B.Ps

- Q.10** In crystal lattice of ice, each O-atom of water molecule is attached to:

- A) Four H-atoms  
B) One H-atom  
C) Two H-atoms  
D) Three H-atoms

- Q.11** The nucleus of an atom contains:

- A) Always neutrons  
B) Always protons and neutrons  
C) Always protons only  
D) Usually protons and neutrons

USE THIS SPACE FOR  
SCRATCH WORK

**Q.12** In the periodic table elements are arranged in order of increasing their:

- A) Mass number                      C) Proton number  
B) Reactivity                        D) Density

**Q.13** An atom with proton number of 19 and mass number of 40 is/has:

- A) Found in the Group - IIA  
B) Found in the third period  
C) Same number of protons and electrons  
D) Same number of protons and neutrons

**Q.14** The neutron particle has:

- A) A mass of 1 gram  
B) A mass approximately equal to that of proton  
C) A charge equal but opposite to that of electron  
D) It is present in all the atoms

**Q.15** Proton numbers of certain elements are given. Which represents an element which would not be in the same period as rest of the elements?

- A) 3                                      C) 9  
B) 10                                    D) 12

**Q.16** Which of the following particles contains 20 neutrons 19 protons and 18-electrons?

- A)  ${}^{39}_{19}\text{K}^{+}$                               C)  ${}^{39}_{19}\text{K}$   
B)  ${}^{40}_{18}\text{Ar}$                               D)  ${}^{39}_{20}\text{Ca}$

**Q.17** Which of the following statements is incorrect?

- A) Metals have 1 – 3 valence electrons  
B) Non-metals have 4 – 7 valence electrons  
C) Noble gases have 2 or 8 valence electrons  
D) All the elements of IIIA group are metals

**Q.18** All of the following statements are correct EXCEPT:

- A) Group number is based on valence electrons  
B) Period is based on number of shells involved in the electronic configuration  
C) Electrons present in the inner shells are called valence electrons  
D) Block of the elements in the modern Periodic table is

USE THIS SPACE FOR  
SCRATCH WORK

based on partially filled atomic orbitals

**Q.19** Which of the following species has maximum number of unpaired electrons?

- A)  $\text{Fe}^{+3}$  C) Zn  
B)  $\text{Ni}^{+2}$  D)  $\text{Cu}^{+}$

**Q.20** The lowest principal quantum number that an electron can have is:

- A) 0 C) 1  
B) 2 D) 3

**Q.21** The relative energy of 4s, 4p and 3d orbitals are in the order of:

- A)  $3d < 4p < 4s$  C)  $4s < 4p < 3d$   
B)  $4s < 3d < 4p$  D)  $4p < 3d < 4s$

**Q.22** With the increase of value of principal quantum number (n), the shape of the s-orbitals remain same although their sizes:

- A) Increase  
B) Decrease  
C) Remain the same  
D) May or may remain the same

**Q.23** All of the following are applications of quantum numbers EXCEPT:

- A) To find group of elements  
B) To find block of elements  
C) To find period of elements  
D) To determine 1<sup>st</sup> ionization energy of elements

**Q.24** In a multi-electron atoms, the energy of the electrons in a particular orbital is determined by:

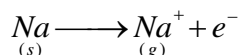
- A) n C)  $n + l$   
B)  $n + l, m$  D)  $n, l, m, s$

**Q.25** The fact that the two electrons in an atomic orbital must have opposite spin as deduced from:

- A) Hund's Rule  
B) Pauli's Exclusion Principle  
C) Aufbau Rule  
D) Heisenberg's Uncertainty Principle

USE THIS SPACE FOR  
SCRATCH WORK

- Q.26** All of the following statements about ionization energy are correct EXCEPT:
- A) Successive ionization energies of an element increase
  - B) Atom of the element must be in the gaseous state before loss of electron
  - C) Elements which have stable electronic configuration have greater ionization energy
  - D) Ionization energy may or may not be endothermic process
- Q.27** Which of the following elements has greater first ionization energy?
- A) Si
  - B) Cl
  - C) P
  - D) Al
- Q.28** Consider the following thermo-chemical equation:



The enthalpy change involved in the above ionization of the solid sodium into gaseous  $\text{Na}^{+}$  ion is:

- A)  $\Delta H_i$
  - B)  $\Delta H_{\text{sub}}$
  - C)  $\Delta H_{\text{at}} + \Delta H_i$
  - D)  $\Delta H_{\text{at}}$
- Q.29** An atomic orbital may never be occupied by:
- A) 1 electron
  - B) 3 electrons
  - C) 2 electrons
  - D) Zero electron
- Q.30** Where in a periodic series do you find strong based formers?
- A) Inert gases
  - B) Middle
  - C) Right
  - D) Left
- Q.31** Which of the following is proper order of characteristic features of quantum numbers?
- A) Size, Shape, Orientation
  - B) Orientation, Size, Shape
  - C) Shape, Size, Orientation
  - D) Shape, Orientation, Size
- Q.32** Which of the following formula is used to determine number of electrons in a sub-shell?
- A)  $2n^2$
  - B)  $l = n - 1$
  - C)  $2(2l + 1)$
  - D)  $m = 2l + 1$

USE THIS SPACE FOR  
SCRATCH WORK



**Q.33** Which of the following ions have more electrons than protons and more protons than neutrons?

- A)  $D^{-1}$  C)  $OD^{-}$   
B)  $He^{+}$  D)  $OH^{-}$

**Q.34** Identify the incorrect statement about electron affinity:

- A) Elements having stable electronic configuration have high electron affinity  
B) Elements of 3rd period have greater electron affinity than that of 2nd period  
C) It is associated with element  
D) Element must be in the gaseous state before gain of electron

**Q.35** In which of the following pair of elements, first element of the pair has comparatively greater electron affinity?

- A) F, Cl C) N, P  
B) S, O D) B, Al

**Q.36** In which of the following pair of elements, 1<sup>st</sup> element of the pair has lower ionization energy?

- A) N, O C) Mg, Al  
B) Ne, F D) S, P

**Q.37** Which of the following is correct electronic configuration of Copper (atomic number of Cu = 29)?

- A)  $[Ar] 3d^9, 4s^2$  C)  $[Kr] 3d^9, 4s^2$   
B)  $[Ar] 3d^{10}, 4s^1$  D)  $[Kr] 3d^{10}, 4s^1$

**Q.38** Correct electronic configuration of potassium (atomic number K=19) is:

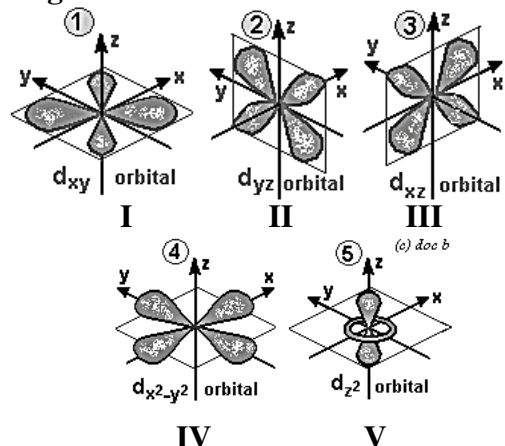
- A)  $[Ar] 4s^1$  C)  $[Kr] 4s^2$   
B)  $[Ne] 4s^2$  D)  $[Kr] 4s^1$

**Q.39** Which of the following atoms represent isotones?

- A)  $^{12}_6C$ ,  $^{13}_6C$ ,  $^{14}_6C$  C)  $^{40}_{18}Ar$ ,  $^{42}_{20}Ca$ ,  $^{43}_{21}Sc$   
B)  $^{40}_{18}Ar$ ,  $^{40}_{20}Ca$ ,  $^{41}_{21}Sc$  D)  $^{14}_7N$ ,  $^{16}_8O$ ,  $^{18}_9F$

USE THIS SPACE FOR  
SCRATCH WORK

Q.40 Followings are all the d-atomic orbitals.



Which of the following is collar shaped d-atomic orbital?

- A) I and II      C) III and IV  
B) V only      D) IV only

Q.41 Mark the incorrect statement:

- A) Number of protons in the nucleus of an atom is called proton number and it is shown by Z  
B) Sum of protons and neutrons in the nucleus of an atom is called nucleon number (mass number) and is shown by A  
C) Number of neutrons = A – Z  
D) Number of protons and electrons in a cation is equal

Q.42 Properties of three fundamental particles are given in the tabular form:

	Particles	Charge	Relative charge	Mass (kg)	Deflection under electric field
I	Proton	$+1.6022 \times 10^{-19}$	+1	$1.6726 \times 10^{-27}$	Deflects toward negative pole
II	Neutron	0	0	$1.6705 \times 10^{-27}$	Undelected
III	Electron	$-1.6022 \times 10^{-19}$	-1	$9.1095 \times 10^{-31}$	Deflects towards positive pole

Identify which one is not correctly matched:

- A) I      C) III  
B) II      D) I and III

USE THIS SPACE FOR  
SCRATCH WORK

- Q.43 Rutherford's model of atom failed because:**
- A) The atom did not have a nucleus and electrons
  - B) It did not account for the attraction between protons and neutrons
  - C) It did not account for the stability of the atom
  - D) There is actually no space between the nucleus and the electrons
- Q.44 Bohr's hydrogen atomic model of atom is contradicted by:**
- A) Planck's quantum theory
  - B) Heisenberg's uncertainty principle
  - C) Photoelectric effect
  - D) Dual nature of electrons
- Q.45 All of the following statements about Rutherford's atomic model are correct EXCEPT:**
- A) Most of the part of atom is empty
  - B) Central part of the atom is positively charged which is called nucleus
  - C) He proposed the planetary model of atom (similar to the solar system)
  - D) All the particles are present in the nucleus except electrons
- Q.46 According to Planck's quantum theory of radiation, all of the following mathematical relationships are correct EXCEPT:**
- A)  $E \propto \nu$
  - B)  $E \propto \frac{1}{\lambda}$
  - C)  $\bar{\nu} = \frac{1}{\lambda}$
  - D)  $E \propto \frac{1}{\nu}$
- Q.47 According to Bohr's hydrogen atomic model, if electron is present in 2<sup>nd</sup> shell (n = 2), the value of radius (for 2<sup>nd</sup> orbit) is:**
- A) 2.116A°
  - B) 2.216A°
  - C) 2.135A°
  - D) 2.345A°
- Q.48 Bohr's hydrogen atomic model theory is applicable for all of the following species EXCEPT:**
- A) H
  - B) He<sup>+1</sup>
  - C) Li<sup>+2</sup>
  - D) Be<sup>+2</sup>

USE THIS SPACE FOR  
SCRATCH WORK

**Q.49** Which of the following statements about Bohr's hydrogen atomic model is incorrect?

- A)  $r_2 - r_1 < r_3 - r_2 < r_4 - r_3$
- B)  $E_2 - E_1 > E_3 - E_2 > E_4 - E_3$
- C) Energy of electron is directly proportional to  $n^2$  ( $n$  = shell number)
- D) According to him electrons not only revolve round the nucleus in circular orbit but also in elliptic orbit

**Q.50** X-rays show all of the following properties EXCEPT:

- A) They are electromagnetic radiations
- B) They travel with the velocity of light
- C) They have greater frequency than gamma rays
- D) They are used to diagnose fracture in the bones

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SCRATCH WORK

**ANSWER KEY (Worksheet-13)**

1	A	14	B	27	B	40	B
2	C	15	D	28	C	41	D
3	C	16	A	29	B	42	B
4	D	17	D	30	D	43	C
5	A	18	C	31	A	44	B
6	C	19	A	32	C	45	C
7	D	20	C	33	D	46	D
8	C	21	B	34	A	47	A
9	D	22	A	35	B	48	D
10	A	23	D	36	D	49	D
11	D	24	C	37	B	50	C
12	C	25	B	38	A		
13	C	26	D	39	C		

**ANSWERS EXPLAINED**

- Q.1 (A)** A phenomenon in which a compound exists in more than one crystalline forms is called **polymorphism**. That compound which exists in more than one crystalline forms is called a polymorphic, and these forms are called polymorphs of each other. Polymorphs have **same chemical properties** but they **differ in the physical properties**. e.g.  $\text{CaCO}_3$  shows **two crystalline forms trigonal and orthorhombic**. Polymorphs have same chemical properties, but they differ in the physical properties. The difference in physical properties is due to different structural arrangement of their particles.
- Q.2 (C)** These substances fulfill the condition because **Al** shows a giant **metallic structure**, **Si** shows **macromolecular structure** while **S** shows a simple **molecular structure**.
- Q.3 (C)** **Ag** shows **face centered cubic structure** while **Na** shows **body centered cubic structure**, **Cd** and

**Mg** show **hexagonal closed packing structure**.

- Q.4 (D)** It is incorrect statement. In fact, **I – I bond distance in the crystal is greater than that of iodine in the gaseous state**.
- **Iodine** in the **solid** state is in the form of **crystal lattice**. Since **iodine molecules** have **greater size** so there is **greater polarizability** **greater charge separation** and thus there are stronger intermolecular force in the **iodine molecules**. So in the crystal lattice there is stretching in the iodine molecules due to greater polarizability.
  - But in case of iodine in the gaseous state there is no polarizability, so iodine molecules are independent from each other.
  - That is why **I – I (271.5ppm) bond length in crystal lattice is greater than that of iodine in the gaseous state i.e. (I – I) has comparatively less bond length value (266.6pm)**.

**Q.5 (A)** In fact, **diamond** has **three dimensional structure but not two dimensional structure**. **Two dimensional structure** is shown by **graphite** (which is allotropic form of carbon).

**Q.6 (C)** In crystal lattice of **NaCl**, the **distance between two nearest ions of the same kind i.e.,  $\text{Cl}^-$  ions is  $5.63\text{\AA}$** . So the distance between two adjacent ions of different kind is  $5.63/2 = 2.815\text{\AA}$ , but not  $2.75\text{\AA}$ .

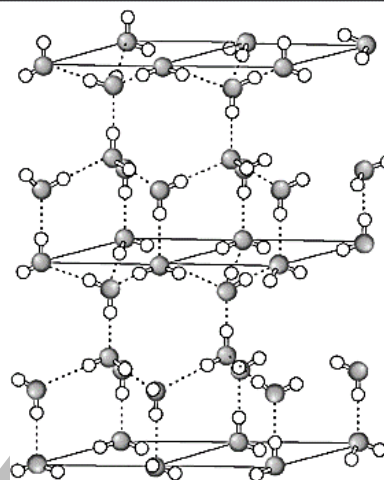


**Q.7 (D)** In fact, iodine molecules have **stronger London dispersion forces** in the **solid state**. But **HCl** has dipole-dipole forces because it is polar molecule whereas **iodine is a non-polar molecule**.

**Q.8 (C)** It is **incorrect option**. In fact **polar molecular** crystals are **soluble** in **polar solvents** e.g. **HCl** in **H<sub>2</sub>O** while **non-molecular solids** are **soluble** in **non-polar solvents** e.g. **iodine** is **soluble** in **carbon tetrachloride solvent**.

**Q.9 (D)** Covalent solids like **diamond, SiC, (SiO<sub>2</sub>)<sub>n</sub>** have **high melting and boiling point** as compared to ionic compounds e.g. **melting boiling of diamond is 3550°C** whereas **melting point of NaCl is 801°C**.

**Q.10 (A)** The presence of two hydrogen atoms and two lone electron pairs in each water molecule results in a **three-dimensional tetrahedral structure** in ice. Each oxygen atom in ice is surrounded tetrahedrally by four others. Hydrogen bonds link each pair of oxygen atoms shown in figure.



- That is why in crystal lattice of ice each O-atom of water molecule is attached to four H-atoms.
- Empty spaces are created in the structures as shown in the figure. That is why when water freezes, it occupies 9% more space and its density decreases.
- The result is that ice floats on water. The structure of ice is just like that of a diamond because each atom of carbon in diamond is at the center of tetrahedron just like the oxygen of water molecules in ice.

**Q.11 (D)** The nucleus of an atom usually contains protons and neutrons **except hydrogen (protium) which does not have neutrons**. All the other elements have protons and neutrons.

**Q.12 (C)** In the modern periodic table elements are arranged in order of increasing proton number which is shown by Z.

**Q.13 (C)** The element with **proton number 19** and **mass number 20** is isotope of K. It has same number of protons and electrons.

**Q.14 (B)** **Neutron particle** has a mass approximately equal to that of proton as shown below.

- Mass of neutrons =  $1.6750 \times 10^{-27}$  kg
- Mass of protons =  $1.6726 \times 10^{-27}$  kg  
{By comparison it is clear that mass of neutron is almost equal to that of proton}

**Q.15 (D)** The element having atomic number 12 belongs to third period because it involves three shells in its electronic configuration such as 2, 8, 2 (K, L, M) i.e three shells.

**Q.16 (A)** It has been explained in the tabular form i.e.

Specie	Protons	Electrons	Neutrons
${}_{19}^{39}\text{K}^+$	19	18	20

**Q.17 (D)** In fact all the elements of IIIA group are metals (except Boron) which is non-metal.

**Q.18 (C)** Electrons present in the inner shells are called core electrons which are responsible for shielding effect (screening effect). This effect is responsible for the decrease in force of attraction of the nucleus for the electrons present in the valence shell.

**Q.19 (A)**  ${}_{26}^{56}\text{Fe}^{+3} = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^5$ .  
( $23e^-$ )

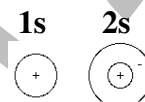
From the electronic configuration of a  $\text{Fe}^{+3}$ , it shows that there are five unpaired electrons in 3d-sub shell and it has the maximum number of unpaired electrons while others species has less number of unpaired electrons.

**Q.20 (C)** Principal quantum number is shown by n. Its possible values are 1,2,3,4,5,6,7 so it is clear that it cannot be zero.

**Q.21 (B)**

Name of sub-shell	n	$\ell$	$n + \ell$	Order of filling of sub-shell
4s	4	0	$4+0=4$	$4s < 3d < 4p$
4p	4	1	$4+1=5$	
3d	3	2	$3+2=5$	

**Q.22 (A)** With the increase n value (principal quantum number), the size of s-orbital increases whereas the shape remains the same. e.g. the size of 2s-orbital is greater than 1s-orbital



**Q.23 (D)** e.g. it can be explained on the basis of electronic configuration as in nitrogen element  ${}_7\text{N}$ :

- w.r.t... n value two shells (2,5) are involved (distribution of electron in shells), it shows that N belongs to 2<sup>nd</sup> period and VA group.
- w.r.t...  $n + \ell$  rule ( $1s^2, 2s^2, 2p^3$ ) it shows that nitrogen is p-block element
- By applying Hund's rule  
 $\left(1s^2, 2s^2, 2\uparrow p_x, 2\uparrow p_y, 2\uparrow p_z\right)$  valency of N = 3
- It is clear that quantum numbers help us to determine period, group, block, and valency of the element but quantum numbers have no concern with ionization energy

**Q.24 (C)** In a multi-electron atoms, the energy of the electrons in a particular orbital is determined by  $n + \ell$  rule, which is in accordance to Aufbau principle which states that the electrons should be filled in the energy sub-shells in order of increasing energy values. It can be explained with the help of following example.

Rule	3d	4s
$n + \ell$	$n = 3, \ell = 2$	$n = 4, \ell = 0$
	$n + \ell = 3 + 2 = 5$	$n + \ell = 4 + 0 = 4$

**Conclusion:**

$n + \ell$  rule shows that energy of 4s sub-shell is less than that of 3d. So 4s sub-shell is preferentially filled first than that of 3d.

**Q.25 (B)** This principle can be stated as follows. It is impossible for two electrons residing in the same atomic orbital of a poly-electrons atom to have the same values of four quantum numbers or two electrons in the same atomic orbital should have opposite spins ( $\uparrow\downarrow$ ).

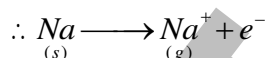
**Q.26 (D)** Ionization energy is always endothermic process because energy always has to be supplied to remove electron from the outermost shell of an isolated atom in the gaseous state. Atom can be neutral or it may carry positive charge. In either case energy has to be supplied.

**Q.27 (B)** Electronic configuration of  $_{17}\text{Cl}$  ( $1s^2, 2s^2, 2p^6, 3s^2, 3p^5$ ) shows that p-sub shell is near to completion and it is very close to electronic configuration of Ar. That is why chlorine (Cl) element has greater first ionization energy than that of other elements. First ionization energy of elements are given in the tabular form for comparison:

Elements	First ionization energy
----------	-------------------------

	( $\text{kJmol}^{-1}$ )
Cl	1251
P	1012
Si	787
Al	578

**Q.28 (C)**



$$\Delta H_{at}^\circ + \Delta H_i^\circ = +108 \text{ kJmol}^{-1} + 496 \text{ kJmol}^{-1}$$

**Conclusion:**

It shows that for the conversion of sodium atom from its solid state into gaseous cationic form, sum of  $\Delta H_{at}^\circ + \Delta H_i^\circ$  is required.

**Q.29 (B)** The volume of space in which there is 95% chance of finding an electron is called atomic orbital. An atomic orbital can accommodate maximum two electrons with opposite spin according to **Pauli's Exclusions Principle**. It can never accommodate three electrons.

**Q.30 (D)** The elements which lie on the extreme left side of the periodic table form the strongest bases such as the elements of **IA group** (NaOH, KOH, RbOH, CsOH).

**Q.31 (A)**

n	$\ell$	m
It tells about <b>size</b> of atomic orbitals	It shows <b>shape</b> of atomic orbital	It tells about <b>orientation</b> of atomic orbitals
<b>Conclusion:</b> So three quantum numbers n, $\ell$ , m depicts <b>size, shape and orientation</b> .		

**Q.32 (C)** This formula helps us to determine number of electrons in a sub-shell e.g.

Formula	Example
$2(2\ell + 1)$	$\ell$ value of d-sub shell = 2 so d-sub shell has number of electrons = $2(2 \times 2 + 1) = 10$ Electrons

**Q.33 (D)** It can be explained with the help of table.

Ions	Protons	Electrons	Neutrons
D <sup>-</sup>	1	2	1
He <sup>+</sup>	2	1	2
OD <sup>-</sup>	9	10	9
OH <sup>-</sup>	9	10	8

**Q.34 (A)** Those elements which have stable electronic configuration have comparatively low electron affinity

- e.g. Neon has stable electronic configuration and its first electron affinity value is only +29 kJmol<sup>-1</sup>. On the other hand its first ionization energy value is +2081 kJmol<sup>-1</sup> which shows that it is comparatively greater value.

**Q.35 (B)** The elements of third period have comparatively greater electron affinity than that of second period elements.

- Because each atom of the elements of the second period has comparatively smaller size due to stronger nucleus hold and overcrowding of electrons.
- Due to these reasons electron affinity of second period elements is comparatively less than that of third period elements as shown in the tabular form.

Electronic affinity (kJmol <sup>-1</sup> ) of 2 <sup>nd</sup> Period	Electronic affinity (kJmol <sup>-1</sup> ) of 3 <sup>rd</sup> Period
O = -141	S = -200

F = -322

Cl = -342

**Q.36 (D)** Ionization energy of phosphorus (P) is greater than that of sulphur (S) because in case of phosphorus 3p-sub shell is half filled as shown in the electronic configuration ( $_{15}\text{P} = 1s^2, 2s^2, 2p^6, 3s^2, 3p^3$ ) whereas in case of sulphur (S) it has four electrons in 3p sub-shell which is not half filled as shown in electronic configuration of ( $_{16}\text{S} = 1s^2, 2s^2, 2p^6, 3s^2, 3p^4$ ).

- By comparison it is clear that the element which has half-filled p-sub shell has stable electronic configuration and has greater first ionization energy.

Elements	Electronic configuration (E.C)	Cause of stability	First I.E kJmol <sup>-1</sup>
$_{15}\text{P}$	$1s^2, 2s^2, 2p^6, 3s^2, 3p^3$	p-sub shell is Half filled more stable E.C	(1012) More first I.E
$_{16}\text{S}$	$1s^2, 2s^2, 2p^6, 3s^2, 3p^4$	p-sub shell is not half filled	(1000) Less first I.E

**Conclusion:** Greater is the stable electronic configuration, more is first ionization energy.

**Q.37 (B)** In 3d-series Cr and Cu show abnormal electronic configuration. General configuration of Cr should be (Ar)  $3d^4, 4s^2$ , since 3d sub-shell is near to half filled, so that is why 3d orbital snatches one electron from 4s and shows electronic configuration (Ar)  $3d^5, 4s^1$ .

- Similarly general electronic configuration of Cu should be (Ar)  $3d^9, 4s^2$ , since 3d sub-shell is near to complete filled, so that is why 3d orbital snatches one electron from 4s and shows electronic configuration (Ar)  $3d^{10}, 4s^1$ . This detail is shown in tabular form.

Elements	Electronic configuration
$_{24}\text{Cr}$	(Ar) $3d^5, 4s^1$
$_{29}\text{Cu}$	(Ar) $3d^{10}, 4s^1$

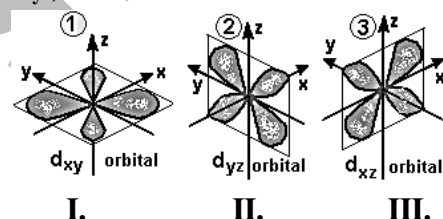
**Q.38 (A)** Detail electronic configuration of  $_{19}\text{K}$  is shown as ( $\frac{1s^2, 2s^2, 2p^6, 3s^2, 3p^6}{\text{Ar (core)}}, 4s^1$ ) so overall shortly it can be shown as  $[\text{Ar}] 4s^1$ .

**Q.39 (C)**  $^{40}_{18}\text{Ar}$ ,  $^{42}_{20}\text{Ca}$ ,  $^{43}_{21}\text{Sc}$  are isotones as shown in the tabular form for comparison.  $^{14}_6\text{C}$  and  $^{16}_8\text{O}$  are also known as isotones, because they have same number of neutrons.

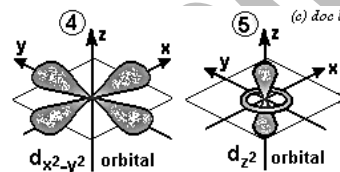
Nuclide	Protons (Z)	Mass number (A)	Neutrons (A-Z)
$^{40}_{18}\text{Ar}$	18	40	22
$^{42}_{20}\text{Ca}$	20	42	22
$^{43}_{21}\text{Sc}$	21	43	22

**Q.40 (B)** d sub-shell has five atomic orbitals such as  $d_{xy}, d_{yz}, d_{xz}, d_{z^2}$ , and  $d_{x^2-y^2}$ .

- Out of these five d-atomic orbitals, three atomic orbitals  $d_{xy}, d_{yz}, d_{xz}$  lie in between the axes.



- Whereas two d-atomic orbitals  $d_{x^2-y^2}$  and  $d_{z^2}$  are present on the axes as shown in the diagram.
- d-orbitals which lie on the x-axes



- From the diagram it is clear that  $d_{z^2}$  atomic orbital is collar shaped.

**Q.41 (D)** In any cation number of electrons is always less than that of protons. The number of protons in a neutral atom or its cation is always same.

- In a chemical reaction there is always exchange of electrons. In a cation number of electrons decreases than that of protons, because in a cation formation there is loss of electron.
- In anion the number of electrons exceeds than that of protons, because in this case atom gains electrons.

**Q.42 (B)** The mass of a neutron is always greater than that of a proton as shown by the value. The mass of proton is  $(1.6726 \times 10^{-27} \text{ kg})$  and that of neutron is  $(1.6750 \times 10^{-27} \text{ kg})$  as shown in the table.

Particles	Mass (kg)	Mass (amu)
Proton	$1.6726 \times 10^{-27}$	1.0073
Neutron	$1.6750 \times 10^{-27}$	1.0087

**Q.43 (C)** Rutherford's planet-like picture was defective and unsatisfactory because the moving electron must be accelerated towards the nucleus. Therefore, the radius of the shell having electron should become



smaller and smaller and the electron should fall into the nucleus. Thus, an atomic structure as proposed by Rutherford would collapse. Due to this reason, Rutherford failed to explain the stability of atom.

**Q.44 (B)** According to Bohr's theory, an electron is a material particle and its position as well as momentum can be determined with great accuracy. But with the advent of the concept of wave nature of electron, it has not been possible for us to measure simultaneously the exact position and velocity of electron. This was suggested by Heisenberg, in 1927. Due to above mentioned reason, Bohr's H-atomic model is contradicted by Heisenberg's uncertainty principle.

**Q.45 (C)** In fact, Rutherford planet like picture was defective and unsatisfactory.

- Solar system follows Newton's law of gravitation which states that a particle attracts every other particle in the universe using a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centers. i.e. mathematical equation of Gravitational force between two objects is shown below:

$$F = G \frac{m_1 m_2}{r^2}$$

- But protons and electrons are charged particles. Protons are

present in the nucleus and electrons revolve around the nucleus. They attract each other (unlike solar system) by the columbic force of attraction.

- According to Coulomb's law, the coulombic force is directly proportional to the product of charges and inversely proportional to square of distance between them as shown by the equation:

$$F_c = \frac{Ze^2}{4\pi\epsilon_0 r^2}$$

**Q.46 (D)** In fact, the amount of energy (E) is directly proportional to wave number ( $\bar{\nu}$ ).

Term	Symbol	Definition	Unit
Frequency	$\nu$	It is the number of wave passing through a point per second.	Hz, s <sup>-1</sup>
Wave length	$\lambda$	It is the distance between two consecutive crests or troughs	cm, mm etc
Wave number	$\bar{\nu}$	It is the number of waves per unit length and is reciprocal to wavelength ( $\bar{\nu} = \frac{1}{\lambda}$ ).	cm <sup>-1</sup> , mm <sup>-1</sup> etc

The SI unit of frequency is the hertz (Hz), named after the German physicist Heinrich Hertz; one hertz means that an event repeats once per second. A previous name for this unit was cycles per second (cps). The SI unit for time period is the second.

**Q.47 (A)** According to Bohr's hydrogen atomic model, mathematically radius  $r_n = 0.529A^\circ (n^2)$ . For hydrogen atom if  $n = 2$  then the value of radius for  $n_2$  (2<sup>nd</sup> shell) from the nucleus of an atom is  $2.116A^\circ$ .

- Q.48 (D) Bohr's hydrogen atomic model theory is applicable only for single electron system. But  $\text{Be}^{+2}$  has two electrons, so for  $\text{Be}^{+2}$  ion it is not applicable.
- Q.49 (D) This was stated by Sommerfeld in 1915 but not by Bohr. Sommerfeld suggested the moving electrons might describe in addition to the circular orbits elliptic orbits as well wherein the nucleus lies at one of the focii of the ellipse.
- Q.50 (C) In fact, frequency of gamma rays is greater than that of X-rays.

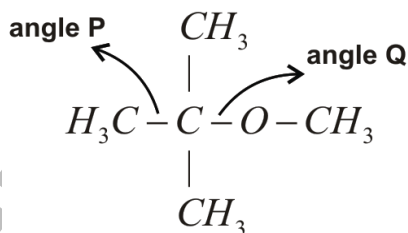
STEP ENTRY TEST 2020

## Worksheet-14

## (A. Physical Chemistry)

## Chemical Bonding

- Q.1 Which of the following molecules does not have planar geometry?
- A) Benzene C) Ethene
- B) Boron trifluoride D) Phosphorous trichloride
- Q.2 Which one of the following pair of compounds contains one that is giant ionic and one that is simple molecule?
- A)  $\text{Al}_2\text{O}_3$  and  $\text{Al}_2\text{Cl}_6$  C)  $\text{SiO}_2$  and  $\text{SiCl}_4$
- B)  $\text{P}_4\text{O}_{10}$  and  $\text{PCl}_3$  D)  $\text{HF}$  and  $\text{PbCl}_4$
- Q.3 Which of the following molecules has only non-coplanar tetrahedral geometry?
- A)  $\text{NF}_3$  C)  $\text{C}_2\text{Cl}_4$
- B)  $\text{C}_3\text{H}_8$  D)  $\text{C}_3\text{H}_6$
- Q.4 Ionic compounds show all of the following properties EXCEPT:
- A) All are present in the solid state
- B) All conduct electricity in the molten state
- C) All show polymorphism and isomerism
- D) All have non-directional and non-rigid bond
- Q.5 MTBE (Methyl tertiary butyl ether) is a constituent of Petrol. Its structural formula is shown below.



What are the values of angle P and angle Q in a molecule of MTBE?

Options	Angle P	Angle Q
A)	$90^\circ$	$105^\circ$
B)	$90^\circ$	$180^\circ$
C)	$109^\circ$	$105^\circ$
D)	$90^\circ$	$180^\circ$

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- Q.6** According to VSEPR theory, which of the following is not the basic condition for the regular geometry:
- A) Central atom is surrounded by similar atoms
  - B) Central atom has no lone pair
  - C) Molecule has similar bonds
  - D) The electronegativity of central or surrounding atoms affect the bond angle
- Q.7** Majority of the compounds in nature have:
- A) Electrovalent bond
  - C) Ordinary covalent bond
  - B) Dative covalent bond
  - D) Hydrogen bond
- Q.8** Which property is not shown by covalent compounds?
- A) They are present in the gas, liquid or solid state
  - B) They are more reactive than ionic compounds
  - C) They show resonance and isomerism
  - D) They have low melting points and boiling points as compared to ionic compounds
- Q.9** Which one of the following molecules shows a linear geometry?
- A)  $\text{H}_2\text{O}$
  - C)  $\text{HCN}$
  - B)  $\text{Cl}_2\text{O}$
  - D)  $\text{C}_2\text{H}_4$
- Q.10** Second and higher electron affinity values are positive because of:
- A) Repulsion between electrons and negatively charged ions
  - B) Attraction between electrons and positively charged ions
  - C) First repulsion between electrons and then attraction
  - D) Both A and B
- Q.11** In which of the following ionic bond is formed between atoms of elements?
- A) Al and Cl
  - C) B and F
  - B) H and Cl
  - D) Na and H
- Q.12** Which of the following molecules has six bonding electrons?
- A)  $\text{C}_2\text{H}_4$
  - C)  $\text{CO}_2$
  - B)  $\text{H}_2\text{S}$
  - D)  $\text{NCl}_3$

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**Q.13** If two atoms are bonded in such a way that one member of the covalently bonded molecule donates both electrons that are shared, then what is this type of bond called?

- A) H-bonding                      C) Coordinate covalent bond  
B) Covalent bond                D) Electrovalent bond

**Q.14** Which of the following molecules shows tetrahedral geometry?

- A)  $\overset{\text{oo}}{\text{NH}}_3$                       C)  $\text{SO}_4^{-2}$   
B)  $\text{SO}_3$                       D)  $\text{SO}_2$

**Q.15** Which type of bonding is responsible for intermolecular forces in liquid  $\text{CCl}_4$ ?

- A) Covalent bonding  
B) Hydrogen bonding  
C) Instantaneous dipole – induced dipole forces  
D) Dipole – Dipole forces

**Q.16** The  $\text{C}_2\text{H}_2$  molecule is linear which can be deduced from the numbers of  $\sigma$  and  $\pi$  bonds present in the molecule?

Options	$\sigma$	$\pi$
A)	2	2
B)	2	3
C)	3	2
D)	3	1

**Q.17** Which one of the following giant solids have greater melting and boiling points on the basis of type of bonding?

- A) Metallic solids                C) Ionic solids  
B) Covalent solids                D) Molecular solids

**Q.18** With the increase of which one of the following factors bond energy of a molecule decreases:

- A) Electronegative difference  
B) Bond order  
C) s-character  
D) Number of lone pair

USE THIS SPACE FOR  
SCRATCH WORK



**Q.19** Which of the following molecules has greater bond energy?

- A) H - H                                      C) O - O  
B) N - N                                      D) F - F

**Q.20** Which of the following has trigonal planar geometry?

- A) SO<sub>2</sub>                                      C) SO<sub>3</sub>  
B) CCl<sub>4</sub>                                      D) H<sub>2</sub>O

**Q.21** Mark the incorrect statement about the type of intermolecular forces present in the indicated molecule:

Option	Molecule	Type of intermolecular forces
A)	HCl	Debye forces
B)	CHCl <sub>3</sub>	Dipole Dipole forces
C)	Halogens in liquid state	London Dispersion forces
D)	Noble gases in liquid state	London Dispersion forces

**Q.22** All of the following molecules have H-bonding EXCEPT:

- A) Ethanol                                      C) Aminoethane  
B) Ethanoic acid                                      D) Propanone

**Q.23** Which of the following will not form H-bond with another of its own molecule?

- A) CH<sub>3</sub>CHO                                      C) CH<sub>3</sub>OH  
B) CH<sub>3</sub>NH<sub>2</sub>                                      D) NH<sub>3</sub>

**Q.24** Solid carbon dioxide (dry ice) is used as a refrigerating agent because it readily changes directly from the solid into the vapor state at low temperature. What does this indicate the main intermolecular bonding / forces in CO<sub>2(s)</sub> to be?

- A) Covalent bonding                                      C) Hydrogen bonding  
B) Ionic bonding                                      D) London dispersion forces

**Q.25** Which of the following theories was put forward by Drude and extended by Loren (1923) to explain the properties of metallic solid?

- A) Electron gas theory                                      C) Band theory  
B) Valance bond theory                                      D) Crystal field theory

USE THIS SPACE FOR  
SCRATCH WORK

- Q.26 When heated solid iodine readily forms iodine vapors. What does this information suggest about the nature of particles in these two physical states of iodine?

Option	Solid	Vapor
A)	Ionic	Atomic
B)	Ionic	Molecular
C)	Molecular	Atomic
D)	Molecular	Molecular

- Q.27 Magnesium oxide is used to line industrial furnaces because it has a very high melting point. Which type of bond needs to be broken for magnesium oxide to melt?

- A) Co-ordinate bond                      C) Covalent bond  
B) Ionic bond                              D) Metallic bond

- Q.28 All of the following are correct statements regarding difference between polar and non-polar bonds EXCEPT:

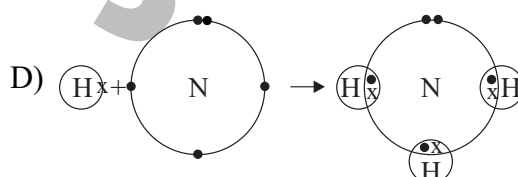
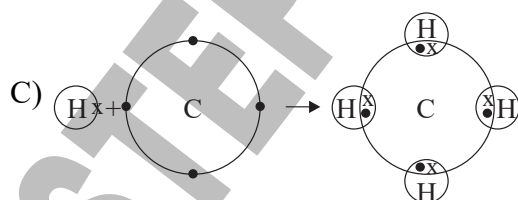
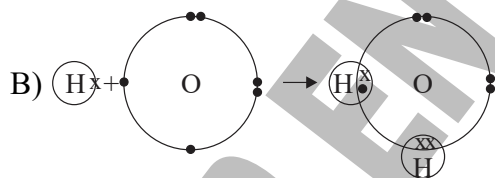
Option	Non-Polar	Polar
A)	It is a covalent bond which exists between two similar atoms or those having negligible electronegativity difference	It is a covalent bond which exists between two dissimilar atoms or those having appreciable electronegativity difference but less than 1.7
B)	It is a weaker bond	It is a stronger bond
C)	It has no polarity	It has always polarity in the molecule
D)	It is more reactive	It is less reactive

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SCRATCH WORK

Q.29 All of the following are correct statements regarding difference between sigma bond and pi-bond EXCEPT:

Option	Sigma bond	Pi bond
A)	It is formed by linear overlapping of two half-filled atomic orbitals	It is formed by sidewise overlapping of two half-filled parallel atomic orbitals
B)	It has restricted rotation about the inter-nuclear axis	It has free rotation about the inter nuclear axis
C)	It has only lobe of electron density between the nuclei	It has two lobes of electron density on opposite sides of inter nuclear axis
D)	It has symmetrical charge density about the inter-nuclear axis	It has no symmetrical charge density about the inter-nuclear axis

Q.30 Which of the following molecules does not obey dot-and-cross model diagram?

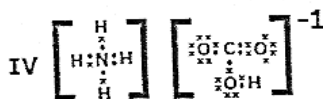
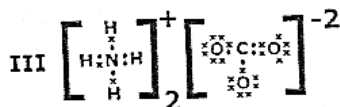
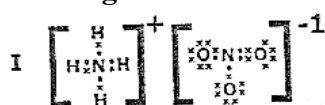


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Q.31 The distance between the nuclei of two atoms forming a covalent bond is called the bond length. All of the following statements are correctly matched EXCEPT:

Options	Compound	Hybridization	Bond	Bond Length (pm)
A)	SiH <sub>4</sub> (Monosilane)	sp <sup>3</sup>	Si – H	148
B)	C <sub>2</sub> H <sub>4</sub> (Ethene)	sp <sup>2</sup>	C = C	154
C)	BF <sub>3</sub> (Boron trichloride)	sp <sup>2</sup>	B – Cl	175
D)	C <sub>2</sub> H <sub>2</sub> (Ethyne)	sp	C ≡ C	120

Q.32 Observe the given dot and cross structures for the following molecules or ionic species:



The co-ordinate covalent bond exists between:

- A) N and C atoms in structure III and IV
- B) N and one H ion in all four structure
- C) N and Cl atom so structure II
- D) N and N atoms of structure I

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**Q.33** All of the following statements are correctly matched for ionic and covalent bonds EXCEPT:

Opt.	Ionic bond (Electrovalent bond)	Covalent bond (Electron pair bond)
A)	It is formed by complete transfer of electron/ electrons from one atom of element to the other.	It is formed by mutual sharing of electrons between two atoms.
B)	The migrated electron/ electrons belongs to only one of the two bonded atoms.	The shared electrons pair belongs to both the bonded atoms.
C)	It is directional bond.	It is non-directional bond.
D)	It is shown by positive and negative charge on the bonded atoms (+, -).	It is shown by small line ( - ) drawn between the two bonded atoms.

**Q.34** No electrovalent bond is 100% ionic in nature. This is because of:

- A) When cations and anions approach each other, polarizability increases only
- B) Sharing of electrons takes place to some extent only
- C) Highest ionic character is present in CsF only
- D) Both A and B

**Q.35** The compound which contains both ionic and covalent bond:

- A)  $\text{CH}_4$
- B) KCN
- C)  $\text{H}_2$
- D) KCl

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SCRATCH WORK

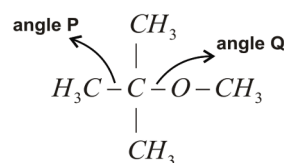


## ANSWER KEY (Worksheet-14)

1	D	11	D	21	A	31	B
2	A	12	D	22	D	32	B
3	B	13	C	23	A	33	C
4	C	14	C	24	D	34	D
5	C	15	C	25	A	35	B
6	D	16	C	26	D		
7	C	17	B	27	B		
8	B	18	D	28	D		
9	C	19	A	29	B		
10	A	20	C	30	B		

## ANSWERS EXPLAINED

- Q.1 (D)  $\text{PCl}_3$  is not planar structure due to the presence of lone pair on the central "P" atom of phosphorous. It is  $\text{LAB}_3$  type molecule and shows **pyramidal geometry** (i.e. irregular geometry) while others are A, B and C have planar structure.
- Q.2 (A)  $\text{Al}_2\text{O}_3$  is giant ionic and  $\text{Al}_2\text{Cl}_6$  is simple molecule
- (B)  $\text{P}_4\text{O}_{10}$  and  $\text{PCl}_3$  are simple molecules
  - (C)  $\text{SiO}_2$  and  $\text{SiCl}_4$ .  $\text{SiO}_2$  is a giant molecule while  $\text{SiCl}_4$  is simple molecule
  - (D)  $\text{HF}$  and  $\text{PbCl}_4$  both are simple molecules
- Q.3 (B) In  $\text{C}_3\text{H}_8(\text{H}_3\text{C}-\text{CH}_2-\text{CH}_3)$ , all the carbon atoms are  $\text{sp}^3$  hybridized and show **non-coplanar tetrahedral structure**.
- Q.4 (C) All the ionic compounds show **polymorphism** and **isomorphism** but do not show isomerism. Isomerism is shown by **covalent compounds**.
- Q.5 (C) MTBE (Methyl tertiary butyl ether) is a constituent of petrol and it has following structure.



From the structure it is clear that the value of **bond angle P** is  $109^\circ$  like alkane because the carbon atom is bonded with four other atoms while the value of **bond angle Q** is  $105^\circ$  just like water because oxygen is bonded with two atoms and has two lone pairs. The presence of two lone pair decreases the bond angle.

Options	Angle P	Angle Q
C)	$109^\circ$	$105^\circ$

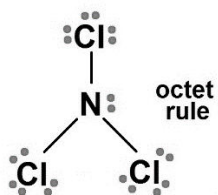
- Q.6 (D) In fact, the electronegativity of **central or surrounding atoms** have **no** effect on the **bond angle**.
- Q.7 (C) **Majority of the compound in nature are ordinary covalent compounds due to the following reason.**
- Carbon is tetravalent. It can form four covalent bonds at a time
  - It has unique property of catenation
  - It shows isomerism
  - It does not form ionic compound
- Q.8 (B) Covalent compound are less reactive than ionic compounds, because first old bonds are broken then new bonds are formed by covalent compounds.
- Q.9 (C)  $\text{HCN}$  molecule shows linear geometry like  $\text{BeCl}_2$ ,  $\text{HgCl}_2$ , and  $\text{CO}_2$ .
- Q.10 (A) Formation of uninegative ion is exothermic process while  $2^{\text{nd}}$ ,  $3^{\text{rd}}$ , and so on are **endothermic process**.  $2^{\text{nd}}$  and higher electron affinities values are positive because when  $2^{\text{nd}}$  electron is added to uninegative ion the

incoming electron is repelled by the already present negative charge and thus energy has to supply to counter the effect of repulsion between incoming electron and negatively charged ion. This clearly explains that second and high electron affinity are positive.

**Q.11 (D)** For the formation of ionic bond, there are two conditions.

- One element should have low ionization energy
- e.g first ionization energy of Na  
 $= +496\text{kJmol}^{-1}$
- Other element should have high electron affinity. It has high first ionization energy ( $1313\text{kJmol}^{-1}$ )
- e.g. electron affinity of H  
 $= -73\text{kJmol}^{-1}$
- e.g Na and H form ionic bond and fulfill the above two conditions

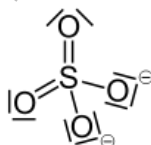
**Q.12 (D)**  $\text{NCl}_3$  has six bonding electrons as shown in the structure.



**Q.13 (C)** It is coordinate covalent bond. A covalent bond in which shared electron pair is donated by only one atom is called coordinate covalent bond. It is shown by an arrow ( $\rightarrow$ )



**Q.14 (C)**  $\text{SO}_4^{2-}$  shows tetrahedral geometry as shown in diagram.



**Q.15 (C)**  $\text{CCl}_4$  is non-polar molecule and it shows tetrahedral geometry. It is in the liquid state because its molecules involve instantaneous dipole induced dipole forces (a type of intermolecular force).

**Q.16 (C)**  $\text{H}-\text{C}\equiv\text{C}-\text{H}$ . From the structure it is clear that it has three sigma bonds and two pi bonds having linear structure.

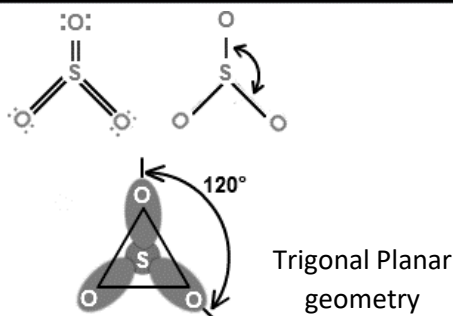
**Q.17 (B)** Covalent solids are giant molecules and have large number of covalent bonds. Due to their cumulative effect the strength of the bond is very high e.g. diamond ( $3550^\circ\text{C}$ ) graphite ( $3700^\circ\text{C}$ ) and silicon carbide  $\text{SiC}$  ( $2730^\circ\text{C}$ ) have high melting points.

**Q.18 (D)** Bond energy of the molecule is greater if the bonded atoms have greater electronegative difference, high bond order and more s-character. But the presence of lone pair decreases bond energy because they produce repulsion.

**Q.19 (A)** [ $\text{H}-\text{H}$  ( $436\text{kJmol}^{-1}$ )]  $\text{H}_2$  molecule has greater bond energy because it have no lone pair and smaller atomic size.

Option	Bond	Bond energy ( $\text{kJmol}^{-1}$ )
A)	$\text{H}-\text{H}$	436
B)	$\text{N}-\text{N}$	163
C)	$\text{O}-\text{O}$	146
D)	$\text{F}-\text{F}$	154.8

**Q.20 (C)**  $\text{SO}_3$  shows trigonal planar geometry. It is  $\text{AB}_3$  type molecule. It shows regular geometry. Double bond are treated as single bond like  $\text{BF}_3$ ,  $\text{AlCl}_3$  as shown in structure.



**Q.21 (A)** HCl is polar molecule and it has permanent dipoles. In HCl molecules there are dipole dipole forces. Debye forces are those forces which exist between polar and non-polar molecules e.g in HCl and Ar there are present debye forces which are also called dipole-induced dipole forces.

**Q.22 (D)** In propanone ( $\text{CH}_3\text{COCH}_3$ ) there is no hydrogen bonding because hydrogen bonding is the electrostatic force between a highly electronegative atom (N, O, F, and rarely Cl) and partial positively charged hydrogen atom.

- In propanone there is no covalently bonded polarized hydrogen atom which is directly associated with more electronegative atoms such as N, O and F. That is why propanone does not show hydrogen bonding. It shows dipole dipole forces.

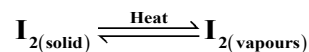
**Q.23 (A)** In ethanal ( $\text{CH}_3\text{CHO}$ ), hydrogen atom is not covalently bonded with more electronegative atom such as N, O, F. That is why it does not show hydrogen bonding. It shows dipole dipole forces.

**Q.24 (D)**  $\text{CO}_2$  is non-polar molecule and its dipole moment value is zero ( $\mu = 0$ ). It has only London dispersion forces because in any non-polar molecule London dispersion forces are present which are the weakest and temporary forces.

**Q.25 (A)** The force which binds a metal cation to a **number of electrons** within its **sphere** of influence is **known as metallic bond** (in term of lattice of positive ions surrounded by mobile electron). Electron gas theory was **put forward by Drude** and **extended by Loren (1923)**. This theory is based on the following postulates:

- Each atom in a metal crystal loses all of its valence electron
- The valence electrons form a electron pool
- Valence electrons are not attached to any individual ion in the sphere of crystal
- Electrons are free to move within sphere of crystal

**Q.26 (D)** Since the solid iodine ( $\text{I}_2$ ) readily sublimates when heated as shown below:



This shows that the forces of attraction between the iodine molecules are very weak (London dispersion forces). As the sublimation process does not require a high temperature, the covalent bonds in the iodine molecules are not broken in the vapour states. Iodine vapours are still in the discrete simple molecular form ( $\text{I}_2$ ).

**Q.27 (B)** The type of bond **needs** to be broken for magnesium oxide to melt is ionic bond. Ionic bond is comparatively stronger than covalent bond. **That is why ionic compounds have higher melting points and boiling points.** Magnesium oxide is used to line industrial furnaces because it has a very high melting point. Melting point of **MgO** is **2,852°C**.

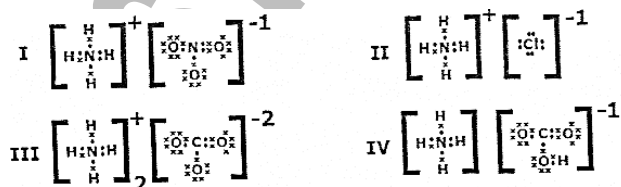
**Q.28 (D)** In fact, polar bond is more reactive than non-polar bond. Greater is the electronegative difference between two covalently bonded atoms in a molecule, greater is the polarity, greater is the reactivity. That is why polar molecules are more reactive than non-polar molecule.

**Q.29 (B)** **Sigma bond** has free rotation about the inter-nuclear axis but pi bond has restricted rotation about the **inter-nuclear axis**.

**Q.30 (B)** Dot-and-cross model is not followed by water molecule as shown in the diagram in option B.

**Q.31 (B)** In ethene  $C_2H_4$  there is  $sp^2$  orbital hybridization in the central carbon atom and **C = C bond length is 133 pm and it is not 154 pm.**

**Q.32 (B)** The co-ordinate covalent bond exists between N and one H ion in all four structure as shown below.



**Q.33 (C)** It is incorrect statement. In fact, the correct statement about ionic and covalent bond is as given in the tabular form:

Opt.	Ionic bond (Electrovalent bond)	Covalent bond (Electron pair bond)
C)	It is non-rigid and non-directional bond	It is rigid and directional bond

**Q.34 (D)** No electrovalent bond is 100% ionic in nature. This is because of:

- When cations and anions approach each other, polarizability increases only
- Sharing of electrons takes place to some extent only

**Q.35 (B)** In KCN there is ionic bond between potassium ion ( $K^+$ ) and cyanide ion ( $CN^-$ ). In cyanide ion there is covalent bond between carbon and nitrogen. So overall in KCN two bonds are involved i.e. ionic and covalent ( $K^+C \equiv N$ ).

**Worksheet-15****(A. Physical Chemistry)****Chemical Energetics**

- Q.1** For the reaction  $\text{NaCl}_{(s)} \xrightleftharpoons{\text{water}} \text{Na}^+_{(aq)} + \text{Cl}^-_{(aq)}$  the change in enthalpy is called:
- A) Heat of reaction                      C) Heat of formation  
B) Heat of combustion                  D) Heat of solution
- Q.2** Evaporation of water is an exceptional case of:
- A) Spontaneous                          C) Non-spontaneous  
B) Decomposition                      D) Hydrolysis
- Q.3** Which statement is contrary to the first law of thermodynamics?
- A) Energy can neither be created nor destroyed  
B) One form of energy can be converted into other form of energy  
C) In an adiabatic process the work done is independent of its path  
D) Continuous production of mechanical work without supplying an equivalent amount of heat is possible
- Q.4** Born Haber's cycle enables us to calculate:
- A) Heat energy                          C) Lattice energy  
B) Heat of hydration                  D) Heat of solution
- Q.5** Which statement is not correct about  $\Delta H^\circ$ ?
- A)  $\Delta H^\circ$  of the reaction depends on temperature  
B)  $\Delta H^\circ$  of reaction can be  $>$  or  $<$  zero  
C)  $\Delta H^\circ$  of catalyzed and uncatalyzed reaction is same  
D)  $\Delta H^\circ$  is always  $< 0$
- Q.6** Which of the following processes is always endothermic?
- A) Atomization                          C) Neutralization  
B) Combustion                          D) Solution
- Q.7** Which one of the following statements is correct for the neutralization of a strong acid by a strong alkali in aqueous solution at  $25^\circ\text{C}$ ?
- A) It is an endothermic process  
B) It can be represented as  $\text{H}_3\text{O}^+_{(aq)} + \text{OH}^-_{(aq)} \longrightarrow 2\text{H}_2\text{O}_{(l)}$   
C) The enthalpy change per mole of  $\text{H}_2\text{O}$  formed is independent of the acid or alkali used as they are strong  
D) Both B and C

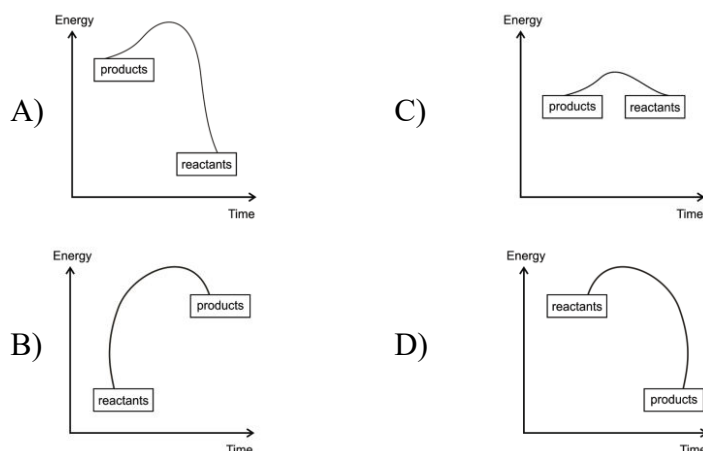
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**Q.8** According to Born Haber cycle,  $\Delta H_{\ell}^{\circ}$  of ionic compound is determined by the formula  $\Delta H_{\ell}^{\circ}$ .

- A)  $\Delta H_{\ell}^{\circ} = \Delta H_f^{\circ} - \Delta H_x$       C)  $\Delta H_{\ell}^{\circ} = \Delta H_x + \Delta H_f^{\circ}$   
B)  $\Delta H_{\ell}^{\circ} = \Delta H_x - \Delta H_f^{\circ}$       D)  $\Delta H_{\ell}^{\circ} = \Delta H_{at}^{\circ} - \Delta H_x$

**Q.9** Which of the following energy profile diagrams best shows an endothermic reaction?



**Q.10** Lattice energy ( $\Delta H_{\ell}^{\circ}$ ) helps to explain all of the following properties of ionic compounds EXCEPT:

- A) Structure      C) Bonding  
B) Properties      D) Dipole Moment

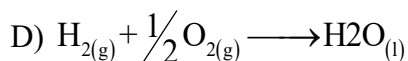
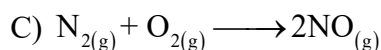
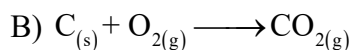
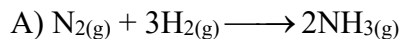
**Q.11** In azeotropic mixture showing positive deviation from Raoult's law, the volume of the mixture is:

- A) Slightly more than the total volume of the components  
B) Slightly less than the total volume of the components  
C) Equal to the total volume of the components  
D) Difficult to predict

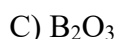
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**Q.12** All of the following reactions are exothermic EXCEPT:

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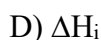
**Q.13** For which one of the following compounds standard enthalpy change ( $\Delta H^\circ$ ) can be measured directly by calorimeter?



**Q.14** All of the following are state functions EXCEPT?



**Q.15** All of the following standard enthalpy change ( $\Delta H^\circ$ ) have only positive value EXCEPT:



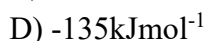
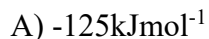
**Q.16** 12.0g of graphite is burnt in a bomb calorimeter and temperature recorded is 5K. Calculate the enthalpy of combustion ( $\Delta H^\circ_c$ ) of graphite if the heat capacity of the calorimeter is 90.0kJmol<sup>-1</sup>?



**Q.17 Glass calorimeter is used to determine:**



**Q.18** Neutralization of 50cm<sup>3</sup> of 0.5M NaOH at 25°C with 50cm<sup>3</sup> of 0.5M HCl 25°C is raised to 31°C. Find enthalpy of neutralization ( $\Delta H_n$ ). Specific heat of water (q) = 5kJ<sup>-1</sup>kg<sup>-1</sup>:



**Q.19** If an endothermic reaction is allowed to take place very rapidly in the air, the temperature of the surrounding air:



**Q.20** Which of the following statements is not correct for  $\Delta E$  and  $\Delta H$ ?

Options	$\Delta E$ (Change in internal energy)	$\Delta H$ (Change in enthalpy)
A)	$\Delta E = q_v$	$\Delta H = q_p$
B)	$\Delta E = q + P\Delta V$	$\Delta H = \Delta E + P\Delta V$
C)	$\Delta E$ is measured at constant volume	$\Delta H$ is measured at constant pressure
D)	$q_v > q_p$	$q_p = p_v$

**Q.21** The nature of an aqueous solution of ammonia ( $\text{NH}_3$ ) is:

- A) Amphoteric                      C) Neutral  
B) Basic                              D) Acidic

**Q.22** An aqueous solution of ethanol in water may have vapour pressure:

- A) Equal to that of water      C) More than that of water  
B) Equal to that of ethanol    D) Less than that of water

**Q.23** The solution which has lower osmotic pressure is called:

- A) Hypotonic solution          C) Isotonic solution  
B) Hypertonic solution        D) Saturated solution

**Q.24** Molal boiling point constant ( $K_b$ ) is related to:

- A) m                                  C) M  
B) ppm                              D) x

**Q.25** All of the followings are examples of pair of partially miscible liquids except:

- A) Iodine water system          C) Nicotine water system  
B) Triethylamine water system    D) Phenol water system

**Q.26** Which of the following aqueous solutions has the lowest vapour pressure at room temperature?

- A) 0.1m NaCl solution          C) 0.1m glucose solution  
B) 0.1m  $\text{CaCl}_2$  solution        D) 0.1m urea solution

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**Q.27** To observe the colligative properties, following conditions should be fulfilled by the solution **EXCEPT**:

- A) Solution should be dilute
- B) Solute should be non-electrolyte
- C) Solute should be non-volatile
- D) Solute can be volatile and non-electrolyte

**Q.28** Which of the following is colligative property?

- A) Osmotic-pressure
- B) Freezing point
- C) Boiling point
- D) Melting point

**Q.29** Two solutions of NaCl and KCl having 0.1m (molal concentration) of each are prepared separately. Which of the following statement is true for the solution:

- A) KCl solution will have higher boiling point than NaCl solution
- B) Both the solutions have different boiling points
- C) KCl and NaCl solutions possess same vapour pressure
- D) KCl solution possesses lower freezing point than NaCl solution

**Q.30** Mark the correct statement about the relative lowering of vapour pressure:

- A) It is independent of the temperature
- B) It depend on the concentration of solute
- C) It is constant when equimolecular proportions of different solutes are dissolved in the same mass of same solvent
- D) All of these

**Q.31** Internal energy of a system depends on all the factors **EXCEPT**:

- A) Chemical nature of a substance
- B) Temperature
- C) Pressure and volume
- D) Path

**Q.32** Ionic solid is dissolved in water if:

- A)  $\Delta H_{\ell}^{\circ} > \Delta H_{\text{hyd}}$
- B)  $\Delta H_{\text{hyd}} > \Delta H_{\ell}^{\circ}$
- C)  $\Delta H_{\text{hyd}} = \Delta H_{\ell}^{\circ}$
- D)  $\Delta H_{\ell}^{\circ} \leq \Delta H_{\text{hyd}}$

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**Q.33** The number of moles of solute in 1000g (1kg) of solvent is called:

- A) Molarity  
B) Molality  
C) Mole fraction  
D) ppm

**Q.34** The colligative property that is generally applied preferably for the determination of molecular mass of macromolecule is:

- A)  $\pi$   
B)  $\Delta T_b$   
C)  $\Delta T_f$   
D)  $\Delta P/P^\circ$

**Q.35** Which of the following is an example of solution in which solute is in the solid state while solvent is in the liquid state?

- A) Paint  
B) Steel  
C) Fog  
D) Milk

**Q.36** The temperature at which two conjugate solutions merge into one another is called:

- A) Upper consolute temperature  
B) Optimum temperature  
C) Transition temperature  
D) Absolute temperature

**Q.37** If mass of solvent is 100g and molal concentration of its solution is 0.2, the amount of urea dissolved in solvent (molar mass of solute is  $60\text{g mol}^{-1}$ ) is:

- A) 1.2g  
B) 1.0g  
C) 0.5g  
D) 0.75g

**Q.38** A sample of tooth paste having 100g, was found to contain 0.5g fluoride ions. The concentration of fluoride ions in ppm is:

- A)  $1.5 \times 10^3$   
B)  $1.25 \times 10^3$   
C)  $5 \times 10^3$   
D)  $2.5 \times 10^3$

**Q.39** 18g glucose is dissolved in 90g of water. The relative lowering of vapour pressure is equal to:

- A)  $\frac{1}{51}$   
B) 5.1  
C)  $\frac{1}{5}$   
D) 6

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**Q.40** A pure solvent has a vapour pressure of 120 torr at 25°C. When 20g of non-volatile solute was dissolved in 300g of benzene, a vapour pressure of 115 torr was observed (molar mass of benzene = 80). What is the molar mass of solute?

- A) 128g                                      C) 140g  
B) 160g                                      D) 180g

**Q.41** A colloidal system involves

- A) A state of dissolution  
B) A state of homogenous mixture  
C) A state of dispersion  
D) A state of suspension

**Q.42** Solvent loving colloids are called:

- A) Lyophobic acid                      C) Lyophilic colloids  
B) Hydrophobic colloids              D) Mesophobic colloids

**Q.43** The fresh precipitate can be passed in colloidal state by

- A) Peptization                              C) Coagulation  
B) Diffusion                                  D) Effusion

**Q.44** A colloidal solution of  $\text{Fe}(\text{OH})_3$  in water is:

- A) Hydrophilic colloid                  C) An emulsion  
B) A hydrophobic colloid              D) Lyophilic colloid

**Q.45** Which of the following properties is not shown by suspension, colloidal solution and true solution?

Opt	Properties	Suspension	Colloidal solution	True solution
A)	Particle size	$> 10^{-5}\text{cm}$	$10^{-7}\text{cm}$	$< 10^{-7}\text{cm}$
B)	Separation with filter paper	Possible	Not possible	Not possible
C)	Nature	Homogenous	Homogeneous	Heterogeneous
D)	Appearance	Opaque	Turbid	Clear

**Q.46** The addition of alcohol to a saturated aqueous solution of calcium acetate first forms a sol and then sets to a gelatinous mass called solid alcohol which is a:

- A) Solid sol                                  C) Aerosol  
B) Solid form                                D) Gel

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**Q.47** A sol is a colloidal solution suspension of very small solid particles ( $10^{-7}$  to  $2 \times 10^{-5}$  cm) in a continuous liquid medium (dispersion medium). Sols are quite stable. Which of the following is not example of sol:

- A) Blood                                      C) Cell fluid  
B) Paint                                        D) Marbles

**Q.48** The colloidal solution of gold prepared by different methods have different colours due to:

- A) Difference in the size of colloidal particles  
B) Fact that gold exhibit variable valency  
C) Different conc. of gold  
D) Presence of different type of foreign particles

**Q.49** Classification of colloidal solution or dispersion can be done on the basis of nature of dispersion medium. Which of the following is not considered colloidal dispersion:

Options	Dispersion medium (DM)	Type of sols
A)	Water	Hydrosols
B)	Acetone	Acylosols
C)	Alcohol	Alcosols
D)	Air	Aerosol

**Q.50** The amount of solute present in a fixed amount of solvent or solution is called:

- A) Concentration of solution    C) Molal solution  
B) Molar solution                      D) ppm Solution

**Q.51** Which of the following is example of colloidal solution in which dispersion phase is in the liquid state and dispersion medium is in the solid state?

- A) Muddy water                              C) Blood  
B) Cheese                                        D) Fog

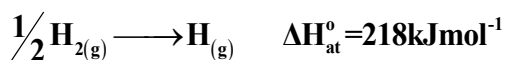
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## ANSWER KEY (Worksheet-15)

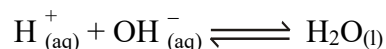
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4	C	14	D	24	A	34	A	44	B		
5	D	15	B	25	A	35	A	45	C		
6	A	16	C	26	B	36	A	46	D		
7	C	17	A	27	D	37	A	47	D		
8	A	18	C	28	A	38	C	48	A		
9	B	19	B	29	C	39	A	49	B		
10	D	20	D	30	D	40	A	50	A		

## ANSWERS EXPLAINED

- Q.1 (D)** The standard enthalpy of a solution ( $\Delta H^\circ_{\text{sol}}$ ) is the amount of heat absorbed or evolved when one mole of a substance is dissolved in so much solvent that further dilution results in no detectable heat change. e.g.  $\Delta H_{\text{sol}}$  of NaCl is (+4.98 kJ mol<sup>-1</sup>).
- Q.2 (A)** Evaporation is a spontaneous, unidirectional, irreversible, and real process. It takes place continuously and it is surface phenomena.
- Q.3 (D)** Continuous production of mechanical work without supplying an equivalent amount of heat is **not** possible, because **input  $\neq$  output**.
- Q.4 (C)** Born Haber's cycle is an application of Hess's law. It enables us to calculate the  $\Delta H_{\text{latt}}$  of **binary ionic compounds** such as  $M^+ X^-$ .
- Q.5 (D)** The value of  $\Delta H$  is **< 0** in case of **exothermic reaction** but not always, because in **endothermic reaction**  $\Delta H$  is **> 0**. So heat of reaction  $\Delta H > 0$  or **< 0**.
- Q.6 (A)**  $\Delta H^\circ_{\text{at}}$  is the amount of heat **absorbed** when **one mole** of gaseous atoms are formed from the element under standard condition. e.g.  $\Delta H^\circ_{\text{at}}$  of hydrogen is given below.



- Q.7 (C)** The enthalpy change per mole of H<sub>2</sub>O formed is independent of the acid or alkali used as they are strong, because  $\Delta H_n$  is merely the heat of formation of one mole of water from neutralization its strong acids and strong bases. Its value is always negative.

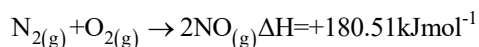


$$\Delta H^\circ_n = -57.4 \text{ kJ mol}^{-1}$$

$\Delta H_n$  for any strong acid with a strong base is approximately the same i.e. - 57.4 kJ mol<sup>-1</sup>.

- Q.8 (A)** Lattice energy ( $\Delta H^\circ_f$ ) of binary ionic compound is determined by the formula  $\Delta H^\circ_f = \Delta H^\circ_f - \Delta H_x$
- Q.9 (B)** It is **endothermic reaction** in which products are at **higher energy level than reactants** as shown in diagram and for such reactions a continuous **source of energy** is needed to complete the reaction.
- Q.10 (D)** The polarity of a polar molecule is quantitatively measured in term of **dipole moment**. The dipole moment ( $\mu$ ) of a molecule may be defined as the product of the electric charge ( $q$ ) and the distance between the positive and negative centers ( $r$ ).
- Mathematically it can be shown as  $\mu_{\text{diatomic}} = q \times r$
- The unit of dipole moment is Debye  $1\text{D} = 3.336 \times 10^{-30} \text{ mC}$ .
- Q.11 (A)** In azeotropic mixture showing positive deviation from Raoult's law the volume of the mixture is slightly more than the total volume of the components.
- Q.12 (C)** To predict whether the reaction is **endothermic** or **exothermic**, it all depends on enthalpy change i.e. if  $\Delta H = +$  value then it is **endothermic**

reaction and if  $\Delta H = -$  then it is exothermic reaction. In options **A, B** and **D**  $\Delta H$  have negative values, so they are exothermic reaction. Only in case **C**  $\Delta H$  is positive so it is endothermic as shown in the reaction.



**Q.13 (D)** Calorimeter is that device which is used to measure  $\Delta H^\circ$ . It is only used for those reactions which complete in one step. Since in case of **A, B** and **C** reactions do not complete in one step, so their  $\Delta H$  cannot be measured directly. But in case of option **D** formation of **MgO** completes in one step. So its  $\Delta H^\circ$  can be measured by calorimeter.

**Q.14 (D)** A state function is a macroscopic property of a system which has some definite values for initial and final states and which is independent of the path followed by the system. **A, B** and **C** are state functions because they only depend on initial and final state whereas **q** and **w** are not state function because they depend on the path followed by the system.

**Q.15 (B)** The standard enthalpy of a solution is the amount of heat absorbed or evolved when one mole of a substance is dissolved in so much solvent that further dilution results in no detectable heat change.

e.g.  $\Delta H_{\text{sol}}$  of **LiCl** =  $-35.0 \text{ kJ mol}^{-1}$  and for  $\Delta H_{\text{sol}}$  of **NaCl** =  $+4.98 \text{ kJ mol}^{-1}$ .

**Q.16 (C)** Given data:

- Heat capacity of calorimeter (c)

$$= 90.0 \text{ kJ mol}^{-1}$$

$$\Delta T = 5 \text{ K}$$

Heat gained by the system  $q = c \times \Delta T$

$$= 90.0 \times 5 = 450 \text{ kJ}$$

$$\text{Number of moles of graphite} = \frac{12}{12} = 1$$

$$\Delta H^\circ_c \text{ of graphite per mol} = \frac{450}{1}$$

$$= 450 \text{ kJ mol}^{-1}$$

Since heat is evolved during combustion, so sign of the answer would be negative

$$\text{i.e. } \Delta H^\circ_c = -450 \text{ kJ mol}^{-1}$$

**Q.17 (A)** Glass calorimeter is used to measure heat of neutralization.

**Q.18 (C)** Solution: Specific heat of water

$$(s) = 5 \text{ J K}^{-1} \text{ g}^{-1}$$

Density of water is around  $1 \text{ g cm}^3$ , so  $100 \text{ cm}^3$  ( $50 \text{ cm}^3 + 50 \text{ cm}^3 = 100 \text{ cm}^3$ ) of total solution is approximately =  $100 \text{ g}$  ( $m = d \times V = 1 \times 100 = 100 \text{ g}$ )

- Total mass of reaction mixture =  $100 \text{ g}$   
Rise in temperature ( $\Delta T$ ) =  $T_2 - T_1$   
 $= 31.0^\circ \text{C} - 25.0^\circ \text{C} = 6^\circ \text{C} = 6 \text{ K}$

Amount of total heat evolved

$$q = m \times s \times \Delta T \text{ (i)}$$

$$= 100 \times 5 \times 6$$

$$= 3000 \text{ J}$$

$$= 3.0 \text{ kJ}$$

So the reaction is exothermic

$$q = -3.0 \text{ kJ}$$

So  $50 \text{ cm}^3$  of  $0.5 \text{ M}$  solution is =  $0.05 \text{ moles}$  of **HCl** and **NaOH** respectively

$$(M_1 \times 1000 = 0.5 \times 50)$$

$$\therefore M_1 = 0.5 \times \frac{50}{1000} = 0.025 \text{ M}$$

$$= 0.025 \text{ mole (ii)}$$

When this heat is divided by number of moles, the  $\Delta H^\circ_n$  is for one mole

Heat of neutralization

$$(\Delta H^\circ_n) = \frac{-3.0 \text{ kJ}}{0.025 \text{ mol}} = -120 \text{ kJ mol}^{-1} \text{ (iii)}$$

**Q.19 (B)** Since in endothermic reaction heat energy is absorbed by the system from the surrounding that is why energy of

the surrounding decreases while the energy of the system increases i.e.  $\Delta H > 0$ .

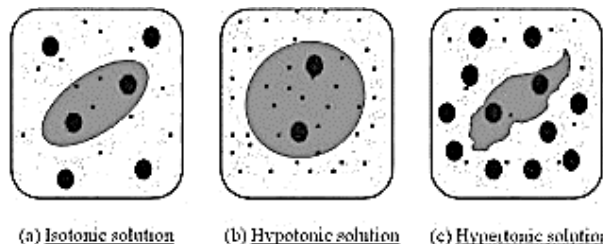
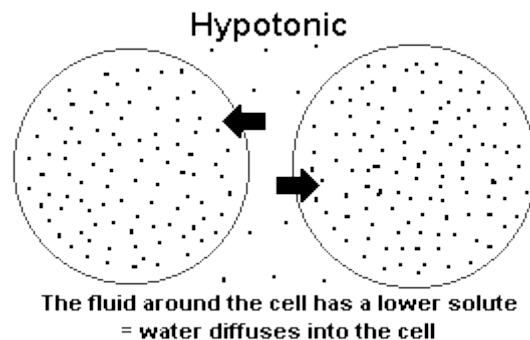
Q.20 (D)

- $\Delta E = q_v$  This shows that a change in internal energy of a system, at constant volume is equal to heat absorbed by the system ( $q_v$ ).
- $\Delta H = q_p$  This shows that change in enthalpy is equal to heat of reaction at constant pressure. The reactions are carried out at constant pressure more frequently than at constant volume. So, working with  $\Delta H$  is more convenient rather than  $\Delta E$ .
- In fact,  $\Delta H = \Delta E + P\Delta V$ .
- Therefore it can be concluded that  $q_p > q_v$ .

Q.21 (B) Since ammonia is a base so when it is dissolved in water, the solution becomes basic in nature. It turns red litmus paper blue. It has pH greater than 7.

Q.22 (C) Since alcohol is more volatile than water because boiling point of alcohol ( $78.5^\circ\text{C}$ ) is less than that of water ( $100^\circ\text{C}$ ) and it has weaker hydrogen bonding. Because of this reason an aqueous solution of ethanol in water has more vapour pressure more than that of water.

Q.23 (A) The solution which has lower osmotic pressure is called hypotonic solution.



Q.24 (A)  $K_b$  is related to **molality**. The **molal boiling point constant ( $K_b$ )** is the ratio of the elevation in boiling point to molality. **Mathematically** it can be shown as  $K_b = \frac{\Delta T_b}{m}$ .  $K_b$  depends upon the **nature of solvent** and **not upon the nature of solute**. e.g.  $K_b$  of water ( $0.52^\circ\text{C/m}$ ).

Q.25 (A) **Iodine** is a **non-polar** while **water** is a **polar**. So **iodine** is **not** soluble in **water** because like is **dissolved** by like. Those **liquids** which **do not** dissolve into each other in any proportion are called immiscible liquids. **Examples of immiscible liquid pair** is as follow:

- Water and benzene ( $\text{H}_2\text{O} + \text{C}_6\text{H}_6$ )
- Water and carbon disulphide ( $\text{H}_2\text{O} + \text{CS}_2$ )

Q.26 (B) As **0.1m  $\text{CaCl}_2$**  solution has **greater number** of solute particles as **compared** to other solutions (A, C and D), therefore **0.1m  $\text{CaCl}_2$**  solution has **low** vapour pressure as compared to others **at room temperature**.

Q.27 (D) If the solute is volatile and non-electrolyte it would not follow **colligative properties** because it **does**



not fulfill the conditions of colligative properties.

**Q.28 (A)** Osmotic pressure is a colligative property like elevation in boiling point ( $\Delta T_b$ ), depression in freezing point ( $\Delta T_f$ ) and lowering in vapour pressure ( $\Delta P$ ). But melting point, boiling point and freezing point are not colligative properties.

**Q.29 (C)** Since two solutions (NaCl and KCl) have same number of solute particles. Therefore they possess same vapour pressure.

**Q.30 (D)** All of the following statements are correct about relative lowering of vapour pressure:

- It is independent of the temperature
- It depend on the concentration of solute
- It is constant when equimolecular proportions of different solutes are dissolved in the same mass of same solvent

**Q.31 (D)** Since internal energy is a state function like P, T, V, G, H, and S and they all depend upon initial and final stage of the system but not on the path of the system.

**Q.32 (B)** Ionic solid is soluble in water if  $\Delta H_{\text{hyd}} > \Delta H_{\text{latt}}$ .

**Q.33 (B)** The number of moles of solute in 1000g (1kg) of solvent is called molality. The symbol for molality is "m".

$$\text{Molality (m)} = \frac{\text{Mass of solute}}{\text{Molar mass of solute}} \times \frac{1}{\text{Mass of solvent in kg}}$$

**Q.34 (A)** For determining the molecular mass of the polymers (macromolecules), osmotic pressure is preferred over other methods as the pressure measurement is around the room temperature. Its mainly because biomolecules are not stable at higher

temperatures and the polymers have poor solubility.

**Q.35 (A)** Paint is an example of solution in which solute is in the solid state while solvent is in the liquid state.

**Q.36 (A)** For example phenol and water are partially miscible liquids. At 25°C the upper layer is 5% solution of phenol in water and the lower layer is 30% water in phenol. These two solutions are conjugate solution to each other. When the temperature of water phenol system is increased, the compositions of both layer change. Water starts travelling from upper to the lower layer and phenol travels from lower to the upper layer. When the temperature of this system approaches 65.9°C, a homogeneous mixture of two components is obtained. This homogenous mixture contains 34% phenol and 66% water. The temperature of 65.9°C at which two conjugate solutions merge into one another, is called critical solution temperature or upper consolute temperature.

**Q.37 (A)**

$$W_2 = \frac{m \times \text{molar mass of solute} \times \text{mass of solvent}}{1000}$$
$$= \frac{0.2 \times 60 \times 100}{1000} = 1.2 \text{ g}$$

$\therefore$  the amount of urea dissolved = 1.2g.

**Q.38 (C)**  $\text{ppm} = \frac{\text{mass of solute}}{\text{mass of solution}} \times 10^6$

$$= \frac{0.5}{100} \times 10^6 = \frac{5}{1000} \times 10^6 = 5 \times 10^3$$

$\therefore$  Concentration of fluoride in ppm =  $5 \times 10^3$

Glucose		Water
$\frac{18}{180}$		$\frac{90}{18}$
0.1	:	5.0
$n_t = 0.1 + 5.0 = 5.1$		

∴ relative lowering of vapour pressure of glucose solution

$$\frac{\Delta p}{p^0} = x_2 = \frac{n_2}{n_1 + n_2} = \frac{0.1}{5.1} = \frac{1}{51}$$

### Striking Information

In chemistry, the **mole fraction** or **molar fraction** ( $x_i$ ) is defined as the amount of a constituent (expressed in moles),  $n_i$ , divided by the total amount of all constituents in a mixture (also expressed in moles),  $n_{\text{tot}}$ .

The sum of all the mole fractions is equal to 1:

$$\sum_{i=1}^N n_i = n_{\text{tot}}; \sum_{i=1}^N x_i = 1$$

Q.40 (A)  $M_2 = \frac{p}{\Delta p} \times \frac{W_2 M_1}{W_1}$

$$M_2 = \frac{120}{5} \times \frac{20 \times 80}{300} = 128 \text{g}$$

**Molar mass of solute = 128g**

Q.41 (C) **Colloidal system** or **colloidal dispersion** is a heterogeneous **system** which is made up of dispersed phase and dispersion medium. In **colloidal dispersion** one substance is dispersed as very fine particles in another substance called dispersion medium.

Q.42 (C) **Solvent loving** colloids are called **lyophilic collides**.

Q.43 (A) **Peptization** is the process responsible for the formation of stable dispersion of colloidal particles in dispersion medium. In other words, it may be **defined** as a process of converting a precipitate into colloidal sol by shaking it with dispersion medium in the presence of small amount of electrolyte.

Q.44 (B) A colloidal solution of  $\text{Fe}(\text{OH})_3$  in water is a **hydrophobic colloid**. A **hydrophobic colloid**, or emulsion, is **defined** as a **colloid** system where the **colloid** particles are hydrophobic particle. **Hydrophobic colloids** do not

interact with water, so they are inherently unstable and generally do not form spontaneously.

Q.45 (C) The statement about **suspension colloidal solution** and **true solution** are as:

- Suspension is heterogeneous
- Colloidal solution is heterogeneous
- True solution is homogenous

Q.46 (D) The addition of alcohol to a saturated aqueous solution of calcium acetate first forms a sol and then sets to a gelatinous mass called solid alcohol which is a gel. Gels are a dispersion of molecules of a liquid within a solid in which the solid is the continuous phase and the liquid is the discontinuous phase. The word gel was coined by 19th-century Scottish chemist Thomas Graham.

Q.47 (D) It is incorrect statement. In fact, Marbles is a example of solid sol (in which dispersion medium is in the solid state), while in blood, paint and cell fluid the dispersion medium is in the liquid state.

Q.48 (A) The colloidal solution of **gold** prepared by **different methods** have **different colours** due to **difference** in the **size of colloidal particles**.

Q.49 (B) Acetone is not sol which is mentioned in the form of acylosol.

Q.50 (A) The amount of solute present in a fixed amount of solvent or solution is called **concentration of solution**.

Q.51 (B) Cheese is a example of colloidal solution in which **dispersion medium (D.M)** is in the solid state while water contents are in the **dispersed phase (D.P)**.

Opt.	DP States	DM States	Colloidal name	Example
A)	Solid	Liquid	Sols	Muddy water
B)	Liquid	Solid	Gels	Cheese
C)	Liquid	Liquid	Emulsion	Blood
D)	Liquid	Gas	Aerosol of liquid	Fog

Colloidal solution can be classified on the basis of:

- Dispersion medium.
- Nature of charge.
- Affinity of D.P for D.M.
- Physical state of D.P and D.M.

Note:

- D.P stands for internal phase or dispersion phase.
- D.M stands for dispersion medium.

## Worksheet-16

## (A. Physical Chemistry)

## Electrochemistry

Q.1 By electrolysis of brine solution, which of the following is deposited/released at anode?

- A)  $H_2$                                       C)  $Cl_2$   
B)  $O_2$                                       D) Na

Q.2 Which of the following is reducing agent?

- A)  $(COOH)_2$                                   C)  $CO_2$   
B)  $F_2$                                         D)  $HNO_3$

Q.3 Oxidation number of nitrogen in  $NO_3^{-1}$  is:

- A) +2    C) +4  
B) +6    D) +5

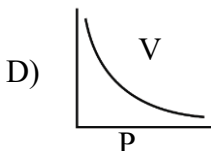
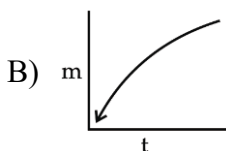
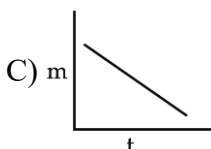
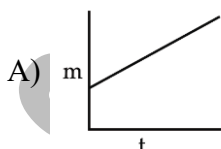
Q.4 Which of the following elements in glucose has zero oxidation state?

- A) C    C) H  
B) O    D) Both A and B

Q.5 All of the following statements about (oxidation) state is / are correct EXCEPT:

- A) It is apparent charge on an atom in a compound  
B) Its value is either zero, positive or negative  
C) It can be variable  
D) Xenon (Xe) can show maximum oxidation state +6 in its compounds

Q.6 Electrolysis of  $CuSO_{4(aq)}$  was carried out using Cu – electrode and a steady current. Which graph shows the change in mass of the cathode with time.



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SCRATCH WORK

**Q.7** In the extraction of Al by electrolysis, why is it necessary to dissolve  $Al_2O_3$  in molten cryolite?

- A) Cryolite provides the ions needed to carry current
- B) To decrease high melting point of the electrolyte
- C) Cryolite reacts with  $Al_2O_3$  to form ions
- D) Molten  $Al_2O_3$  would not conduct electricity

**Q.8** In  $FeCl_3$  the oxidation state of Cl is:

- A) Zero
- B) + 1
- C) - 1
- D) - 2

**Q.9** The process of decomposition of an electrolyte in solution or molten states by the passage of electric current is called electrolysis? All of the following statements about products as a result of electrolysis are correct EXCEPT:

- A) They may be get deposited/released on the electrode surface
- B) They may go out in the form of gases
- C) Electrolytic material may get dissolved into the solution as ions
- D) In Nelson cell, Na metal is a primary product

**Q.10** Which of the following is not conductor of electricity?

- A)  $NaCl_{(aq)}$
- B)  $NaCl_{(molten)}$
- C)  $NaCl_{(s)}$
- D) Silver metal

**Q.11**  $Li^+$  has a smaller ionic mobility than  $K^+$  because of the:

- A) Larger size of  $Li^+$
- B) Greater degree of hydration of  $Li^+$
- C) Larger radius to charge ratio of  $Li^+$
- D) Smaller nuclear charge of  $Li^+$

**Q.12** All of the following is / are characteristics properties of electrolytic cell EXCEPT:

- A) It involves conversion of electrical energy into chemical energy
- B) In it anode has negative charge and cathode has positive charge
- C) It is reverse of addition reaction
- D) It is endothermic process

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SCRATCH WORK



**Q.13** When there is more than one cations in the aqueous solution of an electrolyte, the ions discharge at the cathode can be predicted from the reactivity order of elements given in the electrochemical series. Which of the following is correct order of discharge of positive ions at cathode?

- A)  $\text{Ag}^+ > \text{Cu}^{+2} > \text{H}^+ > \text{Pb}^{+2}$     C)  $\text{Ag}^{+1} > \text{H}^+ > \text{Pb}^{+2} > \text{Cu}^{+2}$   
B)  $\text{Cu}^{+2} > \text{Ag}^{+1} > \text{H}^+ > \text{Pb}^{+2}$     D)  $\text{H}^+ > \text{Ag}^{+1} > \text{Cu}^{+2} > \text{Pb}^{+2}$

**Q.14** Which of the following is correct order of discharge of negative ions on the anode electrode in case of electrolysis of mixture of electrolytes?

- A)  $\text{I}^- > \text{Br}^- > \text{OH}^- > \text{NO}_3^{-1}$     C)  $\text{OH}^- > \text{Br}^- > \text{I}^- > \text{NO}_3^{-1}$   
B)  $\text{Br}^- > \text{OH}^- > \text{NO}_3^{-1} > \text{I}^-$     D)  $\text{NO}_3^{-1} > \text{Br}^- > \text{OH}^- > \text{I}^-$

**Q.15** Na metal cannot be produced by electrolysis of aqueous solution of NaCl.

- A) Na reacts with water  
B)  $\text{Na}^+$  is more stable than Na atom  
C)  $\text{Na}^+$  reacts with  $\text{Cl}^-$  ion in the solution  
D) Reduction of  $\text{H}_2\text{O}$  is preferred to  $\text{Na}^+$

**Q.16** Which of the following is wrong about electrolysis?

- A) Extraction of sodium by the electrolysis of fused NaCl is carried in Down's cell  
B) Ca and Mg metals are extracted by the electrolysis of their fused chlorides  
C) It is used for the extraction of blistered copper from electrolytic copper  
D) Aluminium is extracted by electrolyzing fused bauxite ( $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$ ) in the presence of fused cryolite ( $\text{Na}_3\text{AlF}_6$ )

**Q.17** In which one of the following reactions, hydrogen behaves as an oxidizing agent?

- A)  $\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$     C)  $2\text{Na} + \text{H}_2 \rightarrow 2\text{NaH}$   
B)  $\text{C}_2\text{H}_4 + \text{H}_2 \rightarrow \text{C}_2\text{H}_6$     D)  $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$

**Q.18** When a dilute solution of salt is electrolyzed, a colourless gas is given off at the anode. The gas is:

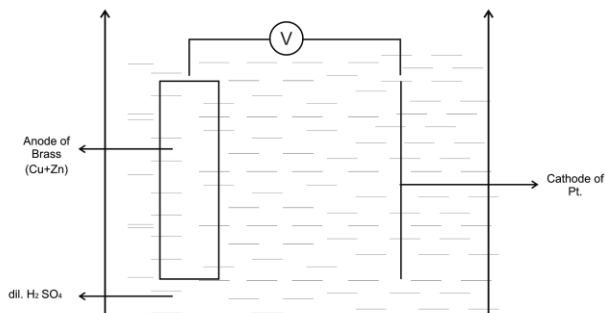
- A) Hydrogen    C) Steam  
B) Oxygen    D) Chlorine

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SCRATCH WORK

Q.19 Coinage metals (Cu, Ag and Au) are the least reactive because they have:

- A) Negative reduction potential
- B) Negative oxidation potential
- C) Positive reduction potential
- D) Positive oxidation potential

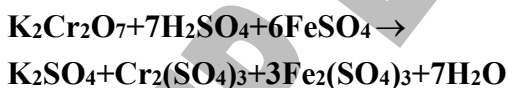
Q.20 The circuit shown in diagram was set up:



Which electrode reaction will occur?

Options	Anode Reaction	Cathode Reaction
A)	Cu dissolves preferentially	Cu is precipitated
B)	Cu dissolves preferentially	Hydrogen gas is evolved
C)	Zn and Cu both dissolves	Hydrogen gas is evolved
D)	Zn dissolves preferentially	Hydrogen gas is evolved

Q.21 Consider the following redox reaction



In this reaction

- I)  $\text{FeSO}_4$  acts as a reducing agent
- II)  $\text{K}_2\text{Cr}_2\text{O}_7$  acts as an oxidizing agent
- III)  $\text{Cr}^{+6}(\text{aq})$  is reduced to  $\text{Cr}^{+3}$
- IV)  $\text{Fe}^{+3}$  is oxidized to  $\text{Fe}^{+2}$

Which of the following statements is/are correct regarding this redox reaction?

- A) I and II only
- B) II and III only
- C) I, II, III
- D) I, II, III, and IV

USE THIS SPACE FOR  
SCRATCH WORK

**Q.22 All of the following are reducing agents EXCEPT:**

- A)  $\text{FeSO}_4$                       C)  $(\text{COOH})_2$   
B)  $\text{H}_2\text{S}$                          D)  $\text{CO}_2$

**Q.23** The potential set up when an electrode is in contact with 1M solution of its own ions at 298 K is known as standard electrode potential (or standard reduction potential denoted by  $E^\circ$ ). All of the following statements about standard electrode potential are correct EXCEPT:

- A) Smaller is the  $E^\circ_{\text{red}}$ , greater is the reducing power of a metal
- B)  $E^\circ_{\text{red}}$  of  $\text{Li}^+$  is minimum (-3.04V)
- C) Greater is the  $E^\circ_{\text{red}}$ , greater is the oxidizing power of a non-metal
- D)  $E^\circ_{\text{red}}$  of  $\text{Cl}_2$  is maximum (+2.87V)

**Q.24 Identify incorrect statement about standard hydrogen electrode:**

- A) It is used as a reference electrode  
B) Its  $E^\circ_{\text{red}}$  is zero or less than zero  
C) When it is connected to zinc electrode in a galvanic cell, it act as cathode  
D) When it is connected to Cu electrode in a galvanic cell, it act as anode

**Q.25** If in a Galvanic cell:

- $\text{Zn}^{+2} / \text{Zn}^0$   $E^0_{\text{red}} = -0.76 \text{ V}$
- $\text{Cu}^{+2} / \text{Cu}^0$   $E^0_{\text{red}} = +0.34 \text{ V}$

**Then the standard cell potential ( $E^{\circ}_{\text{cell}}$ ) of this Galvanic cell is:**

- A) + 1.10 volts  
B) - 0.42 volts  
C) -1.10 volts  
D) + 0.42 volts

**Q.26** On the basis of knowledge of electrochemical series, which reaction is not feasible:

- A)  $\text{Zn} + \text{H}_2\text{SO}_4 (\text{dil}) \rightarrow \text{ZnSO}_4 + \text{H}_2$   
 B)  $\text{F}_2 + \text{KCl} \rightarrow 2\text{KF} + \text{Cl}_2$   
 C)  $\text{Cu} + \text{H}_2\text{SO}_4 (\text{dil}) \rightarrow \text{CuSO}_4 + \text{H}_2$   
 D)  $\text{Cl}_2 + 2\text{KBr} \rightarrow 2\text{KCl} + \text{Br}_2$

**USE THIS SPACE FOR**  
**SCRATCH WORK**

Q.27

When elements are arranged in the order of their standard electrode potential on the basis of hydrogen scale, the resulting list of elements is known as Electrochemical series. Mark the incorrect statement about electrochemical series:

- A) Every top metal can displace lower one in redox reaction
- B) Every lower non-metal can displace higher one in redox reaction
- C)  $E^{\circ}_{\text{cell}} = E^{\circ}_{\text{oxid}} + E^{\circ}_{\text{red}}$
- D)  $E^{\circ}_{\text{red}}$  increases from bottom to top

Q.28

Identify the incorrect statement:

- A) Every top metal acts as anode
- B) Every lower metal acts as cathode
- C) Oxidizing power of an element decreases from top to bottom
- D) Reducing power of an element decreases from top to bottom

Q.29

On the electrolysis of aqueous solution of  $\text{Na}_2\text{SO}_4$  by using inert electrode, which of the following is deposited/released on the cathode electrode?

- A) Na is deposited
- B)  $\text{O}_2$  gas is released
- C) Either Na or  $\text{H}_2$  is released
- D)  $\text{H}_2$  gas is released

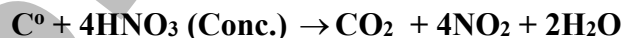
Q.30

On the electrolysis of  $\text{H}_2\text{SO}_4$  (dil) solution by using inert electrode, which of the following is deposited or released at anode electrode

- A)  $\text{H}_2$  gas is released
- B)  $\text{O}_2$  gas is released
- C)  $\text{SO}_2$  gas is released
- D) Either  $\text{O}_2$  or  $\text{SO}_2$  gas is released

Q.31

A redox reaction is shown below:



In this reaction oxidation number of N from nitric acid to  $\text{NO}_2$  is decreased from \_\_\_\_ to \_\_\_\_.

- A) +5 to +2
- B) +5 to +4
- C) +3 to +2
- D) +4 to +2

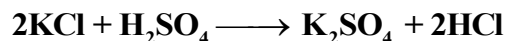
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**Q.32** In sodium sulphate ( $\text{Na}_2\text{SO}_4$ ) what is the oxidation number of sulphur:

- A) +2  
B) +4  
C) +6  
D) +8

**Q.33** Solid potassium halides react with concentrated sulphuric acid, according to the following equations.

**Reaction-1:**



**Reaction-2:**



**Reaction-3:**



What is the largest change in the oxidation number of sulphur in each of these reactions?

Options	Reaction-1	Reaction-2	Reaction-3
A)	0	0	4
B)	0	2	4
C)	0	2	8
D)	0	4	8

**Q.34** Salt bridge has all of the following functions EXCEPT:

- A) It keeps separate both solutions  
B) It maintains electrical neutrality in the cell  
C) It maintains flow of electric current through external circuit  
D) The positive charge around cathode electrode would prevent the electrons to flow from it

**Q.35** To measure the standard electrode potential of Zinc, it is coupled with:

- A) SHE  
B)  $\text{Cl}_2$   
C)  $\text{F}_2$   
D) Cu

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**Q.36 Which one of the following is not redox reaction?**

- A)  $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$
- B)  $\text{MgO} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2\text{O}$
- C)  $\text{Cu} + 4\text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{H}_2\text{O} + 2\text{NO}_2$
- D)  $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$

**Q.37 The element which has greatest value of standard reduction potential ( $E^\circ_{\text{red}}$ ) in the redox reaction acts as:**

- A) Strongest reducing agent
- B) Strongest oxidizing agent
- C) Weakest oxidizing agent
- D) Weakest reducing agent

**Q.38 When a Zn strip is placed in  $\text{CuSO}_4$  solution, Cu gets precipitated, because standard oxidation potential of Zn is?**

- A)  $< \text{Cu}$
- B)  $> \text{Cu}$
- C)  $< \text{SO}_4^{-2}$
- D)  $> \text{SO}_4^{-2}$

**Q.39 Which of the following has highest reduction potential?**

- A) Zn
- B) Al
- C) Au
- D) Pb

**Q.40 The reaction which takes place at electrode when electricity is passed through the solution of an electrolyte is called \_\_\_\_\_.**

- A) Hydrolysis
- B) Neutralization
- C) Electrolysis
- D) Galvanizing

USE THIS SPACE FOR  
SCRATCH WORK

**ANSWER KEY (Worksheet-16)**

1	C	11	B	21	C	31	B
2	A	12	B	22	D	32	C
3	D	13	A	23	D	33	C
4	A	14	A	24	B	34	D
5	D	15	D	25	A	35	A
6	A	16	C	26	C	36	B
7	B	17	C	27	D	37	B
8	C	18	B	28	C	38	B
9	D	19	C	29	D	39	C
10	C	20	D	30	B	40	C

**ANSWERS EXPLAINED****Standard reduction potentials ( $E^\circ$ )  
of substances at 298K**

oxidised form $A_{Ox}$	$+ n e^-$ $+ n e^-$	reduced form $A_{Red}$	$E^\circ / V$
$Li^+_{(aq)} + e^-$	$\rightleftharpoons$	$Li_{(s)}$	-3.04
$K^+_{(aq)} + e^-$	$\rightleftharpoons$	$K_{(s)}$	-2.92
$Na^+_{(aq)} + e^-$	$\rightleftharpoons$	$Na_{(s)}$	-2.71
$Zn^{2+}_{(aq)} + 2 e^-$	$\rightleftharpoons$	$Zn_{(s)}$	-0.76
$Pb^{2+}_{(aq)} + 2 e^-$	$\rightleftharpoons$	$Pb_{(s)}$	-0.13
$2 H^+_{(aq)} + 2 e^-$	$\rightleftharpoons$	$H_{2(g)}$	0.00
$N_{2(g)} + 8 H^+_{(aq)} + 6 e^-$	$\rightleftharpoons$	$2 NH^+_{4(aq)}$	+0.27
$Cu^{2+}_{(aq)} + 2 e^-$	$\rightleftharpoons$	$Cu_{(s)}$	+0.34
$I_{2(s)} + 2 e^-$	$\rightleftharpoons$	$2 I^-_{(aq)}$	+0.54
$O_{2(aq)} + 2 H^+_{(aq)} + 2 e^-$	$\rightleftharpoons$	$H_2O_{2(aq)}$	+0.68
$Fe^{3+}_{(aq)} + e^-$	$\rightleftharpoons$	$Fe^{2+}_{(aq)}$	+0.77
$NO^-_{3(aq)} + 4 H^+_{(aq)} + 3 e^-$	$\rightleftharpoons$	$NO_{(g)} + 2 H_2O_{(l)}$	+0.96
$O_{2(g)} + 4 H^+_{(aq)} + 4 e^-$	$\rightleftharpoons$	$2 H_2O_{(l)}$	+1.23
$Cl_{2(g)} + 2 e^-$	$\rightleftharpoons$	$2 Cl^-_{(aq)}$	+1.36
$Cr_2O^{2-}_{7(aq)} + 14 H^+_{(aq)} + 6 e^-$	$\rightleftharpoons$	$2 Cr^{3+}_{(aq)} + 7 H_2O_{(l)}$	+1.36
$MnO^-_{4(aq)} + 8 H^+_{(aq)} + 5 e^-$	$\rightleftharpoons$	$Mn^{2+}_{(aq)}$	+1.49
$H_2O_{2(aq)} + 2 H^+_{(aq)} + 2 e^-$	$\rightleftharpoons$	$2 H_2O_{(l)}$	+1.78
$F_{2(g)} + 2 e^-$	$\rightleftharpoons$	$2 F^-_{(aq)}$	+2.87

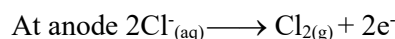
**Q.1 (C)** Chlorine gas ( $Cl_2$ ) is released at anode.

- In the electrolysis of aqueous solution containing a mixture of ions, following is the increasing order of discharge of negative ions at anode electrode.



- In the electrolysis of brine solution, the relative concentration of chloride ions ( $Cl^-$ ) and hydroxide ions ( $OH^-$ ) affect the result.
- The concentration of  $OH^-$  ions in water is only  $10^{-7} \text{ moldm}^{-3}$ . In the aqueous solution concentration of  $Cl^-$  ions is  $0.1 \text{ moldm}^{-3}$ .
- Which clearly shows that the concentration of chloride ions is  $10^6$  times greater than that of  $OH^-$  ions.
- Because of this reason chloride ions are preferentially discharged at anode electrode than that of  $OH^-$  ions (concentration effect).

	Cations	Anions
$NaCl_{(aq)} \longrightarrow Na^+_{(aq)} + Cl^-_{(aq)}$	$Na^+_{(aq)}$	$Cl^-$
$HOH \longrightarrow H^+_{(aq)} + OH^-_{(aq)}$	$H^+_{(aq)}$	$OH^-$



**Q.2 (A)** Oxalic acid ( $COOH$ )<sub>2</sub> is reducing agent and oxidation number of carbon increases from +3 to +4 in redox reaction.

**Q.3 (D)** ( $NO_3^{-1}$ )

$$x + (-2 \times 3) = -1$$

$$x - 6 = -1$$

$$x = +5$$

so oxidation number of N in  $NO_3^{-1} = +5$ .

**Q.4 (A)** Oxidation of carbon is zero in glucose such as. **Formula of glucose** =  $C_6H_{12}O_6$ .

$$x \times 6 + 1 \times 12 - 2 \times 6 = 0$$

$$6x + 12 - 12 = 0$$

$$6x + 0 = 6$$

$$x = 0$$

$\therefore$  Oxidation number of carbon is zero.

**Q.5 (D)** Oxidation state of **Xe** can be not only +6 but it can also be +8 as shown in the compound **XeO<sub>4</sub>**. In this compound oxidation state of **Xe** is +8. Therefore, maximum oxidation state of Xenon is +8 not +6.

e.g.

- O.S of Xe in **XeOF<sub>4</sub>** is +6
- O.S of Xe in **XeO<sub>4</sub>** is +8

**Q.6 (A)** According to **Faraday's second law** of electrolysis, mass of the metal deposited on the electrode is directly proportional to the quantity of electricity (i.e.  $m \propto Q$ ) where  $Q = It$ . Option A justifies the statement. At the cathode, **Cu<sup>2+</sup>** ions migrate there and is reduced to form **Cu**.  $Cu^{+2} + 2e^- \rightarrow Cu$ . Hence the mass of the cathode electrode increases with time.

**Q.7 (B)** The main purpose of cryolite is to reduce the melting point of **Al<sub>2</sub>O<sub>3</sub>** (M.P = 2072°C). The minimum melting point is achieved when a mixture of substances is formed (M.P of mixture = 1009°C).

**Q.8 (C)** In **FeCl<sub>3</sub>** oxidation of **Fe** = +3 while total negative charge on chlorine = -3. Charge on chlorine per atom = -1. So oxidation number of chlorine in **FeCl<sub>3</sub>** is -1.

**Q.9 (D)** In **Nelson cell** water is reduced preferentially to **Na<sup>+</sup>** i.e. **Na** metal is not extracted by electrolysis of brine. **Na metal** is obtained by electrolysis of molten **NaCl** in **Down's cell**.

**Q.10 (C)** **NaCl** in the solid state does not conduct electricity because free ions are not available. For the passage of electricity, free ions of **NaCl** are obtained when **NaCl** is in the molten state or in the solution form.

**Q.11 (B)** **Li<sup>+</sup>** has a smaller ionic mobility than that of **K<sup>+</sup>** because size of **Li<sup>+</sup>** is a smaller and  $\Delta H_{hyd}$  of **Li<sup>+</sup>** = -499 kJ mol<sup>-1</sup> which is greater than that of **K<sup>+</sup>** ion ( $\Delta H_{hyd}$  = -305 kJ mol<sup>-1</sup>). So greater is the  $\Delta H_{hyd}$ , smaller is the mobility of ion.

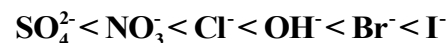
**Q.12 (B)** In the **electrolytic cell** cathode is shown by **negative (-)** sign while anode is shown by **positive (+)** sign. However, in **galvanic cell** cathode is shown by **positive (+)** sign while anode is shown by **negative sign (-)**.

**Q.13 (A)** Greater is the **E<sup>0</sup><sub>red</sub>** value, more the ions are preferentially deposited or released at the cathode.

Order of increasing discharge of positive ions =  $Pb^{+2} < H^+ < Cu^{+2} < Ag^+$

**Q.14 (A)** In the electrolysis of a solution containing a mixture of ions.

**Following increasing order of discharge of negative ions at anode electrode is given below.**



Therefore, the decreasing order of discharge of given negative ions in the given question is:



Q.15 (D) Because  $E^\circ_{\text{red}}$  of  $\text{H}_2\text{O}$  is greater i.e. ( $\text{H}^+$  ions = 0.0V) than that of

$\text{Na}^+$  ( $E^\circ_{\text{red}} = -2.71\text{V}$ ).

Q.16 (C) In fact, electrolytic copper is obtained from blistered copper. **Blistered copper** is obtained by bessemerisation of ore of copper (**Chalcopyrite**  $\text{CuFeS}_2$ ). It is impure one. Pure copper obtained by electrolysis of blistered copper is known as electrolytic copper.

Q.17 (C) In this **redox reaction hydrogen** acts as an oxidizing agent because it gains electrons during redox reaction. It is more electronegative ( $\text{H} = 2.1$ ) than that of Na (0.9). 
$$2\overset{0}{\text{Na}}_{R.A} + \overset{0}{\text{H}_2}_{O.A} \rightarrow 2\overset{+1}{\text{Na}}\overset{-1}{\text{H}}$$

Q.18 (B) When a dilute solution of salt and water is electrolyzed, a colourless  $\text{O}_2$  gas is given off at the anode. Generally  $\text{OH}^-$  ions are preferentially released in the form of oxygen gas at anode. Because generally it is preferentially released than most of the other negative ions of the salts in dilute solution.

Q.19 (C) Coinage metals **Cu, Ag, Au**, are the least reactive because they have high positive  $E^\circ_{\text{red}}$  values as shown ( $\text{Cu}^{+2} = +0.34\text{V}$ ,  $\text{Ag}^+ = 0.78\text{V}$ ,  $\text{Au}^{3+} = +1.50\text{V}$ ) greater is the  $E^\circ_{\text{red}}$  value of a metal, least is the reactivity.

$$\text{i.e. } E^\circ_{\text{red}} \propto \frac{1}{\text{reducing power of a metal}}$$

Q.20 (D)

- At anode oxidation takes place such as  $\text{Zn}_{(s)} \rightarrow \text{Zn}^{2+}_{(aq)} + 2\text{e}^-$ . It shows that

**Zn** metal is continuously consumed and converted into

$\text{Zn}^{+2}$  ( $E^\circ_{\text{oxi}}$  of  $\text{Zn}^0 = +0.76\text{V}$ ).

- At cathode reduction takes place such as  $2\text{H}^+_{(aq)} + 2\text{e}^- \rightarrow \text{H}_{2(g)}$  ions whereas hydrogen gas is continuously released at cathode.

Q.21 (C) In this redox reaction  $\text{FeSO}_4$  acts as a reducing agent and it is oxidized from  $\text{Fe}^{+2}$  ( $\text{FeSO}_4$ ) to  $\text{Fe}^{+3}$   $\{\text{Fe}_2(\text{SO}_4)_3\}$ .  $\text{K}_2\text{Cr}_2\text{O}_7$  acts as oxidizing agent. In this redox reaction  $\text{Cr}^{+6}$  ( $\text{K}_2\text{Cr}_2\text{O}_7$ ) is reduced to  $\text{Cr}^{+3}$   $\{\text{Cr}_2(\text{SO}_4)_3\}$ . In this redox reaction  $\text{Fe}^{+3}$  is not oxidized to  $\text{Fe}^{+2}$  (which is incorrect statement). In fact, it is reduced from  $\text{Fe}^{+3}$  to  $\text{Fe}^{+2}$ .

Q.22 (D)  $\text{CO}_2$  is an oxidizing agent while all others are A, B and C are reducing agent.  $\text{CO}_2$  has tendency to gain electrons.

Q.23 (D) In fact,  $E^\circ_{\text{red}}$  of  $\text{F}_2$  is maximum (+2.87V). In the electrochemical series  $\text{F}_2$  is the strongest oxidizing agent because it can displace all the halogens in the redox reaction i.e  $\text{F}_2$  can displace  $\text{Cl}_2$ ,  $\text{Br}_2$  and  $\text{I}_2$ .

Q.24 (B) Standard hydrogen electrode is used as a reference electrode and its  $E^\circ_{\text{red}}$  is zero volt.

Q.25 (A) The standard cell potential ( $E^\circ_{\text{cell}}$ ) of this Galvanic cell is +1.10V. Since it is positive value, so the reaction is spontaneous and feasible.  $E^\circ_{\text{cell}}$  can be calculated as:

Given data

- $\text{Zn}^{+2}/\text{Zn}^0 \quad E^\circ_{\text{red}} = -0.76 \text{ V}$
- $\text{Cu}^{+2}/\text{Cu}^0 \quad E^\circ_{\text{red}} = +0.34 \text{ V}$
- Since  $\text{Zn}^{+2}$  ion has smaller  $E^\circ_{\text{red}}$  value therefore Zn is more electropositive than Cu. So Zn act as reducing agent and loses electron.
- On the other hand  $\text{Cu}^{+2}$  ion has greater reduction potential value therefore,  $\text{Cu}^{+2}$  is less electropositive than  $\text{Zn}^{+2}$ .

$$E^\circ_{\text{oxid}} \text{ Zn}^0/\text{Zn}^{+2} = +0.76 \text{ V}$$

$$\begin{aligned} E^\circ_{\text{cell}} &= E^\circ_{\text{oxid}} + E^\circ_{\text{red}} \\ &= \text{Zn}/\text{Zn}^{+2} + \text{Cu}^{+2}/\text{Cu}^0 \\ &= 0.76 + 0.34 \text{ V} \\ &= +1.10 \text{ V} \end{aligned}$$

$E^\circ_{\text{cell}}$  of this Galvanic cell = +1.10V which shows that reaction is feasible.

**Q.26 (C)**  $\text{Cu} + \text{H}_2\text{SO}_4(\text{dil.}) \rightarrow \text{No reaction.}$   
According to applications of electrochemical series every top metal can displace lower metal but lower metal cannot displace higher one. Since reduction potential of  $\text{Cu}^{+2}/\text{Cu}$  is +0.34V and that of hydrogen is zero volt, so hydrogen cannot be displaced by Cu. So this is not feasible reaction. Greater is the  $E^\circ_{\text{red}}$  value, less is electropositive character.

**Q.27 (D)** In fact,  $E^\circ_{\text{red}}$  decreases from bottom to top. That is why from bottom to top electropositive character (reducing power) of an element increases.

Conclusion:

$$E^\circ_{\text{red}} \propto \frac{1}{\text{Reducing Power}}$$

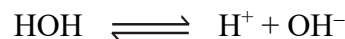
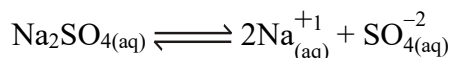
(e.g.  $\text{Li}^{+1}$  has minimum standard reduction potential ( $E^\circ_{\text{red}} = -3.04 \text{ V}$ ) and it is the strongest reducing agent in the electrochemical series)

**Q.28 (C)** In fact, oxidizing power of an element increases from top to bottom. i.e.  $\text{F}_2$  is the strongest oxidizing agent in the electrochemical series.

Conclusion:

- i.e.  $E^\circ_{\text{red}} \propto \text{Oxidizing power}$  (e.g.  $\text{F}_2$  has maximum standard reduction potential ( $E^\circ_{\text{red}} = +2.87 \text{ V}$ ) and it is the strongest oxidizing agent in the electrochemical series)

**Q.29 (D)** On electrolysis of aqueous solution of  $\text{Na}_2\text{SO}_4$  by using inert electrode.  $\text{H}_2$  gas is released at cathode electrode while  $\text{O}_2$  is released at anode. Its detail is shown below.

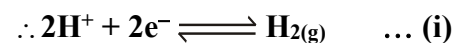


- At cathode

Since  $E^\circ_{\text{red}}$  of  $\text{H}^+$  ions is greater than that of  $\text{Na}^+$  ions. That is why,  $\text{H}^+$  ions are preferentially reduced at cathode electrode and hydrogen  $\text{H}_2$  gas is released at cathode as shown below

Order of discharge of positive ion  
 $= \text{H}^+ > \text{Na}^+$

$$= E^\circ_{\text{red}} = 0.000 \text{ V} > E^\circ_{\text{red}} = -2.714 \text{ V}$$



- At anode

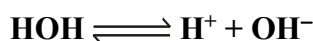
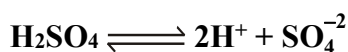
Order of discharge of an anion at cathode electrode is as follow



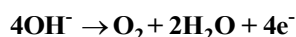


So  $OH^-$  ions are preferentially oxidized at anode and  $O_2$  gas is released as shown below  
 $\therefore 4OH^- \rightarrow O_2 + 2H_2O + 4e^- \dots (ii)$

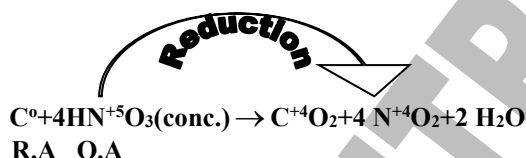
Q.30 (B)  $O_2$  is released at anode by electrolysis of dil.  $H_2SO_4$  as shown below



$OH^-$  ions are preferentially discharged at anode electrode and oxygen gas is released as shown below.



Q.31 (B) In this redox reaction, decrease in oxidation number of N from  $HNO_3$  to  $NO_2$  is from +5 to +4, as shown below.



Q.32 (C)

$Na_2SO_4$	
We know that the oxidation number of one atom of Na is +1. There are two atoms of Na. $2 \times +1 = +2$	We know that one atom of O is assigned -2. There are four atoms of O. $4 \times -2 = -8$

Since the sum of positive charges plus the sum negative charges must be equal 0,

$$(+2) + x + (-8) = 0$$

$$x + 2 - 8 = 0$$

$$x = +6$$

Q.33 (C) In reaction I, II and III, change in the oxidation state of sulphur is 0, 2 and 8 respectively as shown in the table:

Opt.	Reaction-1	Reaction-2	Reaction-3
C)	0	2	8

Q.34 (D) The progress of cell reaction results in the development of positive charge around the anode due to increase in the concentration of  $Zn^{2+}$  ion.

- And negative charge around cathode due to decrease in the concentration of  $Cu^{2+}$  ions.
- The positive charge around anode would prevent the electrons to flow from it and negative charge around cathode will check the electrons to reach copper rod.
- This would stop the working of the cell.
- The salt bridge does not allow the solution around the electrode to acquire charge. The anions from the electrolyte in the salt bridge move towards anode and the cations move towards cathode to maintain the electrical neutrality of the solutions in anodic as well as cathodic compartments.

Q.35 (A) To measure the standard electrode potential of zinc is coupled with standard hydrogen electrode (SHE).

Q.36 (B) In a redox reaction, there is always transfer of electron/electrons from a reducing agent to an oxidizing agent. But in case of option "B" since there

is no change in oxidation number in overall reaction, so it is not redox reaction.

**Q.37 (B)** The element which has the greatest value of standard reduction potential is used as strongest oxidizing agent e.g. maximum reduction potential is that of fluorine in electrochemical series as shown in the tabular form:

Element	Electrode	Standard reduction potential ( $E^\circ$ )
$F_2$	$F_2 + 2e^- \rightarrow 2F^-$	+2.87volts

**Q.38 (B)** When a Zn strip is placed in  $CuSO_4$  solution, Cu gets precipitated, because standard oxidation potential of  $Zn > Cu$  as shown in the tabular form.

$E^\circ_{\text{oxd}}$ of Zn = +0.76V	$E^\circ_{\text{oxd}}$ of Cu = -0.34V
$Zn \rightarrow Zn^{+2} + 2e^-$	$Cu \rightarrow Cu^{+2} + 2e^-$

**Q.39 (C)** Au has highest standard reduction potential as compared to other given in the question.

Element	Electrode	Standard reduction potential ( $E^\circ$ )
Zn	$Zn^{+2} + 2e^- \rightarrow Zn$	-0.76V
Al	$Al^{+3} + 3e^- \rightarrow Al$	-1.66V
Au	$Au^{+3} + 3e^- \rightarrow Au$	+1.50V
Pb	$Pb^{+2} + 2e^- \rightarrow Pb$	-0.126V

**Q.40 (C)** The reaction which takes place at electrode when electricity is passed through the solution of an electrolyte is called electrolysis.

## Worksheet-17

## (A. Physical Chemistry)

## Chemical Equilibrium

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SCRATCH WORK

- Q.1 A reversible reaction shows all of the following characteristic features EXCEPT:**
- A) It can proceed in both directions
  - B) In it the whole amount of reactant does not change into product
  - C) Chemical equilibrium can establish in it
  - D) It is applicable to stoichiometric calculation
- Q.2 Chemical equilibrium is not associated with:**
- A) It is macroscopic property
  - B) At equilibrium the amount of reactant = the amount of product
  - C) It is established in closed system
  - D) It can establish from either side of reactant or product
- Q.3 If the reaction  $A + B \rightarrow AB$ . If concentration of A and B are doubled, the rate of reaction will:**
- A) Increase two times
  - B) Decrease to one half
  - C) Increase four times
  - D) Decrease to one
- Q.4 Which one of the following factors can change the value of  $K_c$ ?**
- A) Temperature
  - B) Pressure
  - C) Concentration of reactants
  - D) Concentration of products
- Q.5 Which of the following principle / rule is applicable at equilibrium?**
- A) Law of mass action
  - B) Pauli's Exclusion Principle
  - C) Le-Chatelier's Principle
  - D) Hund's Rule
- Q.6 In which of the following reactions decrease or increase in pressure has no effect in the change of direction of reaction?**
- A)  $N_2 + O_2 \rightleftharpoons 2NO$
  - B)  $N_2 + 3H_2 \rightleftharpoons 2NH_3$
  - C)  $PCl_5 \rightleftharpoons PCl_3 + Cl_2$
  - D)  $2SO_2 + O_2 \rightleftharpoons 2SO_3$

USE THIS SPACE FOR  
SCRATCH WORK

**Q.7** In which of the following reactions,  $K_c$  value has no unit?

- A)  $H_2 + I_2 \rightleftharpoons 2HI$       C)  $N_2 + 3H_2 \rightleftharpoons 2NH_3$   
B)  $PCl_5 \rightleftharpoons PCl_3 + Cl_2$       D)  $2SO_2 + O_2 \rightleftharpoons 2SO_3$

**Q.8** Consider the following reaction  $2SO_2 + O_2 \xrightleftharpoons{V_2O_5} 2SO_3$  the unit of  $K_c$  is:

- A)  $\text{mol dm}^{-3}$       C)  $\text{dm}^3 \text{mol}^{-1}$   
B)  $\text{dm}^3 \text{mol}^{-2}$       D)  $\text{dm}^6 \text{mol}^{-2}$

**Q.9** In which of the following reactions, heterogeneous equilibrium is established?

- A)  $H_2 + I_2 \rightleftharpoons 2HI$       C)  $N_2 + 3H_2 \rightleftharpoons 2NH_3$   
B)  $PCl_5 \rightleftharpoons PCl_3 + Cl_2$       D)  $MgCO_3 \rightleftharpoons MgO + CO_2$

**Q.10** Which one of the following statements is correct about a reaction for which the equilibrium constant is independent of temperature?

- A) The activation energies for both forward and reverse reactions are zero  
B) The enthalpy change is zero  
C) Its rate constants do not vary with temperature  
D) There are equal number of moles of reactants and products in it

**Q.11** Which of the following is the strongest acid?

- A) HI      C)  $HClO_3$   
B)  $HNO_3$       D)  $H_2SO_4$

**Q.12** Which one of the following groups of elements forms strongest bases?

- A) IVA      C) IIA  
B) IIIA      D) IA

**Q.13** Which one of the following statements is incorrect?

- A) Strong acid has greater concentration of hydrogen ions  
B) Strong acid has low pH value  
C) Greater is  $pK_a$  value, stronger is the acid  
D) Smaller is concentration of  $OH^-$  ions weaker is the base

**Q.14** Which of the following is not buffer solution?

- A)  $CH_3COOH + CH_3COONa$       C)  $HCl + NaCl$   
B)  $H_2CO_3 + NaHCO_3$       D)  $H_3PO_4 + Na_2HPO_4$

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SCRATCH WORK

- Q.15 If  $K_a$  value is  $10^{-6}$  then  $K_b$  value is:  
A)  $10^{-4}$  C)  $10^{-6}$   
B)  $10^{-8}$  D)  $10^{-10}$
- Q.16 Which one of the following statements is incorrect for  $K_c$ ?  
A) It may or may not have unit  
B) It depends on equilibrium concentration  
C) It is associated with  $\Delta H$   
D) It tells us about rate of reaction
- Q.17 All of the following are characteristic features of solubility product EXCEPT?  
A) If solubility is known, then  $K_{sp}$  can be calculated  
B) If  $K_{sp}$  is known, then solubility can be calculated  
C) It is applicable if the molar concentration of ions is greater than 0.1M  
D) The term  $K_{sp}$  is related with reversible process
- Q.18 Which one of the following statements is correct about the effect of a catalyst?  
A) It increases the equilibrium constant for the forward reaction  
B) It increases the rate constant for the forward reaction but not that of the reverse reaction  
C) It increases the yield of product at equilibrium  
D) It provides an alternative route for a reaction
- Q.19 Water dissociates as shown:



At  $25^\circ\text{C}$  the equilibrium value of  $[\text{H}^+]$  is  $10^{-7} \text{ mol dm}^{-3}$ ,  
 $[\text{H}_2\text{O}] = \frac{1000}{18} \text{ mol dm}^{-3}$ . What is the order of increasing numerical value of pH,  $pK_a$  and  $pK_w$  for this equilibrium at this temperature? [ $pK_w = -\log K_w$ ]

Options	Smallest	Larger	Largest
A)	pH	$pK_a$	$pK_w$
B)	pH	$pK_w$	$pK_a$
C)	$pK_a$	$pK_w$	pH
D)	$pK_w$	$pK_a$	pH



USE THIS SPACE FOR  
SCRATCH WORK

**Q.20** In order to get maximum yield of  $\text{NH}_3$ , all of the following are optimum conditions EXCEPT?

- A) High pressure
- B) Continuous withdrawal of  $\text{NH}_3$
- C) High temperature
- D) Use of catalyst

**Q.21** Which of the following is Henderson's equation for acidic buffer solution?

- A)  $\text{pH} = \text{pK}_a + \log \frac{[\text{Salt}]}{[\text{Acid}]}$
- B)  $\text{pH} = \text{K}_a + \log \frac{[\text{Salt}]}{[\text{Acid}]}$
- C)  $\text{pH} = \text{pK}_b + \log \frac{[\text{Salt}]}{[\text{Acid}]}$
- D)  $\text{pH} = \text{pK}_a - \log \frac{[\text{Salt}]}{[\text{Acid}]}$

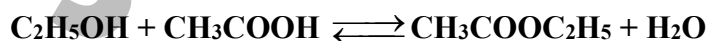
**Q.22** Which of the following statements is incorrect about Henderson's equation for acidic buffer solution?

- A)  $\text{pH} = \text{pK}_a$  if  $[\text{Salt}] = [\text{Acid}]$
- B)  $\text{pH} > \text{pK}_a$  if  $[\text{Salt}] > [\text{Acid}]$
- C)  $\text{pH} < \text{pK}_a$  if  $[\text{Salt}] < [\text{Acid}]$
- D)  $\text{pH} = \text{K}_a$  if  $[\text{Salt}] = [\text{Acid}]$

**Q.23** The decrease in the solubility of an electrolyte by adding another electrolyte having common ion is called common ion effect. Identify incorrect statement about common ions effect:

- A) It is an application of Le-Chatelier's Principle
- B) It is always in the reverse direction
- C) The term electrolyte, acid or base is used for it
- D) It is used for the purification of a substance

**Q.24** The equilibrium constant for the reaction between acetic acid and ethyl alcohol is 4.0. A mixture of 2.0 moles of acetic acid and 2.0 moles of  $\text{C}_2\text{H}_5\text{OH}$  is allowed to come to equilibrium. Calculate the number of moles of ethyl acetate at equilibrium



- A) 1.5 moles
- B) 1.3 moles
- C) 1.6 moles
- D) 1.4 moles

USE THIS SPACE FOR  
SCRATCH WORK

Q.25 Given that pKa of acetic acid is 4.7, what is pH of solution of 0.01 M acetic acid and 0.1 sodium acetate is:

- A) 3.7 C) 4.7  
B) 5.7 D) 2.7

Q.26 The Le-Chatlier principle states that if a stress is applied to a system at equilibrium, the system acts in such a way so as to nullify as far as possible, the effect of that stress. Which of the following effect of change is not according to this principle:

Opt.	Change at equilibrium	Effect of change
A)	Increase in concentration of reactant	Reaction moves in the forward direction
B)	Increase in pressure	Reaction moves in that direction which has less number of moles
C)	Increase in temperature	Reaction always moves in the exothermic side
D)	Increase in the concentration of the product	Reaction moves in the reverse direction

Q.27 Different relationship between  $K_c$  and  $K_p$  are given:

Cond.	Case	Example	Conclusion
I	If $\Delta n = 0$ ( $n_p = n_r$ )	$H_2 + I_2 \rightleftharpoons 2HI$	$K_p = K_c$
II	If $\Delta n = +ve$ ( $n_p > n_r$ )	$PCl_5 \rightleftharpoons PCl_3 + Cl_2$	$K_p > K_c$
III	If $\Delta n = -ve$ ( $n_p < n_r$ )	$N_2 + 3H_2 \rightleftharpoons 2NH_3$	$K_p < K_c$

Which of the following relationship between  $K_c$  and  $K_p$  is/are correct?

- A) I only C) III only  
B) II only D) I, II, III

Q.28 pH of an aqueous solution is 10.0 Its pOH is:

- A) 7 C) 4  
B) 9 D) 10

Q.29 Mark the correct statement:

- A) Greater is the  $K_a$  value, stronger is the acid  
B) Greater is pH value, stronger is the acid  
C) Greater is pKa value, stronger is the acid  
D) Smaller is  $H^+$  ion concentration, stronger is the acid

USE THIS SPACE FOR  
SCRATCH WORK

**Q.30** The phenomenon of interaction of cations and anions of a salt with water in order to produce acidity or alkalinity is known as salt hydrolysis. Which of the following salts is not hydrolyzed?

- A)  $\text{CuSO}_4$  C)  $\text{Na}_2\text{SO}_4$   
B)  $\text{Na}_2\text{CO}_3$  D)  $\text{AlCl}_3$

**Q.31** Which of the following is acidic salt?

- A)  $\text{Na}_2\text{SiO}_3$  C)  $\text{K}_2\text{SO}_4$   
B)  $\text{Na}_2\text{B}_4\text{O}_7$  D)  $\text{FeCl}_3$

**Q.32** According to Lewis theory:

- Acid is electron pair acceptor
- Base is electron pair donor

All of the following are Lewis acids EXCEPT:

- A)  $\text{H}^+$  C)  $\text{BF}_3$   
B)  $\text{AlCl}_3$  D)  $\text{PCl}_3$

**Q.33** Which of the following halide ions is stronger Lewis base?

- A)  $\text{F}^-$  C)  $\text{Br}^-$   
B)  $\text{Cl}^-$  D)  $\text{I}^-$

**Q.34** An indicator is a substance which is used to determine the end point of a reaction. All of the following statements are correctly matched regarding indicators EXCEPT:

Options	Type of Titration	Name of Indicator
A)	Acid base indicators	Phenolphthalein, methyl orange
B)	Redox titration	$\text{K}_3[\text{Fe}(\text{CN})_6]$ an internal indicator, $\text{KMnO}_4$ an external indicator
C)	Iodimetry titration	Starch indicator
D)	Argentometry	$\text{K}_2\text{CrO}_4$

**Q.35** Phenolphthalein is used as an indicator in acid base titration. For which of the following acid base titration it is used as an indicator:

- A) Strong base and strong acid  
B) Weak acid and weak base  
C) Strong acid and weak base  
D) Very weak base and strong acid

## ANSWER KEY (Worksheet-17)

1	D	11	A	21	A	31	D
2	B	12	D	22	D	32	D
3	C	13	C	23	C	33	A
4	A	14	C	24	B	34	B
5	C	15	B	25	B	35	A
6	A	16	D	26	C		
7	A	17	C	27	D		
8	C	18	D	28	C		
9	D	19	B	29	A		
10	B	20	C	30	C		

## ANSWERS EXPLAINED

**Q.1 (D)** It is not applicable to stoichiometric calculation because in the assumptions of stoichiometric calculations, the whole amount of reactant is converted into product but in case of reversible reaction the whole amount of reactant does not convert into product.

**Q.2 (B)** At equilibrium the amount of reactant  $\neq$  amount of product. However at equilibrium the rate of forward reaction = rate of reverse reaction.

**Q.3 (C)** In reaction  $A + B \rightarrow AB$

Rate of forward reaction =  $k[A][B]$

According to condition if concentration of A and B are doubled, then rate of forward reaction will increase four times as shown below.

Rate of forward reaction

$$= k[A][B] = k[2][2] = 4k$$

**Q.4 (A)** The numerical value of  $K_c$  and  $K_p$  for a reaction changes with change of temperature. There are three possibilities.

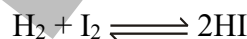
- Case # I If  $\Delta H = 0 \rightarrow K_c$  remains same at different temperature.

- Case # II If  $\Delta H = + \rightarrow K_c$  increases with the increase of temperature.
- Case # III If  $\Delta H = - \rightarrow K_c$  decreases with the increase of temperature.

**Q.5 (C)** "Le-Chatelier's Principle states that if a stress is applied to system at equilibrium, the system acts in such a way so as to nullify, as far as possible, the effect of that stress.

**Q.6 (A)** Since the number of moles of reactants = number of moles of products, so there is no effect of increase or decrease in pressure in the given reversible reaction.

**Q.7 (A)** In this reaction  $K_c$  has no unit



$$K_c = \frac{[HI]^2}{[H_2][I_2]} = \frac{(\cancel{\text{mol dm}^{-3}})^2}{(\cancel{\text{mol dm}^{-3}})(\cancel{\text{mol dm}^{-3}})}$$

So  $K_c$  has no unit.

**Q.8 (C)**  $2SO_2 + O_2 \xrightleftharpoons{V_2O_5} 2SO_3$

$$K_c = \frac{[SO_3]^2}{[SO_2]^2 [O_2]} = \frac{(\cancel{\text{mol dm}^{-3}})^2}{(\cancel{\text{mol dm}^{-3}})^2 (\cancel{\text{mol dm}^{-3}})} = \text{dm}^3 \text{mol}^{-1}$$

**Q.9 (D)**  $MgCO_{3(s)} \rightleftharpoons MgO_{(s)} + CO_{2(g)}$

In this reaction heterogeneous equilibrium is established because reactant and products are not in the same phase.

**Q.10 (B)**  $\Delta H = 0$  then the value of  $K_c$  is constant, independent of temperature i.e the value of  $K_c$  neither increases nor decreases.

Q.11 (A) The  $pK_a$  values of acids HI,  $HClO_3$ ,  $HNO_3$  and  $H_2SO_4$  are -10, -1.0, -1.3 and -3.0 respectively. Smaller is  $pK_a$  value stronger is the acid so HI is stronger acid than that of  $HClO_3$ ,  $HNO_3$  and  $H_2SO_4$ .

Q.12 (D) The elements of IA group form the strongest bases i.e NaOH, KOH, CsOH etc.

Q.13 (C) In fact greater is  $pK_a$  value, weaker is the acid, as already explained in Q#11.

Q.14 (C) Acidic buffer solution is prepared by mixing weak acid and salt of it with strong base. So  $HCl + NaCl$  cannot form acidic buffer solution because  $HCl$  is strong acid and it does not fulfill the condition of acidic buffer solution.

Q.15 (B) As we know that  $K_a \cdot K_b = 10^{-14}$

$$K_a = 10^{-6} \quad K_b \times 10^{-6} = 10^{-14}$$

$$K_b = \frac{10^{-14}}{10^{-6}}$$

$$K_b = 10^{-14+6}$$

$$\therefore K_b = 10^{-8}$$

Q.16 (D) The equilibrium constant for a reversible reaction indicates the extent of a reaction. It gives no information about the rate of reaction.  $K_c$  tells us how far, but not how fast the reaction goes. In fact, the extent and the rate of a reaction are quite independent.

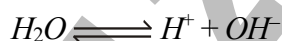
Q.17 (C) In fact,  $K_{sp}$  concept is valid only for saturated solutions in which the total concentration of ions is no more than about  $0.01 \text{ mol dm}^{-3}$ . This means that it is quite inappropriate to use the solubility product concept for

soluble compounds such as NaCl,  $CuSO_4$  etc. It is applicable for sparingly soluble salts.

Q.18 (D) A catalyst provides an alternative route for a reaction to take place with a lower activation energy, so that the speed of the reaction increases.

Q.19 (B)  $pH = -\log(10^{-7}) = 7$ , ... i

$pK_w = -\log(10^{-14}) = 14$ , ... ii



$$K_a = \frac{[H^+][OH^-]}{[H_2O]} \Rightarrow [H_2O]K_a = [H^+][OH^-] = K_w$$

$$\therefore K_a = \frac{K_w}{[H_2O]} \quad \dots \text{iii}$$

$$-\log K_a = -\log K_w + \log [H_2O],$$

$$pK_a = pK_w + \log \frac{1000}{18}$$

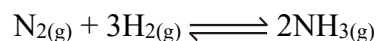
$$\text{where } \log \frac{1000}{18} = \log 55.5 = 1.74 \quad \dots \text{iv}$$

$$\therefore pK_a = 14 + 1.74 = 15.74 \quad \dots \text{v}$$

Option	Smallest	Larger	Largest
B	pH	$pK_w$	$pK_a$
	7	14	15.74

Conclusion in case (B) the values of pH,  $pK_w$  and  $pK_a$  increase respectively.

Q.20 (C) In is not optimum condition in order to get maximum yield of ammonia. In the given reaction as shown below:



$$\Delta H = -92 \text{ kJ}$$

$$\Delta H = -46 \text{ kJ mol}^{-1}$$

Since the forward reaction is exothermic, the temperature should be kept low ( $400^\circ\text{C}$ ), so that reaction should remain in the forward direction.



- Other optimum condition:

i. **High pressure (200 – 300 atm):** With increase in pressure reaction moves in the forward direction

ii. **Continuous withdrawal of ammonia**

As a result, continuous withdrawal of ammonia the reaction moves in the forward direction because concentration of product decreases continuously. That is why reaction continuously moves in the forward direction.

iii. Use of catalyst Fe along with promoters (MgO, Al<sub>2</sub>O<sub>3</sub>, SiO<sub>2</sub>) speeds up the reaction.

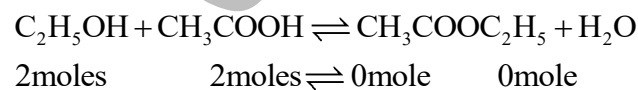
Q.21 (A) Henderson's equation for acidic buffer solution is  $\text{pH} = \text{pK}_a + \log \frac{[\text{Salt}]}{[\text{Acid}]}$

Other options B, C and D are incorrect.

Q.22 (D)  $\text{pH} = \text{K}_a$  is incorrect option. All the other options A, B and C are correct because they fulfill the conditions of Henderson's equation for acidic buffer solution.

Q.23 (C) For common ion effect only the term electrolyte is used because for common ion effect that substance is taken which must be ionized in the solution. There are many acids and bases which do not dissociate into ions. So they cannot be treated as electrolytes.

Q.24 (B)



$$\begin{array}{cccc} & 2-x & 2-x & x\text{mole} & x\text{mole} \\ \text{Eq. molar conc.} & \frac{2-x}{v} & \frac{2-x}{v} & \frac{x}{v} & \frac{x}{v} \end{array}$$

$$K_c = \frac{[\text{CH}_3\text{COOC}_2\text{H}_5][\text{H}_2\text{O}]}{[\text{CH}_3\text{COOH}][\text{C}_2\text{H}_5\text{OH}]}$$

$$K_c = \frac{\frac{x}{v} \cdot \frac{x}{v}}{\frac{(2-x)}{v} \cdot \frac{(2-x)}{v}} = \frac{x^2}{(2-x)^2}$$

$$\begin{aligned} 4 &= \frac{x^2}{(2-x)^2} \\ &= \frac{x^2}{(2-x)^2} = 4 \dots (i) \end{aligned}$$

By taking under root on both side in equation (i) we get

$$\frac{x}{2-x} = 2$$

$$x = 4 - 2x$$

$$x = 2(2-x)$$

$$x + 2x = 4$$

$$3x = 4$$

$$x = \frac{4}{3} = 1.33\text{moles}$$

Q.25 (B) Given data  $\text{pK}_a = 4.7$ ,

$$[\text{CH}_3\text{COOH}] = 0.01\text{mol dm}^{-3}$$

$$[\text{CH}_3\text{COONa}] = 0.1\text{mol dm}^{-3}$$

$$\text{pH} = \text{pK}_a + \log \frac{[\text{Salt}]}{[\text{Acid}]}$$

$$\text{pH} = \text{pK}_a + \log \frac{[\text{CH}_3\text{COONa}]}{[\text{CH}_3\text{COOH}]}$$

$$\text{pH} = \text{pK}_a + \log \frac{[0.1]}{[0.01]}$$

$$\text{pH} = 4.7 + \log \frac{[0.1]}{[0.01]}$$

$$\text{pH} = 4.7 + 1 = 5.7$$

Q.26 (C) It is incorrect statement. In fact, when temperature is increased at equilibrium then reaction always moves towards endothermic side.

Q.27 (D) Statements I, II and III are correct as given in the question.

Q.28 (C)  $\text{pH} + \text{pOH} = 14$

$$\text{pOH} = 14 - \text{pH}$$

$$= 14 - 10$$

$$= 4$$

Q.29 (A) Greater is the  $K_a$  value, stronger is the acid.

Q.30 (C)  $\text{Na}_2\text{SO}_4$  is a neutral salt and it cannot be hydrolyzed. Such salt which are formed by strong acids and strong bases are not hydrolyzed because their conjugates are weak in nature.

Q.31 (D)  $\text{FeCl}_3$  is acidic salt because it is formed by neutralization of strong acid  $\text{HCl}$  and weak base  $\text{Fe}(\text{OH})_3$ .

Q.32 (D)  $\text{PCl}_3$  is Lewis base because it acts as electron pair donor.

Q.33 (A) The strength of anions as base can alternatively be expressed in terms of electronegativity of anion. More is the electronegativity of atom carrying negative charge, more will be its basic nature i.e. order of decreasing basic strength of halide ions is as follow:

- $\text{F}^- > \text{Cl}^- > \text{Br}^- > \text{I}^-$
- $\text{NH}_2^- > \text{OH}^- > \text{SH}^-$

Q.34 (B) In fact,  $\text{K}_3[\text{Fe}(\text{CN})_6]$  is used as an external indicator while  $\text{KMnO}_4$  is used as an internal indicator.

Q.35 (A) Phenolphthalein is used as an indicator in such acid base titration in when strong base is taken such as  $\text{NaOH}$ ,  $\text{KOH}$  etc.

**Worksheet-18****(A. Physical Chemistry)****Reaction Kinetics**

**Q.1** The change in concentration of reactants or products per unit time is called rate of reaction. The rate of reaction:

- A) Increases as the reaction proceeds
- B) Decreases as the reaction proceeds
- C) Remains the same as the reaction proceeds
- D) May decrease or increase as the reaction proceeds

**Q.2** With the increase of 10°C temperature, the rate of reaction doubles. This increase in rate of reaction is due to:

- A) Decrease in activation energy of reaction
- B) Decrease in the number of collision between molecules of reactants
- C) Increase in activation energy of molecules of reactants
- D) Increase in number of effective collision

**Q.3** The minimum amount of energy required for an effective collision is called activation energy. Which one of the following statements is incorrect about activation energy?

**$E_a$  = Activation energy  $K$  = Specific rate constant**

- A)  $E_a$  of exothermic reaction in the forward reaction is less than that of backward reaction
- B)  $E_a$  of endothermic reaction in the forward direction is greater than that of reverse reaction
- C)  $E_a$  is directly proportional to  $k$
- D)  $E_a$  is independent of temperature

**Q.4** Order of reaction is the number of reacting molecules whose concentration alters as a result of chemical change. For which order of reaction, the unit of rate constant ( $k$ ) is the same as that of rate of reaction?

- A) 1<sup>st</sup> order reaction
- B) Zero order reaction
- C) 2<sup>nd</sup> order reaction
- D) 3<sup>rd</sup> order reaction

**Q.5** Which of the following statements about order of reaction is incorrect?

- A) It determines mechanism of reaction
- B) It is determined experimentally
- C) It is associated with rate equation
- D) It is always equal to molecularity

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**Q.6** In which of the following order of reaction, the half-life is independent of initial concentration?

- A) Zero order                      C) 1<sup>st</sup> order  
B) 2<sup>nd</sup> order                      D) 3<sup>rd</sup> order

**Q.7** All of the following factors affect rate of reaction EXCEPT:

- A) Concentration of reactants    C) Catalyst  
B) Molecularity                      D) Temperature

**Q.8** The addition of catalyst to a reaction can.

- A) Change the enthalpy  
B) Change the entropy  
C) Change the nature of products  
D) Change the activation energy

**Q.9** The experimental relationship between rate of reaction and concentration of reactant is called:

- A) Rate Law                      C) Hess's Law  
B) Law of mass action              D) Le-Chatelier's principle

**Q.10** The specific rate constant is equal to rate of reaction when concentration of reactants are taken as unity. Which of the following factors affects specific rate constant?

- A) Concentration of reactants    C) Temperature  
B) Pressure                      D) Surface area

**Q.11** A reaction in which catalyst is used is called catalysis. Which of the following is an example of heterogeneous catalysis?

- A)  $2\text{SO}_2 + \text{O}_2 \xrightleftharpoons{\text{V}_2\text{O}_5} 2\text{SO}_3$   
B)  $\text{CH}_3\text{COOH} + \text{C}_2\text{H}_5\text{OH} \xrightleftharpoons{\text{H}^+} \text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O}$   
C)  $\text{SO}_2 + \text{O}_2 \xrightleftharpoons{\text{NO}} 2\text{SO}_3$   
D) Both B and C

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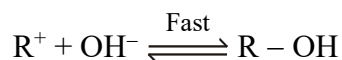
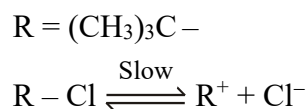
**Q.12** Half life cycle of an order of reaction is inversely proportional to initial concentration raised to the power one less than order of reaction. For which of the following half-life of an order of reaction is inversely proportional to the initial concentration of reactants?

- A) Zero order                      C) 2<sup>nd</sup> order  
B) 1<sup>st</sup> order                        D) 3<sup>rd</sup> order

**Q.13** If the reaction  $P + Q \longrightarrow R + S$  is described as being of zero order w.r.t to P. It means that:

- A) P is a catalyst in this reaction  
B) P molecules do not possess sufficient energy to react  
C) The rate of reaction is independent of conc. of Q  
D) The rate of reaction is independent of conc. of P

**Q.14** The hydrolysis of  $(CH_3)_3CCl$  by  $OH^-$  ion proceed in two steps:



Which of the following rate equation is consistent with this mechanism of reaction?

- A) rate =  $k[RCI]^2$                       C) rate =  $k[RCI][OH^{-1}]$   
B) rate =  $k[RCI][OH^{-}]^2$                 D) rate =  $k[RCI]$

**Q.15** Which one of the following correctly represents the units of the rate constant k for a first order reaction?

- A)  $s^{-1}$                                       C)  $mol\ dm^{-3}s$   
B)  $mol.dm^{-3}s^{-1}$                         D)  $mol^{-1}dm^3s$

**Q.16** If rate of reaction decay of a radioactive isotope decreases from 200 counts per minutes to 25 counts per minute after 24 hours. What is half life?

- A) 3 hours                                C) 4 hours  
B) 6 hours                                D) 8 hours

**Q.17** Consider the general reaction  $nA \longrightarrow \text{Product}$ . The rate of equation for a reaction is given by rate of reaction =  $k[A]^n$ . If the value of  $n = 2$ . Then the unit of k for the 2<sup>nd</sup> order of reaction is:

- A)  $mol\ dm^{-3}s^{-1}$                       C)  $mol^{-1}dm^3s^{-1}$   
B)  $mol^{-2}dm^6s^{-1}$                     D)  $mol^{-1}s^{-1}$

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Q.18 For the gaseous reaction  $2X + Y \rightarrow X$ .

$$\text{rate} = k[X]^2[Y]^0$$

If the pressure in the reaction vessel is doubled but temperature remains constant. By what factor does the rate of reaction increases?

- A) 2  
B) 8  
C) 3  
D) 4

Q.19 A radioactive element has two isotopes, "G" and "H", with half lives of 5 min and 15 min respectively. An experiment starts with 4 times as many atoms of "G" as of "H". Radioactive decay is a first order reaction. How long will it be before the number of atoms of "G" left equal the number of atoms of "H" left?

- A) 5 min  
B) 10 min  
C) 15 min  
D) 20 min

Q.20 The half-life of any order of reaction is inversely proportional to the initial concentration, (a) raised to the power one less than the order of reaction:

$$\left(t_{1/2}\right)_n \propto \frac{1}{a^{n-1}}$$

Which of the following mathematical expression is true for the half-life period of zero order reaction?

- A)  $\left(t_{1/2}\right)_0 \propto a^0$   
B)  $\left(t_{1/2}\right)_2 \propto \frac{1}{a^1}$   
C)  $\left(t_{1/2}\right)_3 \propto \frac{1}{a^3}$   
D)  $\left(t_{1/2}\right)_1 \propto \frac{1}{a^2}$

Q.21 All of the following are characteristic features of catalyst EXCEPT:

- A) It speeds up a chemical reaction  
B) It is used in smaller amount  
C) It can initiate a chemical reaction  
D) Enthalpy change of a catalyzed and uncatalyzed reaction is not same

Q.22 In some of the reactions, a product formed acts as a catalyst, this phenomenon is called:

- A) Autocatalysis  
B) Enzyme Catalysis  
C) Negative catalysis  
D) Poisoning of a catalyst

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**Q.23 Identify the incorrect statement about enzyme catalysis:**

- A) It is highly specific in action
- B) Its activity is increased by the presence of activator
- C) It shows maximum rate of reaction at minimum temperature
- D) Its catalytic activity is inhibited by a poison

**Q.24 A solution A of concentration  $0.10 \text{ mol dm}^{-3}$  undergoes first order reaction at an initial rate of  $5.0 \times 10^{-4} \text{ mol dm}^{-3} \text{ s}^{-1}$ . The value of rate constant for this reaction is:**

- A)  $2 \times 10^{-3} \text{ s}^{-1}$
- B)  $3 \times 10^{-3} \text{ s}^{-1}$
- C)  $4 \times 10^{-3} \text{ s}^{-1}$
- D)  $5 \times 10^{-3} \text{ s}^{-1}$

**Q.25 Which of the following is an example of first order reaction?**

- A)  $2\text{N}_2\text{O}_{5(g)} \longrightarrow 2\text{N}_2\text{O}_{4(g)} + \text{O}_{2(g)}$
- B)  $2\text{FeCl}_{3(aq)} + 6\text{KI}_{(aq)} \longrightarrow 2\text{FeI}_{2(aq)} + 6\text{KCl}_{(aq)}$
- C)  $\text{NO}_{(g)} + \text{O}_{3(g)} \longrightarrow \text{NO}_{2(g)} + \text{O}_{2(g)}$
- D)  $\text{CHCl}_{3(l)} + \text{Cl}_{2(g)} \longrightarrow \text{CCl}_{4(l)} + \text{HCl}_{(g)}$

**Q.26 The reaction which takes place among the molecules when they have:**

- A) Activation energy
- B) Properly oriented
- C) Activation energy and proper orientation
- D) Concentrated

**Q.27 All of the following statements are correct for rate of reaction and specific rate constant EXCEPT:**

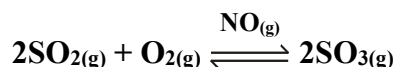
Opt.	Rate of reaction	Specific rate constant
A)	Change in concentration of reactant or product per unit time is called rate of reaction	It is equal to rate of reaction when molar concentration of reactants are taken as unity
B)	$\text{Rate} = \frac{\Delta C}{\Delta t}$	$k =$ proportionality constant
C)	Its unit is $\text{mol dm}^{-3} \text{ s}^{-2}$	Its unit does not depend on order of reaction
D)	Its value changes with the passage of time	Its value remains constant under given conditions

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Q.28 Mark the incorrect statement about molecularity and order of reaction:

Opt.	Molecularity	Order of reaction
A)	It is number of molecules involved in the balanced equation	It is sum of exponents of molar concentration of reactants as given in the rate equation
B)	It is theoretical value	It is experimental value
C)	Molecularity is $\geq 3$	Order of reaction can be 1, 2 or 3
D)	It can have zero value	It cannot have small integral, half integral and zero value

Q.29 Choose the type of catalysis in the following reaction:



- A) Homogeneous catalysis    C) Biological catalysis  
B) Heterogeneous catalysis    D) Gas catalysis

Q.30 Which of the following physical methods is used to determine rate of reaction when rate of reaction depends on the rate of change in the concentration of reacting ions or ions are formed during the reaction?

- A) Electrical conductivity method  
B) Dilatometric method  
C) Refractometric method  
D) Optical rotation method

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**ANSWER KEY (Worksheet-18)**

1	B	11	A	21	D
2	D	12	C	22	A
3	C	13	D	23	C
4	B	14	D	24	D
5	D	15	A	25	A
6	C	16	D	26	C
7	B	17	C	27	C
8	D	18	D	28	D
9	A	19	C	29	A
10	C	20	A	30	A

**ANSWERS EXPLAINED**

**Q.1 (B)** The frequency with which the molecules collide depends upon their concentrations of reactants. The more crowded the molecules are, the more likely they are to collide and react with one another. So as the reaction proceeds collision frequency of the molecules decreases, and thus the rate of reaction decreases.

**Q.2 (D)** It can be explained by Collision Theory such as: For a reaction to take place, the colliding particles must have energy equal to or greater than  $E_a$ . since there are more particles with energy greater than  $E_a$  with the increase of  $10^\circ\text{C}$ , the frequency of effective collisions with sufficient energy also increases. Hence, the rate of reaction doubles (Arrhenius equation  $k = Ae^{-E_a/RT}$  proves it) with the increase of  $10^\circ\text{C}$  temperature.

**Q.3 (C)** In fact,  $E_a$  is inversely proportional to  $K$ .

- Smaller is  $E_a$  value, greater is  $K$  value, faster is the rate of reaction.

**Q.4 (B)** For general reaction  $nA \longrightarrow \text{Product}$   
 $\therefore$  rate of reaction =  $k[A]^n$ . For zero order reaction  $[A] = 1$ ,  $n = 0$ .

Rate of reaction =  $k \therefore k = \text{rate of reaction} = \text{mol dm}^{-3}\text{s}^{-1}$

**Conclusion:** For zero order reaction unit of  $k = \text{rate of reaction} = \text{mol dm}^{-3}\text{s}^{-1}$

**Q.5 (D)** Order of reaction may or may not equal to molecularity.

**Q.6 (C)**  $(t_{1/2})_n \propto \frac{1}{a^{n-1}}$

$\Rightarrow$  For 1<sup>st</sup> order reaction  $n = 1$

•  $(t_{1/2})^1 \propto \frac{1}{a^{1-1}} \Rightarrow (t_{1/2}) \propto \frac{1}{a^0} \Rightarrow$

independent of initial concentration

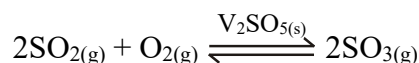
**Q.7 (B)** Molecularity is associated with balanced equation but it has no concern with rate of reaction.

**Q.8 (D)** Addition of catalyst decreases  $E_a$  by changing mechanism of reaction.

**Q.9 (A)** The experimental relationship between rate of reaction and concentration of reactant is called rate law.

**Q.10 (C)** The only factor which affects the value of specific rate constant is temperature.

**Q.11 (A)** In heterogeneous catalysis reactant and catalyst are not in the same phase as shown in the reaction.



**Q.12 (C)**  $(t_{1/2})_2 \propto \frac{1}{a^{2-1}} \Rightarrow (t_{1/2})_2 \propto \frac{1}{a^1}$

$\therefore$  Half-life of second order reaction is inversely proportional to initial concentration for second order reaction.

**Q.13 (D)** Zero order with respect to a reactant means that the rate of reaction is independent of the concentration of the reactant i.e. a change in concentration of  $P$  has no effect on the rate of the reaction.

**Q.14 (D)** Since rate of reaction is always determined from the slow step, and in the given reaction only one molecule  $\text{RCl}$  takes part. It means that rate of

reaction depends on concentration of RCl only.

- Q.15 (A) For general reaction  $nA \longrightarrow \text{Product}$   
A rate of reaction =  $k[A]^1$ . For 1<sup>st</sup> order reaction

$$n = 1, \text{ rate of reaction} = kA$$
$$\therefore k = \frac{\text{rate of reaction}}{[A]}$$

$$= \frac{\text{mol dm}^{-3} \text{s}^{-1}}{\text{mol dm}^{-3}} = \text{s}^{-1}$$

$$\therefore \text{unit of } k \text{ for first order reaction} = \text{s}^{-1}$$

- Q.16 (D)  $200 \xrightarrow{t_{1/2}} 100 \xrightarrow{t_{1/2}} 50 \xrightarrow{t_{1/2}} 25$

$$\text{Hence, } 3 \times t_{1/2} = 24$$

$$t_{1/2} = 8 \text{ hrs}$$

**Conclusion the half-life of decay of a radioactive isotope = 8 hrs**

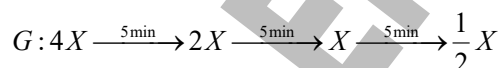
- Q.17 (C) For general reaction  $nA \longrightarrow \text{Product}$   
 $\therefore$  rate of reaction =  $k[A]^n$ . For 2<sup>nd</sup> order reaction

$$n = 2, k = \text{dm}^3 \text{mol}^{-1} \text{s}^{-1}$$

- Q.18 (D) When the pressure is doubled (e.g. by having the volume), [X] and [Y] are doubled. Since the reaction is second order with respect to X, therefore, the rate increases by 4 times.

- Q.19 (C) Let the number of atoms in G and H be 4X and X respectively.

**Solution:**



- Q.20 (A) Mathematical expression for the half-life period of zero order reaction is  $\left(t_{1/2}\right)_0 \propto a$ .

- Q.21 (D) In fact, enthalpy change of a catalyzed and uncatalyzed reaction is same.

- Q.22 (A) In some of the reactions, a product formed acts as a catalyst, this phenomenon is called autocatalysis.

e.g. the reaction of oxalic acid with acidified  $\text{KMnO}_4$  is slow at the beginning, but after sometimes,  $\text{MnSO}_4$  produced in the reaction makes it faster, so the product  $\text{MnSO}_4$  act as a autocatalysis.

- Q.23 (C) It shows maximum rates of reaction at an optimum temperature.

- Q.24 (D) **Solution:**

Given data:

$$\text{Initial rate of reaction} = 5 \times 10^{-4} \text{ mol dm}^{-3} \text{s}^{-1}$$

$$\text{Concentration of A substance} = 0.10 \text{ mol dm}^{-3}$$

$$\text{Initial rate} = k[A] =$$

$$k = \frac{\text{Rate of reaction}}{A} = \frac{5 \times 10^{-4}}{0.10} = 5 \times 10^{-3} \text{ s}^{-1}$$

- Q.25 (A)  $2\text{N}_2\text{O}_{5(g)} \longrightarrow 2\text{N}_2\text{O}_{4(g)} + \text{O}_{2(g)}$  is an example of first order reaction.

- Q.26 (C) The reaction takes place among the molecules of reactants when they have required activation energy and proper orientation.

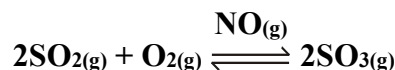
- Q.27 (C) It is incorrect statement. In fact, the correct statement is given in the tabular form:

C)	Its unit is $\text{mol}^1 \text{dm}^{-3} \text{s}^{-1}$	Its unit depends on order of reaction
----	---	---------------------------------------

- Q.28 (D) It is incorrect statement. In fact, the correct statement is given in the tabular form:

Opt.	Molecularity	Order of reaction
D)	It cannot have zero value	It cannot have integral fractional and zero value

- Q.29 (A) A type of reaction in which reactants and catalyst are in the same phase is called homogenous catalysis. The reaction below is an example of homogenous catalysis.



**Q.30 (A)** Electrical conductivity is a physical method which is used to determine rate of reaction when rate of reaction depends on the rate of change in the concentration of reacting ions or ions are formed during the reaction.

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Q.62 Answer is “Bacteria have been used”

*Explanation:* Bacteria have been used for such purposes.

Q.63 Answer is “Gene therapy”

*Explanation:* Researchers may use one of the several approaches for correcting faulty genes. Gene therapy is the most common approach.

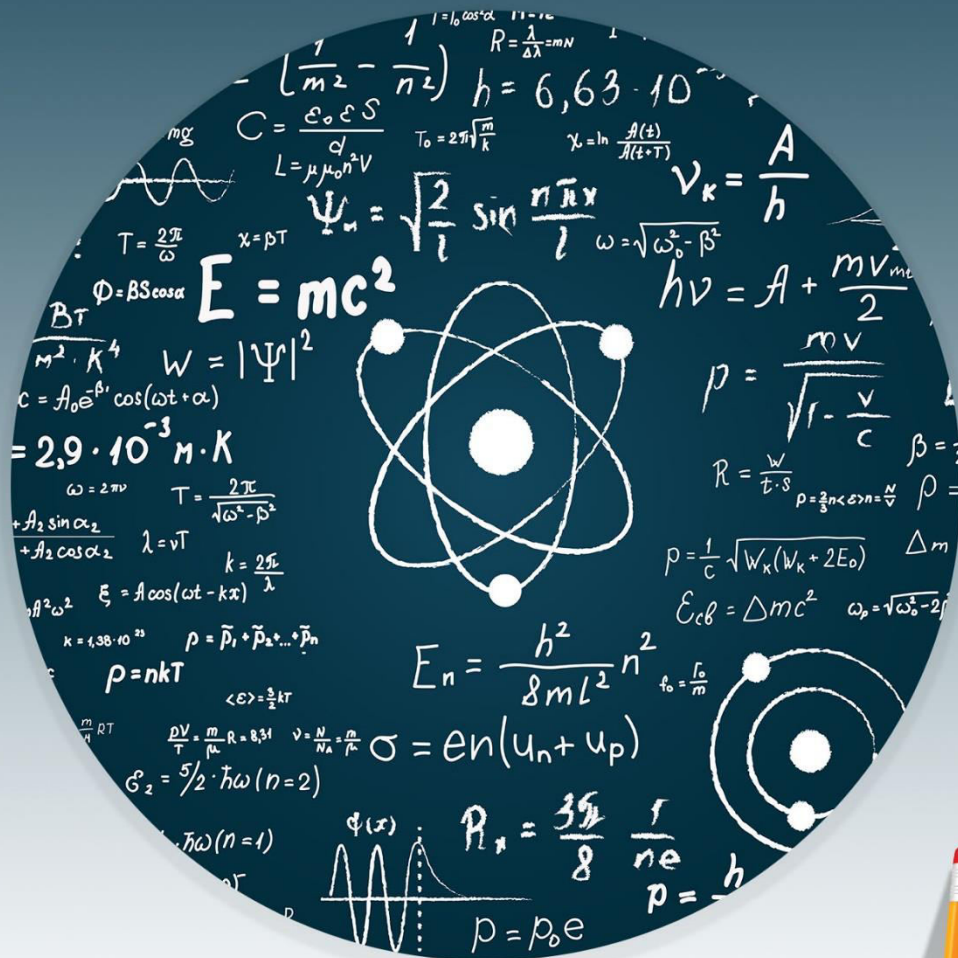
Q.64 Answer is “Polymerase chain reaction”

*Explanation:* In this technique DNA polymerase is compelled to polymerize a given piece of DNA again and again, So that multiple copies are produced, thus the technique is known as polymerase chain reaction (PCR).

STEP ENTRY TEST 2020



# PHYSICS



WORKSHEETS 1-18



**STP**

## Worksheet-1

**Topics:-** Coulomb's Law, Electric Field Strength, Electric Potential & Potential Gradient, Electric and Gravitational Force, Capacitors & Energy Stored in Capacitor

**Q.1** For a capacitor the charge per unit volt is called:

- A) Charge density                      C) Capacitance  
B) Charge per unit volume       D) None of these

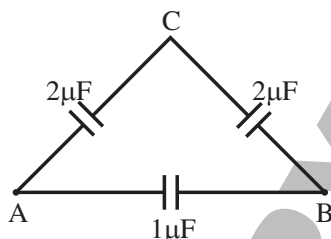
**Q.2** Farad is unit of:

- A) Charge                                  C) Current  
B) Potential                               D) Capacitance

**Q.3** A capacitor is a perfect insulator for:

- A) A.C                                       C) Both "A" and "B"  
B) Pure D.C                               D) Pulsating D.C

**Q.4** What is the effective capacitance between A and B?



- A)  $2\mu\text{F}$                                       C)  $1.0\mu\text{F}$   
B)  $1.5\mu\text{F}$                                  D)  $0.5\mu\text{F}$

**Q.5** The Coulomb's law is:

$$\vec{F} = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{r^2} \hat{r}$$

The units of " $\epsilon_0$ " are:

- A)  $\text{N m}^{-2} \text{C}^{-2}$                               C)  $\text{N}^{-1} \text{m}^{-2} \text{C}^2$   
B)  $\text{N m}^{-2} \text{C}^2$                                D) None of these

**Q.6** A  $50\mu\text{F}$  capacitor has a potential difference of 8 volts across it, The charge on the capacitor will be:

- A)  $4 \times 10^{-4} \text{ C}$                               C)  $4 \times 10^4 \text{ C}$   
B)  $4 \times 10^{-3} \text{ C}$                               D)  $4 \times 10^3 \text{ C}$

**Q.7** Three capacitors of capacitance  $3\mu\text{F}$  each are connected in parallel the equivalent capacitance will be:

- A)  $9\mu\text{F}$                                         C)  $27\mu\text{F}$

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B)  $\frac{1}{3} \mu F$

D)  $2 \mu F$

**Q.8** If  $6 \mu F$ ,  $4 \mu F$  and  $2 \mu F$  capacitors are connected in series the equivalent capacitance is given by:

A)  $\frac{12}{11} \mu F$

C)  $\frac{6}{11} \mu F$

B)  $\frac{11}{12} \mu F$

D)  $\frac{11}{6} \mu F$

**Q.9** The study of charges at rest under the action of electric forces is called:

A) Electromagnetics

C) Electricity

B) Electrostatics

D) None of these

**Q.10** The existence of an object is primarily because of:

A) Magnetic force

C) Gravitational force

B) Electric force

D) Nuclear force

**Q.11** Which one is sure test for the presence of charge on a body?

A) Attraction

C) Both A and B

B) Repulsion

D) None of these

**Q.12** Coulomb's force:

A) Obeys inverse square law

B) Depends on magnitudes of charges

C) Depends on medium between charges

D) All of these

**Q.13** A charge  $q$  is divided into two parts ' $q_1$  and  $(q - q_1)$ '. What is the ratio  $\frac{q}{q_1}$  so that force between the two parts placed at a given distance is maximum?

A) 1:1

C) 1:2

B) 2:1

D) 1:4

**Q.14** The ratio of the force between two charges in vacuum to that the force between two same charges when a medium is placed between them is:

A)  $\epsilon_r:1$ C)  $\epsilon_o:1$ B)  $1:\epsilon_r$ D)  $1:\epsilon_o$ 

**Q.15** The ratio of electric force to electric field strength gives the units of:

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- A) Current  
B) Charge  
C) Time  
D) None of these

**Q.16** The work done in carrying a unit positive charge from one point to other in electric field keeping the charge in equilibrium is called:

- A) Electric potential energy  
B) Electric potential difference  
C) Electric field strength  
D) None of these

**Q.17** An ECG records \_\_\_\_\_ between points on human skin.

- A) Current  
B) Charge  
C) Voltage  
D) Electric field

**Q.18** Which statement is true for two oppositely charged metal plates?

- A) Electric field is constant between plates  
B) Potential difference is constant between plates  
C) Electric potential is zero at mid-point of plates  
D) All of these

**Q.19** If a charge of 5 C is moved against an electric field of  $10 \text{ N C}^{-1}$  through a distance of 5 m, the P.E gained by charge is:

- A) 25 J  
B) 200 J  
C) 2 J  
D) 250 J

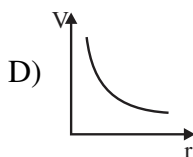
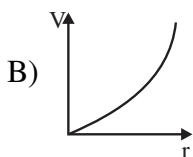
**Q.20** Two point charges each of magnitude “q” and opposite sign are separated by distance “2d”. Which one of following statement is true?

- A) Electric Potential at midpoint of charges is zero  
B) Electric field at midpoint of charges is not zero  
C) Potential difference (due to electric potentials of both charges) at midpoint is not zero  
D) All of these

**Q.21** The graph which correctly describes the relation between electric potential “V” at a point due to point charge and distance “r” from point charge is:



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**Q.22** If the magnitude of a point charge is doubled and distance of a point from point charge is halved, then electric potential and electric field at that point becomes:

- A) Two times each
- B) Two times & four times
- C) Four times & Eight times
- D) None of these

**Q.23** A particle carrying a charge of  $10e$  falls through a potential difference of  $5\text{ V}$ , the energy gained by it is:

- A)  $50\text{ eV}$
- B)  $5\text{ eV}$
- C)  $3.2 \times 10^{-18}\text{ J}$
- D) Both A and C

**Q.24** If a positive charge is brought near the positive plate of a capacitor, its P.E will:

- A) Increase
- B) Decrease
- C) Remain same
- D) None of these

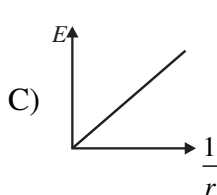
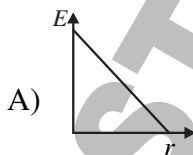
**Q.25** If a charge of  $+10\text{ C}$  is stored on either the plate of a parallel plate capacitor of capacitance  $5\text{ }\mu\text{F}$ . Then energy stored in the capacitor in mega Joules is:

- A) 10
- B) 15
- C) 20
- D) 5

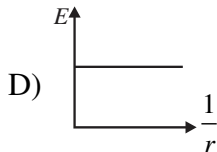
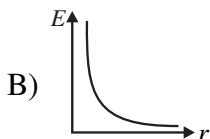
**Q.26** The coulomb's force between two charges " $q_1 = 2\text{ }\mu\text{C}$ " and " $q_2$ " is  $2\text{ N}$ . The distance between them is  $3\text{ m}$ , what is the charge  $q_2$ ?

- A)  $1 \times 10^0\text{ C}$
- B)  $1 \times 10^{-3}\text{ C}$
- C)  $2 \times 10^{-2}\text{ C}$
- D)  $4 \times 10^{-2}\text{ C}$

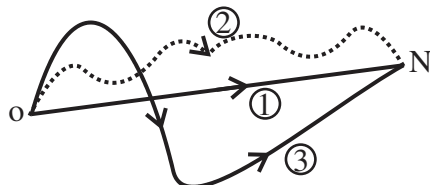
**Q.27** While moving from positive plate of a charged capacitor towards its negative plate, the electric field " $E$ " varies with distance covered " $r$ " as:



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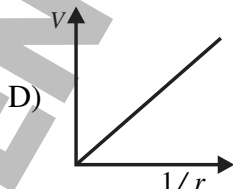
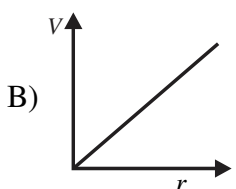
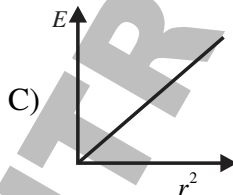
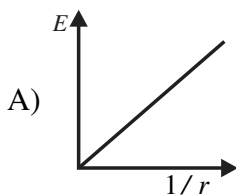
- Q.28 In the region of an electric field a charge is moved from "O" to "N" via three different paths  $W_1$ ,  $W_2$  and  $W_3$  denote the work done along three paths. Then:



- A)  $W_1 < W_2 < W_3$   
B)  $W_1 > W_2 > W_3$   
C)  $W_1 = W_2 > W_3$   
D)  $W_1 = W_2 = W_3$
- Q.29 The electric field strength between two oppositely charged parallel plates is  $E$ . If the distance between the plates is halved and potential difference is doubled, then the electric field strength becomes:

- A)  $E$   
B)  $2E$   
C)  $4E$   
D)  $8E$

- Q.30 Which of the following is correct graph for a point charge?



- Q.31 Five identical capacitors connected in series have an equivalent capacitance of  $4 \mu\text{F}$ . If all of them are now connected in parallel across a  $400 \text{ V}$  source, the total energy stored in them will be:

- A)  $2 \text{ J}$   
B)  $4 \text{ J}$   
C)  $6 \text{ J}$   
D)  $8 \text{ J}$

- Q.32 How three capacitors of  $2 \mu\text{F}$  each be connected to have an equivalent capacitance of  $3 \mu\text{F}$ ?

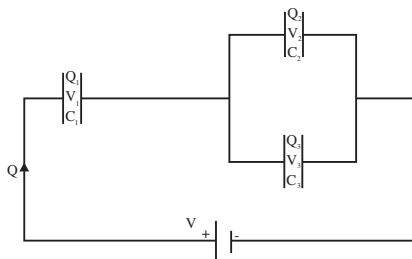
- A) All the capacitors should be connected in series  
B) All the capacitors should be connected in parallel

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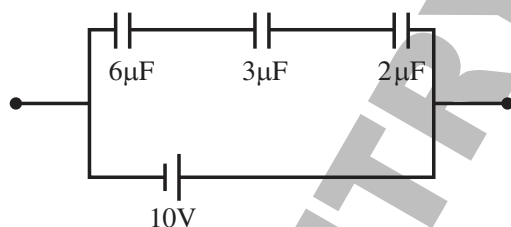
- C) Two capacitors in series and one is parallel across their series combination  
D) Two capacitors in parallel and one is in series with their parallel combination

**Q.33** In the diagram below are shown three capacitors  $C_1$ ,  $C_2$ ,  $C_3$  joined to a battery. With symbols having their usual meanings, the correct conditions will be:



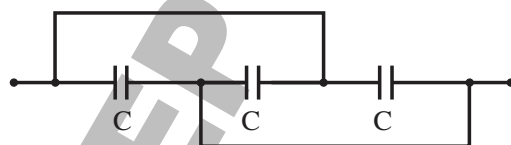
- A)  $Q_1=Q_2=Q_3$  and  $V_1=V_2=V_3=V$   
B)  $Q_1=Q_2+Q_3$  and  $V=V_1+V_2+V_3$   
C)  $Q_1=Q_2+Q_3$  and  $V=V_1+V_2$   
D)  $Q_2=Q_3$  and  $V_2=V_3$

**Q.34** In figure below, the charge on  $3\ \mu\text{F}$  capacitor is:



- A)  $3\ \mu\text{C}$   
B)  $5\ \mu\text{C}$   
C)  $10\ \mu\text{C}$   
D) Zero

**Q.35** What is the equivalent capacitance of the combination shown:



- A)  $3C$   
B)  $C$   
C)  $\frac{C}{2}$   
D)  $\frac{C}{3}$

**Q.36** Which of the following is similarity between electric and

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gravitational force?

- A) Both are Conservative forces
- B) Both are long range forces
- C) Both obey inverse square law
- D) All of these

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**ANSWER KEY (Worksheet-1)**

1	C	11	B	21	D	31	D
2	D	12	D	22	C	32	C
3	B	13	B	23	A	33	C
4	A	14	A	24	A	34	C
5	C	15	B	25	A	35	A
6	A	16	B	26	B	36	D
7	A	17	C	27	D		
8	A	18	D	28	D		
9	B	19	D	29	C		
10	B	20	D	30	D		

**SOLUTIONS****Unit – 9 (WS-1)****Q.1** Answer is “C”

**Solution:-**  $Q = CV \Rightarrow C = \frac{Q}{V}$

$$1 \text{ farad} = \frac{1 \text{ coulomb}}{1 \text{ volt}}$$

**Q.2** Answer is “D”

**Solution:-** Capacitance of capacitor has the unit “Farad” which is defined as:

$$1 \text{ farad} = \frac{1 \text{ coulomb}}{1 \text{ volt}}$$

**Q.3** Answer is “B”

**Solution:-** Capacitor has infinite reactance for pure D.C. i.e.  $X_c = \frac{1}{2\pi fC}$

As  $f_{D.C} = 0$ , so  $\Rightarrow X_c = \infty$

**Q.4** Answer is “A”**Solution:-**

The equivalent capacitance between A and B is:

$$C_{AB} = \left( \frac{2 \times 2}{2 + 2} \right) + 1 = 2 \mu F$$

**Q.5** Answer is “C”

**Solution:-** The units of “ $\epsilon_0$ ” are reciprocal of the units of “k”.

**Q.6** Answer is “A”

**Solution:-**  $Q = CV$

**Q.7** Answer is “A”

**Solution:-**  $C_e = nC$

**Q.8** Answer is “A”

**Solution:-**  $\frac{1}{C_e} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$

**Q.9** Answer is “B”

**Solution:-** “The study of charges at rest under the action of the electric force is named as electrostatics”.

**Q.10** Answer is “B”

**Solution:-** Matter is composed of atoms and existence of atom is primarily due to electric forces present in it.

**Q.11** Answer is “B”

**Solution:-** If a test charge is brought near an object (about which we are going to find whether it is charged or not) and test charge is attracted towards it, this leads to two possibilities:

- That object is oppositely charged
- That object is neutral but because of Electrostatic Induction it shows attraction for test charge.

Hence, attraction is not a sure test to find whether an object is charged or not.

**Q.12** Answer is “D”

**Solution:-** Coulomb’s law is given as

$$F = \frac{1}{4\pi\epsilon_0\epsilon_r} \frac{q_1q_2}{r^2}$$

$$F \propto q_1q_2, \quad F \propto \frac{1}{r^2}, \quad F \propto \frac{1}{\epsilon_r}$$

**Q.13 Answer is “B”**

**Solution:-** If the charge  $q$  is divided into equal parts, the product of these parts and electric force between them will be maximum. i.e  $\Rightarrow q_1 = q - q_1$

**Q.14 Answer is “A”**

**Solution:-** The Coulomb's force in case of vacuum and medium is given as:

$$F_{\text{vac}} = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{r^2}; F_{\text{med}} = \frac{1}{4\pi\epsilon_0 \epsilon_r} \frac{q_1 q_2}{r^2}$$

Taking ratio

$$\frac{F_{\text{vac}}}{F_{\text{med}}} = \epsilon_r$$

**Q.15 Answer is “B”**

**Solution:-** Electric field strength is defined as:

$$E = \frac{F}{q} \Rightarrow \frac{F}{E} = q = \text{coulomb}$$

**Q.16 Answer is “B”**

**Solution:-** Electric potential difference is defined as:

$$\Delta V = \frac{W_{AB}}{q_0}$$

**Q.17 Answer is “C”**

**Solution:-** ECG records electric voltage and display it on graph.

**Q.18 Answer is “D”**

**Solution:-** Between two oppositely charged metal plates:

i.  $E = -\frac{\Delta V}{\Delta r} = \text{constant}$

ii.  $\Delta V = -E\Delta r = \text{constant}$

iii.  $V_{\text{mid}} = V_+ + V_- = \frac{kq}{r} - \frac{kq}{r} = 0$

**Q.19 Answer is “D”**

**Solution:-**  $\Delta V = \frac{\Delta U}{q} \dots\dots (i)$

Also  $\Delta V = E\Delta r \dots\dots (ii)$

Compare (i) and (ii) and solve for P.E.

**Q.20 Answer is “D”**

**Solution:-**

i.  $V_{\text{mid}} = V_+ + V_- = \left(\frac{kq}{d}\right) + \left(\frac{k(-q)}{d}\right) = 0$

ii.  $\vec{E}_{\text{mid}} = \vec{E}_+ + \vec{E}_- \neq 0$

iii.  $\Delta V = V_+ - V_- = \left(\frac{kq}{d}\right) - \left(\frac{k(-q)}{d}\right) \neq 0$

**Q.21 Answer is “D”**

**Solution:-**  $V \propto \frac{1}{r}$

**Q.22 Answer is “C”**

**Solution:-**  $E = \frac{kq}{r^2}, V = \frac{kq}{r}$

**Q.23 Answer is “A”**

**Solution:-**  $K.E = Q\Delta V$

**Q.24 Answer is “A”**

**Solution:-** If a charge is moved against the coulomb force, then P.E increases and vice versa.

**Q.25 Answer is “A”**

**Solution:-** Energy stored is given as:

$$E = \frac{1}{2} \frac{Q^2}{C}$$

**Q.26 Answer is “B”**

**Solution:-** Use Coulomb's law;

$$F = k \frac{q_1 q_2}{r_2} \Rightarrow q_2 = \frac{Fr^2}{kq_1}$$

Put the values and solve for  $q_2$ .

**Q.27** Answer is “D”

**Solution:-** Electric field between capacitor plates is constant at every point. So, graph of electric field strength will be a horizontal straight line whether it is plotted against “r” or “1/r”.

**Q.28** Answer is “D”

**Solution:-** Electric field just like gravitational field is conservative so, work done is independent of path followed.

**Q.29** Answer is “C”

**Solution:-** Electric field strength is given as

$$E = \frac{\Delta V}{\Delta r}$$

If  $\Delta V' = 2\Delta V$  and  $\Delta r' = \frac{1}{2}\Delta r$  then

$$E' = \frac{2\Delta V}{\frac{1}{2}\Delta r} = 4 \frac{\Delta V}{\Delta r}$$

$$E' = 4E$$

**Q.30** Answer is “D”

**Solution:-**  $V = \frac{kq}{r} \Rightarrow V \propto \frac{1}{r}$

**Q.31** Answer is “D”

**Solution:-** Series Equivalent

$$C_{s,e} = \frac{C}{n} = \frac{C}{5} = 4 \mu F$$

$$C = 20 \mu F$$

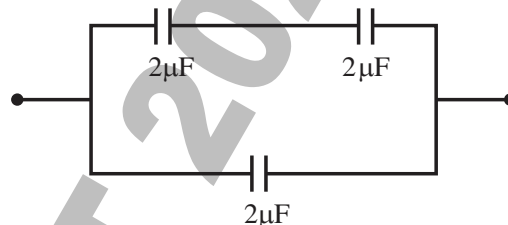
Now if these five capacitors each of capacitance  $20 \mu F$  are connected in parallel across 400 V source, then

$$C_{p,e} = nC = 5C = 100 \mu F$$

$$\text{Energy stored} = \frac{1}{2} C_{p,e} V^2$$

**Q.32** Answer is “C”

**Solution:-**



$$C_e = \left( \frac{2 \times 2}{2 + 2} \right) + 2 = 3 \mu F$$

**Q.33** Answer is “C”

**Solution:-** In series charge is same and in parallel combination the voltage is same.

**Q.34** Answer is “C”

**Solution:-** In series combination;

$$\text{i. } Q_{6\mu F} = Q_{3\mu F} = Q_{2\mu F} = C_e V$$

$$\text{ii. } \frac{1}{C_e} = \frac{1}{6} + \frac{1}{3} + \frac{1}{2}$$

Find  $C_e$  from (ii) and put in (i) to find Q.

**Q.35** Answer is “A”

**Solution:-** All capacitors are in parallel, so their parallel equivalent is given as:

$$C_e = nC = 3C$$

**Q.36** Answer is “D”

**Solution:-** Read properties of electric and gravitational forces.

**Worksheet-02**

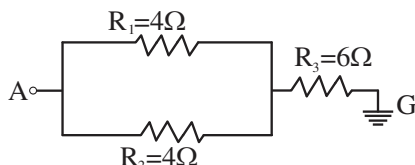
**Topics:- Current, Ohm's Law, Combination of Resistors, Resistivity, Potential Difference & e.m.f, Power Dissipation, Kirchhoff's Rules, Potentiometer**

- Q.1** The graphical representation of ohm's law is:  
A) Hyperbola C) Parabola  
B) Ellipse D) Straight Line
- Q.2** ohm is defined as:  
A) volt / ampere C) ampere / volt  
B) volt / coulomb D) joule / coulomb
- Q.3** The resistance of a meter cube of the substance is called:  
A) Resistivity C) Permittivity  
B) Conductivity D) None of these
- Q.4** The S.I unit of resistivity is:  
A) ohm-m C) ohm-m<sup>3</sup>  
B) ohm-m<sup>2</sup> D) ohm-cm
- Q.5** When the resistances are connected in series the equivalent resistance is equal to?  
A) Sum of the reciprocal of the individual resistances  
B) Sum of individual resistances  
C) Product of the individual resistances  
D) Can't be predicted
- Q.6** The potential difference across resistances in series combination is:  
A) Always same C) May be same or different  
B) Always different D) None of these
- Q.7** Three resistances 500 ohm, 350 ohm and 500 ohm are connected in series the equivalent resistance will be:  
A) 1300  $\Omega$  C) 650  $\Omega$   
B) 1350  $\Omega$  D) 1400  $\Omega$
- Q.8** The resistance of a 60 watt bulb in a 120 volt line is:  
A) 240  $\Omega$  C) 60  $\Omega$   
B) 220  $\Omega$  D) 200  $\Omega$

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### 0.9 In the circuit shown



**If voltage applied at A is 20 V then what would be the resultant current passing through  $R_3$ .**

- A) 4 A                      C) 2.5 A  
B) 6 A                      D) 10 A

**Q.10** If a battery of 9 V is connected across 2.0  $\Omega$  resistance, then what would be the resultant current?

- A) 4.0 A                      C) 3.5 A  
B) 4.5 A                      D) 5.0 A

**Q.11** How many different resistances are possible with two equal resistors?

- A) 2                      C) 4  
B) 3                      D) 5

**Q.12** Internal resistance of the cell is caused due to the:

- A) Static charges  
B) Electrodes  
C) Electrolyte  
D) None of these

**Q.13** A voltmeter directly connected across a battery in a circuit where current is flowing, will measure:

- A) Emf  
B) Terminal potential difference  
C) Internal resistance  
D) None of these

**Q.14 Value of current for ideal short circuit is:**

- A) Zero  
B) Infinity  
C) Both are possible  
D) Non-zero but finite

**Q.15** Value of current is \_\_\_\_\_ for open circuit.

- A) Zero
- B) Infinity
- C) Either A or B
- D) Non-zero but finite

**Q.16** For close circuit (with load applied across battery), the emf  $E$  of battery is related with terminal potential difference  $V_t$  as:

- A)  $E > V_t$                       C)  $E = V_t$   
B)  $E < V_t$                       D) All of these

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Q.17 Kirchhoff's 1<sup>st</sup> rule is in accordance with law of conservation of:

- A) Energy  
B) Momentum  
C) Mass  
D) Charge

Q.18 When the battery is being charged, then emf  $E$  and terminal Potential difference  $V_t$  are related as:

- A)  $E > V_t$   
B)  $E < V_t$   
C)  $E = V_t$   
D) Any of these

Q.19 The potential difference between the terminals of a battery in open circuit is 2.2 V. When it is connected across a resistance of  $5\ \Omega$ , the potential falls to 1.8 V. The current drawn from battery is:

- A) 0.46 A  
B) 0.54 A  
C) 0.26 A  
D) 0.36 A

Q.20 Referring to Q .19, the internal resistance of battery is:

- A)  $3.1\ \Omega$   
B)  $2.1\ \Omega$   
C)  $1.1\ \Omega$   
D)  $0.51\ \Omega$

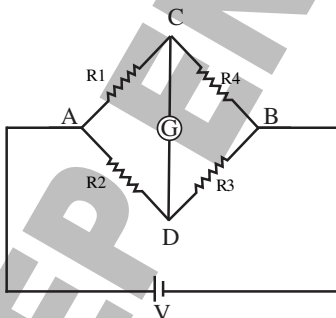
Q.21 In the rules for finding the potential changes, if a resistor is traversed in the direction of current, the change in potential is:

- A) Zero  
B) Negative  
C) Positive  
D) Any of these

Q.22 Kirchhoff's 2<sup>nd</sup> rule is based on:

- A) Energy conservation  
B) Mass conservation  
C) Charge conservation  
D) Momentum conservation

Q.23 In the bridge shown below:



The final expression of balanced bridge is:

- A)  $\frac{R_1}{R_2} = \frac{R_3}{R_4}$   
B)  $\frac{R_1}{R_3} = \frac{R_4}{R_2}$   
C)  $\frac{R_2}{R_4} = \frac{R_1}{R_3}$   
D)  $\frac{R_1}{R_4} = \frac{R_2}{R_3}$

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Q.24 In the bridge circuit shown in Q.23, if  $R_1=R$ ,  $R_2=R$ ,  $R_3=2R$  and  $R_4=2R$ , then the effective Resistance between A and B is:

- A)  $\frac{5R}{2}$  C)  $\frac{3R}{2}$   
B)  $\frac{7R}{2}$  D)  $\frac{4R}{3}$

Q.25 Referring to the values of resistances in Q.24, the effective resistance between C and D is:

- A)  $\frac{5R}{2}$  C)  $\frac{3R}{2}$   
B)  $\frac{7R}{2}$  D)  $\frac{4R}{3}$

Q.26 Referring to the Q.24, the net current through Galvanometer is:

- A) Zero C) Half of maximum  
B) Maximum D) Can't be predicted

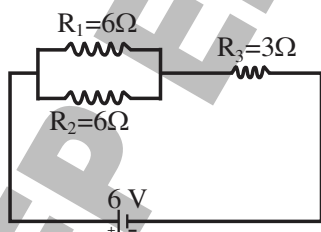
Q.27 Wheatstone bridge is based on Kirchhoff \_\_\_\_\_.

- A) 1<sup>st</sup> C) 3<sup>rd</sup>  
B) 2<sup>nd</sup> D) 4<sup>th</sup>

Q.28 A charge of 90 C passes through a wire in 1 hour and 15 minutes. What is the current in the wire?

- A) 1 mA C) 20 mA  
B) 5 mA D) 10 mA

Q.29 Find the equivalent resistance of the circuit:



- A) 3  $\Omega$  C) 6  $\Omega$   
B) 12  $\Omega$  D) 4  $\Omega$
- Q.30 Referring to Q.29, the total current drawn from source is:
- A) 0.5 A C) 1 A  
B) 2 A D) 0.25 A

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**Q.31** Referring to Q.29, the current passing through  $R_1$  is:

- A) 0.5 A                      C) 1 A  
B) 2 A                        D) 0.25 A

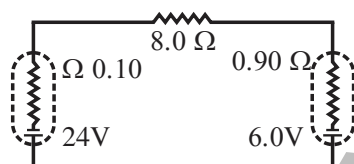
**Q.32** Referring to Q.29, the current passing through  $R_2$  is::

- A) 0.5 A                      C) 1 A  
B) 2 A                        D) 0.25 A

**Q.33** Referring to Q.29, the current passing through  $R_3$  is:

- A) 0.5 A                      C) 1 A  
B) 2 A                        D) 0.25 A

**Q.34** Calculate terminal potential difference of 24 V cell in circuit:



- A) 24.2 V                      C) 24 V  
B) 23.8 V                      D) 22.6 V

**Q.35** Referring to Q.34, Calculate terminal potential difference of 6 V cell in circuit:

- A) 4.2 V                      C) 7.8 V  
B) 5.5 V                      D) 6 V

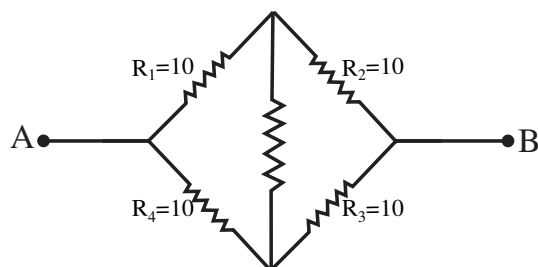
**Q.36**  $2 \times 10^6$  electrons pass through a conductor in 1 ms. Find electric current flowing through conductor:

- A)  $32 \times 10^{-9}$  A                      C)  $3.2 \times 10^{-10}$  A  
B)  $32 \times 10^{-10}$  A                      D)  $0.32 \times 10^{-10}$  A

**Q.37** A carbon resistor is connected to a battery of 50 V and 2 A current is passing through it. If voltage is increases to 75 V, the current will become:

- A) 3 A                          C) 4.5 A  
B) 1.5 A                        D) 6 A

- Q.38 If the resistance of each resistor is 10 ohm in the following figure, then what will be the effective resistance between points 'A' and 'B'?



- A) 40 ohm  
B) 50 ohm  
C) 30 ohm  
D) 10 ohm
- Q.39 The ratio of effective resistances of two identical resistors, first connected in series then in parallel is:
- A) 1:2  
B) 2:1  
C) 4:1  
D) 1:4
- Q.40 A wire carrying electronic current is:
- A) Negatively charged  
B) Positively charged  
C) Electrically neutral  
D) Any of these
- Q.41 To compare two emfs in potentiometer, we use:
- A)  $\frac{E_1}{E_2} = \frac{\ell_2}{\ell_1}$   
B)  $\frac{E_1}{E_2} = \frac{\ell_1}{\ell_2}$   
C)  $\frac{E_1}{E_2} = \frac{r_2}{r_1}$   
D)  $\frac{E_1}{E_2} = \frac{\ell_1 \ell_2}{\ell_1 + \ell_2}$

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ANSWER KEY (Worksheet-02)									
1	D	11	B	21	B	31	A	41	B
2	A	12	C	22	A	32	A		
3	A	13	B	23	D	33	C		
4	A	14	B	24	C	34	B		
5	B	15	A	25	D	35	C		
6	C	16	A	26	A	36	C		
7	B	17	D	27	B	37	A		
8	A	18	B	28	C	38	D		
9	C	19	D	29	C	39	C		
10	B	20	C	30	C	40	C		

**SOLUTIONS****Unit – 9 (WS-02)**

Q.1 Answer is “D”

**Solution:-** Graph of ohm’s law is between “V” and “I”. Since  $V \propto I$ , so, graph is straight line inclined with “V-axis”.

Q.2 Answer is “A”

**Solution:-** By ohm’s law:

$$R = \frac{V}{I}$$

$$1 \text{ ohm} = \frac{1 \text{ volt}}{1 \text{ ampere}}$$

Q.3 Answer is “A”

**Solution:-** Resistivity of material of wire is defined as:

$$\rho = \frac{RA}{L} \quad \rho = \frac{R(1 \text{ m}^2)}{(1 \text{ m})}$$

Q.4 Answer is “A”

**Solution:-** By formula

$$\rho = \frac{RA}{L} = \frac{\Omega \text{ m}^2}{\text{m}} = \Omega \text{ m}$$

Q.5 Answer is “B”

**Solution:-**  $R_e = R_1 + R_2 + R_3 + \dots$

Q.6 Answer is “C”

**Solution:-** If resistances are same then potential is also same, otherwise it is different.

Q.7 Answer is “B”

**Solution:-**  $R_e = R_1 + R_2 + R_3$

Q.8 Answer is “A”

**Solution:-** Use relation:-  $P = \frac{V^2}{R}$

Q.9 Answer is “C”

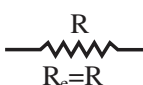
**Solution:-**  $I = \frac{V}{R_e}$


Q.10 Answer is “B”

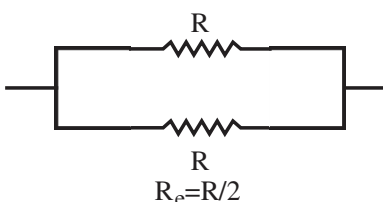
**Solution:-**  $I = \frac{V}{R}$

Q.11 Answer is “B”

**Solution:-** By two resistors of equal value, following different resistances can be obtained:

i. 

ii. 

iii. 

Q.12 Answer is “C”

**Solution:-** Internal resistance is the hindrance which charge carriers feel while passing through electrolyte inside the battery.

Q.13 Answer is “B”



**Solution:-** When current is flowing through circuit, the voltmeter measures terminal potential difference. When current is not flowing, voltmeter reads emf.

**Q.14 Answer is "B"**

**Solution:-** For short circuit

$$R = 0 \Rightarrow I = \infty$$

**Q.15 Answer is "A"**

**Solution:-** For open circuit

$$I = 0 \Rightarrow R = \infty$$

**Q.16 Answer is "A"**

**Solution:-** When battery is being discharged:  $E = V_t + Ir$

**Q.17 Answer is "D"**

**Solution:-** Kirchhoff's first rule is another statement of law of conservation of charge.

**Q.18 Answer is "B"**

**Solution:-** When battery is being charged then

$$E = V_t - Ir$$

**Q.19 Answer is "D"**

**Solution:-**  $V_t = IR \Rightarrow I = \frac{V_t}{R} = \frac{1.8}{5}$

**Q.20 Answer is "C"**

**Solution:-**  $E = V_t + Ir$

**Q.21 Answer is "B"**

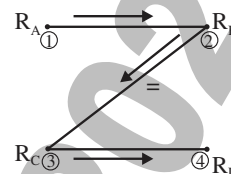
**Solution:-** Read rules for finding potential changes at the end of 2<sup>nd</sup> Kirchhoff's rules.

**Q.22 Answer is "A"**

**Solution:-** Kirchhoff's 2<sup>nd</sup> rule is based on law of conservation of energy.

**Q.23 Answer is "D"**

**Solution:-** Trick:



$$\frac{R_A}{R_B} = \frac{R_C}{R_D}$$

**Q.24 Answer is "C"**

**Solution:-** Ignore Galvanometer while finding Equivalent resistance.

**Q.25 Answer is "D"**

**Solution:-** Ignore Galvanometer while finding Equivalent resistance.

**Q.26 Answer is "A"**

**Solution:-** For balanced Bridge;  $I_g = 0$

**Q.27 Answer is "B"**

**Solution:-**

Principle of Wheat stone Bridge.

**Q.28 Answer is "C"**

**Solution:-**  $I = \frac{Q}{t}$

**Q.29 Answer is "C"**

**Solution:-**  $R_e = (R_1 \parallel R_2) + R_3$

**Q.30 Answer is "C"**

**Solution:-**  $V = I R_e$

**Q.31 Answer is "A"**

**Solution:-**  $I_1 = \left( \frac{R_2}{R_1 + R_2} \right) I$

**Q.32 Answer is "A"**

**Solution:-**  $I_2 = \left( \frac{R_1}{R_1 + R_2} \right) I$

**Q.33 Answer is “C”**

**Solution:-**  $I_3 = I_1 + I_2$

**Q.34 Answer is “B”**

**Solution:-**

**Step-I**

Find net current through circuit

$$I = I_{\text{net}} = \frac{V_{\text{net}}}{R_e} = \frac{24 - 6}{0.1 + 8 + 0.9} = 2 \text{ A}$$

**Step-II**

$$E = V_t + Ir$$

$$V_t = E - I_{\text{net}} r$$

$$V_t = 24 - (2)(0.1) = 23.8 \text{ V}$$

**Q.35 Answer is “C”**

**Solution:-**

**Step-I**

Finding net current through circuit

$$I = I_{\text{net}} = \frac{V_{\text{net}}}{R_e} = \frac{24 - 6}{0.1 + 8 + 0.9} = 2 \text{ A}$$

**Step-II**

When two batteries of different voltages are connected such that their high potential terminals or low potential terminals are combined, then smaller battery gets charged & for smaller battery;

$$E = V_t - Ir$$

$$V_t = E + Ir$$

$$V_t = 6 + (2)(0.9)$$

$$V_t = 7.8 \text{ V}$$

**Q.36 Answer is “C”**

**Solution:-**

Use:

$$I = \frac{Q}{t} = \frac{ne}{t}$$

**Q.37 Answer is “A”**

**Solution:-**

Initially

$$V = IR$$

$$R = \frac{V}{I} = \frac{50}{2} = 25 \Omega$$

After increasing voltage

$$I' = \frac{V'}{R} = \frac{75}{25} = 3 \text{ A}$$

**Q.38 Answer is “D”**

**Solution:-**

$$R_{AB} = (10 + 10) \parallel (10 + 10)$$

**Q.39 Answer is “C”**

**Solution:-**

$$R_s = nR$$

$$R_p = \frac{R}{n}$$

Taking ratio

$$\frac{R_s}{R_p} = \frac{nR}{\frac{R}{n}} = n^2$$

**Q.40 Answer is “C”**

**Solution:-**

Any current carrying object is electrically neutral.

**Q.41 Answer is “B”**

**Solution:-**

To compare two emf we use:

$$\frac{E_1}{E_2} = \frac{\ell_1}{\ell_2}$$


## Worksheet-03

**Topics:- Magnetic Field Due to Current Carrying Straight Wire & Solenoid, Force on a Moving Charge in Magnetic Field & e/m of Electron**

USE THIS SPACE FOR  
SCRATCH WORK

- Q.1** Two parallel beams of positrons moving in the same direction will:
- A) Repel each other
  - B) Will not interact with each other
  - C) Attract each other
  - D) First attract then repel each other
- Q.2** The value of permeability of free space in S.I unit is:
- A)  $4\pi \times 10^7 \text{ Wb A}^{-1} \text{ m}^{-1}$
  - B)  $4\pi \times 10^{-7} \text{ Wb A}^{-1} \text{ m}^{-1}$
  - C)  $4\pi \times 10^{-10} \text{ Wb A}^{-1} \text{ m}^{-1}$
  - D)  $4\pi \times 10^{10} \text{ Wb A}^{-1} \text{ m}^{-1}$
- Q.3** The magnetic field along the axis of solenoid with N turns carrying a current I is given by:
- A)  $B = \mu_o nI$
  - B)  $B = \mu_o NI$
  - C)  $B = \frac{\mu_o n}{I}$
  - D)  $B = \frac{I}{\mu_o N}$
- Q.4** In case of solenoid if it is cut into equal parts then “n” becomes:
- A) Half
  - B) Remains same
  - C) Double
  - D) Quadruple
- Q.5** Generalized form of Ampere’s law is given by:
- A)  $\sum_{r=1}^n (\vec{B} \cdot \vec{\Delta l})_r = I$
  - B)  $\sum_{r=1}^n (\vec{B} \cdot \vec{\Delta l})_r = \mu_o I$
  - C)  $B = \mu_o nI$
  - D)  $B = \mu_o \frac{N}{L} I$
- Q.6** The magnetic induction at a distance r from an infinitely long straight wire, carrying current I, is given by:
- A)  $\frac{\mu_o 2I}{4\pi r}$
  - B)  $\frac{\mu_o r}{4\pi 2I}$
  - C)  $\frac{4\pi 2I}{\mu_o r}$
  - D)  $\frac{4\pi r}{\mu_o 2I}$
- Q.7** If we double all the parameters of force acting on current carrying conductor placed inside uniform magnetic field keeping the conductor perpendicular to field, then magnetic force becomes:
- A) Remains same
  - B) Double
  - C) Eight times
  - D) Four times

USE THIS SPACE FOR  
SCRATCH WORK

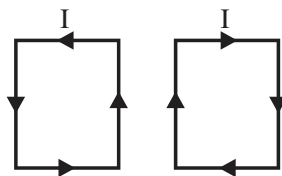
- Q.8** A current carrying solenoid is squeezed to half of its length keeping number of turns same and current constant, How would it changes the magnetic field in it?
- A) Remains same                      C) Becomes half  
B) Becomes double                      D) Becomes four times
- Q.9** According to Amperes Law if current is increased the value of magnetic field will be:
- A) Increased                      C) Remain same  
B) Decreased                      D) May increase or decrease
- Q.10** A magnetic field is applied on an electron at rest then it will:
- A) Start moving                      C) Remain at rest  
B) Start rotating                      D) Start accelerating
- Q.11** A charge particle is projected perpendicular into a region of  $\vec{B}$  such that before entering its  $K.E = 6 \text{ eV}$ , what will be true about it?
- A) It will be in angular dynamic equilibrium  
B) It will be continuously accelerated yet its  $K.E$  will remain same  
C) It will move along a circular path with no torque  
D) All of these
- Q.12** An  $\alpha$ -particle is projected in a region of magnetic field as shown in the following figure. What will be the direction of torque in it?
- 
- A) Clock-wise                      C) Along axis of rotation  
B) Anti-clock wise                      D) It has no torque
- Q.13** An electron is injected into a uniform magnetic field with components of velocity parallel to and normal to the field direction. The path of the electron is a:
- A) Helix                      C) Parabola  
B) Circle                      D) Straight line

- Q.14 Particle enters a region where a uniform electric field  $E$  and a uniform magnetic field  $B$  exist. If  $E$  and  $B$  are perpendicular to each other and also perpendicular to the velocity  $v$  of the particle, then particle will move undeviated if  $v =$ \_\_\_\_\_.

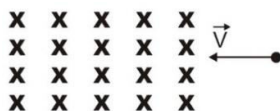
- A)  $\frac{B}{E}$                       C)  $\frac{E}{B}$   
B)  $EB$                       D)  $\frac{E^2}{B}$

- Q.15 Two rectangular loops lying in same plane carrying currents of same value situated near each other as shown in the figure will:

- A) Attract each other  
B) Repel each other  
C) Remain stationary  
D) Start rotating



- Q.16 A beam of  $\beta$  particles is projected in the magnetic field as shown in the figure. The  $\beta$  particles:



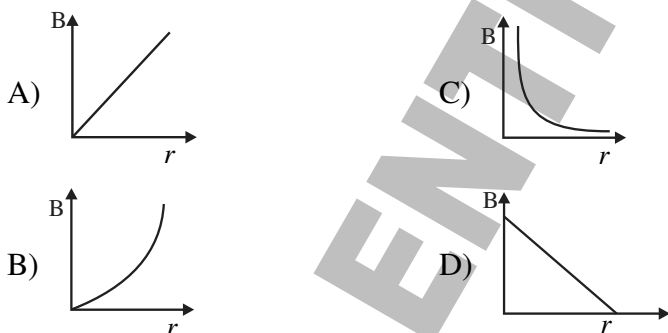
- A) Will deflect in the upward direction  
B) Will deflect in the downward direction  
C) Suffer no deflection  
D) Will deflect out of paper
- Q.17 When a charge is moving with uniform speed it produces?  
A) Constant electric field      C) Varying electric field  
B) Constant magnetic field      D) Varying magnetic field
- Q.18 The geometry of magnetic field lines produced around the current carrying conductor depend upon:  
A) Length of conductor      C) Shape of conductor  
B) Area of conductor      D) All of these
- Q.19 Magnetic field  $\vec{B}$  due to finite length current carrying solenoid at the corners of solenoid is:  
A)  $B = \mu_0 nI$                       C)  $B = \frac{1}{2} \mu_0 nI$   
B)  $B = 2\mu_0 nI$                       D)  $B = 4\mu_0 nI$

USE THIS SPACE FOR  
SCRATCH WORK

4



- Q.26** A velocity selector has a magnetic field of 0.3 T. If a perpendicular electric field of  $10,000 \text{ V m}^{-1}$  is applied, what will be the speed of the particle that will pass through the selector?
- A)  $3.7 \times 10^5 \text{ m s}^{-1}$                       C)  $2.3 \times 10^4 \text{ m s}^{-1}$   
B)  $3.3 \times 10^4 \text{ m s}^{-1}$                       D)  $4.6 \times 10^5 \text{ m s}^{-1}$
- Q.27** A straight wire of length 0.5 m and carrying a current of 1.2 A is placed in a uniform magnetic field of 4 T. The magnetic field is perpendicular to the length of the wire. The force on the wire is:
- A) 2.4 N                                      C) 1.2 N  
B) 3.0 N                                      D) 2.0 N
- Q.28** The magnetic field lines in the middle of a solenoid are:
- A) Circles                                      C) Spiral  
B) Parallel to axis                          D) Perpendicular to axis
- Q.29** If some current is passed in a spring, then the spring:
- A) Gets expanded                          C) Oscillates  
B) Gets compressed                      D) Remains unchanged
- Q.30** Which of the following graph correctly represents the variation of magnetic flux density (B) with distance (r) for a straight wire carrying an electric current?



USE THIS SPACE FOR  
SCRATCH WORK

**ANSWER KEY (Worksheet-03)**

1	C	11	D	21	B
2	B	12	D	22	D
3	A	13	A	23	D
4	B	14	C	24	A
5	B	15	A	25	A
6	A	16	A	26	B
7	C	17	B	27	A
8	B	18	C	28	B
9	A	19	C	29	B
10	C	20	A	30	C

**SOLUTIONS****Unit – 9 (WS-03)****Q.1** Answer is “C”

**Solution:-** Two beam of positrons moving in the same direction will attract each other because of dominating magnetic force which is attractive.

**Note:**

These beams can repel each other due to the repulsive electric force which becomes dominant at low velocities of moving particles. If not mentioned anything about velocities, then simply choose the attractive force between similar charges moving parallel.

**Q.2** Answer is “B”

**Solution:-** Permeability of free space is given as:

$$\mu_0 = 4\pi \times 10^{-7} \text{ Wb A}^{-1} \text{ m}^{-1}$$

**Q.3** Answer is “A”

**Solution:-** Magnetic field inside the solenoid is:  $B = \mu_0 nI = \mu_0 \frac{N}{\ell} I$

**Q.4** Answer is “B”

**Solution:-**  $n = \frac{N}{L} = \text{remain same}$

**Q.5** Answer is “B”

**Solution:-**

$$\sum_{r=1}^N (\vec{B} \cdot \Delta \vec{\ell}) = \mu_0 \left( \begin{array}{l} \text{Current Enclosed by} \\ \text{Amperian Path} \end{array} \right)$$

**Q.6** Answer is “A”

**Solution:-** Ampere’s law for straight wire is:

$$B = \frac{\mu_0 I}{2\pi r} = \frac{\mu_0 2I}{4\pi r}$$

**Q.7** Answer is “C”

**Solution:-**  $F = ILB \sin \theta$

**Q.8** Answer is “B”

**Solution:-** Magnetic field inside solenoid is given as:

$$B = \mu_0 nI = \frac{\mu_0 NI}{\ell}$$

**Q.9** Answer is “A”

**Solution:-** According to Ampere’s law  $B \propto I$

**Q.10** Answer is “C”

**Solution:-** When electron is at rest,  $v=0$  then,  $F = evB \sin \theta = 0$

**Q.11** Answer is “D”

**Solution:-**  $W = \Delta K.E$ ; as no work is done so K.E remains same. Also in angular dynamic equilibrium, “ $\omega$ ” = constant and  $\alpha = 0$  so  $\tau = I\alpha$ , there will be no torque.

**Q.12** Answer is “D”

**Solution:-** The magnetic force on  $\alpha$ -particle is given as  $\vec{F} = q(\vec{v} \times \vec{B})$

The direction of force by right hand rule turns out to be upward when  $\alpha$ -particle enters in magnetic field. So, this force deflects the path in anticlockwise direction.

**Q.13** Answer is “A”

**Solution:-**

- If  $\theta = 90^\circ$  between  $\vec{v}$  and  $\vec{B}$ , then path is circular.
- If  $\theta = 0^\circ/180^\circ$ , then path is straight line.

iii. If  $\theta$  is other than  $0^\circ, 90^\circ, 180^\circ$ , then path is helical.

**Q.14 Answer is "C"**

**Solution:-** Use  $F_B = F_E$ ,  $qvB = qE$ ,  
$$v = \frac{E}{B}$$

**Q.15 Answer is "A"**

**Solution:-** The sides of rectangular loops closer to each other are carrying current in same direction, so they will attract each other.

**Q.16 Answer is "A"**

**Solution:-** " $\beta$ " has "-ve" charge so opposite deflection.

**Q.17 Answer is "B"**

**Solution:-** A charge moving with uniform speed produces magnetic field which is of constant value at any certain point around it.

**Note:-**

If Question is asked that a charge moving with uniform speed possesses / exhibits, then its answer would have been both electric and magnetic fields.

**Q.18 Answer is "C"**

**Solution:-** Geometry of magnetic field lines depend on shape of conductor only.

**Q.19 Answer is "C"**

**Solution:-** At corners field is half as compared to field at centre.

**Q.20 Answer is "A"**

**Solution:-** At mid points, M.F by both conductors cancel each other.

**Q.21 Answer is "B"**

**Solution:-** For straight wire;

$$B = \frac{\mu_0 I}{2\pi r} \Rightarrow B \propto \frac{1}{r}$$

**Q.22 Answer is "D"**

**Solution:-** When a charge particle enter into magnetic field region perpendicularly, then;

$$F = qvB \sin 90^\circ = qvB = \text{max}$$

**Q.23 Answer is "D"**

**Solution:-** In this case, the velocity of electron is either parallel ( $\theta = 0^\circ$ ) or antiparallel ( $\theta = 180^\circ$ ) to magnetic field, hence

$$F = qvB \sin \theta = 0$$

So, electron will continue its straight line motion.

**Q.24 Answer is "A"**

**Solution:-**

$$qB = \frac{mv^2}{r}$$

$$qB = \frac{mv}{r}$$

$$r = \frac{mv}{qB} = \frac{p}{qB} = \frac{\sqrt{2mK.E}}{qB}$$

So,

$$\frac{r_p}{r_\alpha} = \sqrt{\frac{m_p}{m_\alpha} \times \frac{q_\alpha}{q_p}}$$

Put the value of  $m_\alpha = 4m_p$  and  $q_\alpha = 4q_p$  solve.

**Q.25 Answer is "A"**

**Solution:-** Use  $B = \frac{\mu_0 NI}{\ell}$

**Q.26 Answer is "B"**

**Solution:-**  $v = \frac{E}{B}$

**Q.27 Answer is "A"**

**Solution:-** As  $\theta = 90^\circ$  So  $F = ILB$

**Q.28 Answer is "B"**

**Solution:-** Field lines inside solenoid are along its axis.

**Q.29 Answer is "B"**

**Solution:-** Adjacent loops of spring carry current in same direction and get attracted, hence spring gets compressed.

**Q.30** Answer is “C”

**Solution:-**  $B = \frac{\mu_0 I}{2\pi r} \Rightarrow B \propto \frac{1}{r}$

STEP ENTRY TEST 2020

**Worksheet-4**

**Topics:- Magnetic Flux, Faraday's Law, Lenz's Law, Transformer, Alternating Current, Peak and RMS Value of AC**

- Q.1** A metallic rod falls under gravity in such a way that it's two ends points in the direction of east and west, then:
- A) No e.m.f is induced at all
  - B) An e.m.f is induced in it as it cuts earth's magnetic field
  - C) Two e.m.f's of equal but opposite directions are generated giving no net e.m.f induced
  - D) Gravitational field opposes it's downward motion
- Q.2** A bar magnet of magnetic field 2 T is made to move towards a coil having a galvanometer with a speed of  $4 \text{ m s}^{-1}$  such that galvanometer shows a deflection " $\theta_1$ ". Now if the same bar magnet is made to move away from same coil with same speed and galvanometer shows deflection " $\theta_2$ " then what is true?
- A)  $\theta_1 = \theta_2$  and both deflections are in same direction
  - B)  $\theta_1 < \theta_2$  and both deflections are in same direction
  - C)  $\theta_1 > \theta_2$  and both deflections are in opposite directions
  - D)  $\theta_1 = \theta_2$  but both deflections are in opposite direction
- Q.3** With reference to the Q.2 if only  $\vec{B}$  is doubled and bar is only made to move towards coil with a speed of  $4 \text{ m s}^{-1}$  then:
- A) Induced e.m.f becomes half
  - B) Induced e.m.f remains same
  - C) Induced e.m.f is doubled
  - D) None of these
- Q.4** With reference to the Q.2 if both  $\vec{B}$  and speed of bar magnet are doubled then:
- A) Induced e.m.f becomes quadrupled
  - B) Induced e.m.f remains same
  - C) Induced e.m.f is doubled
  - D) None of these
- Q.5** With reference to Q.2 if only number of turns of coil are doubled then:
- A) Induced e.m.f becomes half
  - B) Induced e.m.f remains same
  - C) Induced e.m.f is doubled
  - D) None of these

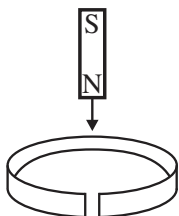
USE THIS SPACE FOR  
SCRATCH WORK

- Q.6** The relation for motional e.m.f is written as:  
A)  $\varepsilon = -vBL\cos\theta$  C)  $\varepsilon = +vBL\sin\theta$   
B)  $\varepsilon = -vBL\sin\theta$  D)  $\varepsilon = -vBL \tan\theta$
- Q.7** If a conductor is moved across a  $\vec{B}$  such that  $\theta=90^\circ$  then induced e.m.f:  
A) Is a maximum C)  $\varepsilon = -vBL$   
B) Is zero D) Both "A" and "C"
- Q.8** At what angle when a rod is moved in a uniform  $\vec{B}$  such that induced e.m.f becomes half of it's maximum?  
A)  $30^\circ$  C)  $60^\circ$   
B)  $45^\circ$  D)  $90^\circ$
- Q.9** According to Lenz's law the direction of induced current is such that it:  
A) Decreases flux if it is increasing  
B) Opposes the cause which produces it  
C) Increases flux if it is decreasing  
D) All of these
- Q.10** The value of induced e.m.f in a coil mainly depends upon:  
A) Increase in flux  
B) Decrease in flux  
C) Both "A" & "B"  
D) Rate of change of magnetic flux
- Q.11** If we take away north-pole of a bar magnet from a coil then the end of coil facing north-pole act as:  
A) A north pole C) May be north or south  
B) A south pole D) No pole will be induced
- Q.12** Which of the following is true about dependence upon resistance of the coil in which e.m.f is generated?  
A) Only induced current depends upon resistance of coil  
B) Only e.m.f depends upon resistance of coil  
C) Both e.m.f and induced current depends upon resistance of coil  
D) Can't be predicted

USE THIS SPACE FOR  
SCRATCH WORK



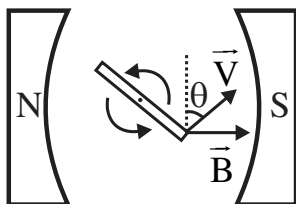
- Q.13 A bar magnet as shown in figure is allowed to fall down into a coil having a cut. What is true?



- A) e.m.f will be induced only  
B) Neither e.m.f nor current will be induced  
C) Both e.m.f and current will be induced  
D) None of these
- Q.14 Considering the statement of Q.13 what is true about the acceleration of bar magnet while coming down?  
A)  $a=g$   
B)  $a<g$   
C)  $a>g$   
D)  $a=0$
- Q.15 Considering the figure of Q.13 if the coil is complete and does not have cut in it then:  
A) Only e.m.f will be induced  
B) Only current will be induced  
C) Both e.m.f and current will be induced in it  
D) Nothing will be induced
- Q.16 Considering the statement of Q.15 what is true about the acceleration produced in the bar magnet while falling downwards?  
A)  $a=g$   
B)  $a>g$   
C)  $a<g$   
D)  $a=0$
- Q.17 Under which of the following conditions even when both area of coil and  $\vec{B}$  in the region are continuously changing yet there is no e.m.f induced?  
A) If  $A \propto \frac{1}{B}$   
B) If flux remains zero  
C) If coil is placed parallel to  $\vec{B}$   
D) All of these

USE THIS SPACE FOR  
SCRATCH WORK

- Q.18 Consider the figure in which an upper view for a rotating coil is shown placed in the uniform magnetic field. For which value of “ $\theta$ ” the induced e.m.f will be a maximum?



- A)  $90^\circ$                       C)  $60^\circ$   
B)  $30^\circ$                       D)  $0^\circ$
- Q.19 The ratio of the number of turns in primary and secondary coils of a transformer is 1:20. The ratio of the currents in the primary and secondary coils will be:  
A) 1:20                      C) 1:400  
B) 20:1                      D) 400:1
- Q.20 The relation for e.m.f produced by an A.C generator is:  
A)  $\varepsilon = \varepsilon_0 \sin \theta$                       C) Both “A” and “B”  
B)  $\varepsilon = N\omega AB \sin \theta$                       D) None of these
- Q.21 The maximum e.m.f induced by an A.C generator which has only one turn is:  
A)  $N\omega AB$                       C)  $\omega AB$   
B)  $NAB$                       D) None of these
- Q.22 A step-up transformer is the one which:  
A) Increases voltage level                      C) Keeps power level same  
B) Decreases current level                      D) All of these
- Q.23 In a step-up transformer the turns ratio is found to be 2:1; such a transformer will:  
A) Increase current level                      C) Both “A” & “B”  
B) Decrease voltage level                      D) Decrease current level
- Q.24 A transformer steps down 100 volt to 10 volt to operate a device with an impedance of 2 ohm. Then the current drawn from the mains by the primary of the transformer is:  
A) 50 A                      C) 0.5 A  
B) 5 A                      D) 0.05 A
- Q.25 An ideal step down transformer is connected to main supply of 240 V. It is desired to operate a 12 V, 30 W lamp. What is the current in the primary?  
A) 0.125 A                      C) 0.5 A  
B) 0.25 A                      D) 0.75 A

USE THIS SPACE FOR  
SCRATCH WORK

- Q.26** Referring to Q.25, what is the transformation ratio:  
 A) 10 C) 20  
 B)  $\frac{1}{20}$  D)  $\frac{1}{10}$
- Q.27** Magnetic flux passing through a surface area will be half of maximum value when:  
 A)  $\vec{A}$  makes  $60^\circ$  with  $\vec{B}$  C)  $\vec{A}$  makes  $45^\circ$  with  $\vec{B}$   
 B)  $\vec{A}$  makes  $30^\circ$  with  $\vec{B}$  D)  $\vec{A}$  makes  $0^\circ$  with  $\vec{B}$
- Q.28** Magnetic flux passing through a surface area will be  $\frac{1}{\sqrt{2}}$  times the maximum flux if plane area makes \_\_\_\_\_ angle with magnetic field.  
 A)  $30^\circ$  C)  $60^\circ$   
 B)  $45^\circ$  D)  $75^\circ$
- Q.29** The basic difference between A.C and D.C is:  
 A) Direction reversal by A.C  
 B) Changing magnitude by A.C  
 C) Both A and B  
 D) None of these
- Q.30** An A.C current is given by  $I=100 \sin 100\pi t$ . It will achieve value of 50 A after \_\_\_\_\_ second.  
 A)  $\frac{1}{600}$  C)  $\frac{1}{300}$   
 B)  $\frac{1}{1800}$  D)  $\frac{1}{900}$
- Q.31** A bulb is connected with A.C supply. The intensity of light from the bulb:  
 A) Changes continuously  
 B) Decreases and becomes zero  
 C) Increases and reaches to its maximum  
 D) Remains constant
- Q.32** Two A.Cs are represented by  $I_1 = 100 \sin 100\pi t$  and  $I_2 = 100 \sin 200\pi t$ , the relation between the frequencies of these A.Cs is:  
 A)  $f_1 = f_2$  C)  $f_2 = 2f_1$   
 B)  $f_1 = 2f_2$  D)  $f_1 = 10f_2$

USE THIS SPACE FOR  
SCRATCH WORK

Q.33 The time taken by A.C to reach half of maximum value is \_\_\_\_\_ while initial phase of A.C is  $90^\circ$ .

- A)  $\frac{T}{8}$  C)  $\frac{T}{12}$   
B)  $\frac{T}{6}$  D)  $\frac{T}{4}$

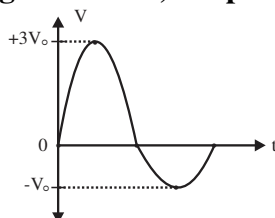
Q.34 How many times A.C achieves zero value in one cycle:

- A) Once C) Thrice  
B) Twice D) Four times

Q.35 The rms value of A.C in 1<sup>st</sup> half is:

- A) Zero C)  $\frac{I_0}{\sqrt{2}}$   
B)  $\frac{I_0}{2}$  D)  $\frac{2I_0}{\sqrt{2}}$

Q.36 In the following waveform, the peak to peak value is:



- A)  $+2V_0$  C)  $+1V_0$   
B)  $+3V_0$  D)  $+4V_0$

Q.37 Referring to questions # 36, the rms value will be:

- A)  $\frac{V_0}{\sqrt{2}}$  C)  $\sqrt{\frac{3}{2}}V_0$   
B)  $\sqrt{\frac{2}{5}}V_0$  D)  $\sqrt{\frac{5}{2}}V_0$

Q.38 The rate of heat production in a resistor due to an alternating current of rms value 10A is same as that due to a direct current of:

- A) 10 A C)  $10\sqrt{3}$  A  
B)  $10\sqrt{2}$  A D) 5 A

Q.39 The voltage of domestic A.C is 220 volt what does this represent:

- A) Mean voltage B) Peak voltage  
C) Root mean voltage D) Root mean square voltage

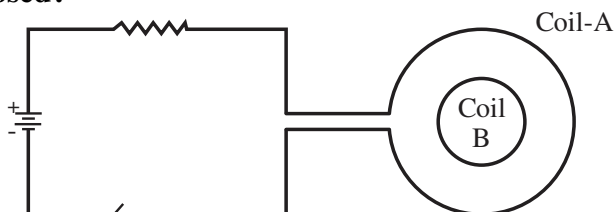
Q.40 Mostly voltmeters read \_\_\_\_\_ value of A.C voltage:

- A) Mean voltage B) Peak voltage  
C) Root mean voltage D) Root mean square voltage

Q.41 In the figure shown, what is the direction of induced

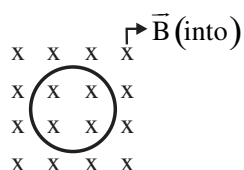
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current in the coil B at the moment when the switch is closed?



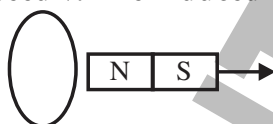
- A) Clockwise
- B) Anticlockwise
- C) No current is induced
- D) Induced current changes its direction from clockwise to anticlockwise

Q.42 A loop of wire is placed in a perpendicular magnetic field. Suddenly, the magnitude of magnetic field begins to increase, what is the direction of the induced current in the loop?



- A) Clockwise
- B) Anticlockwise
- C) No current is induced
- D) Out of the page

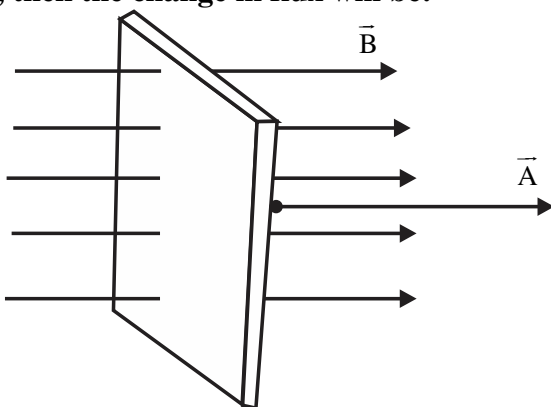
Q.43 In the figure shown, the magnet is moved towards the coil with a speed  $v$ . The induced emf in coil is " $\epsilon$ ". Now if the magnet and coil recede away from one another each moving with speed  $v$ . The induced emf in the coil is:



- A)  $\epsilon$
- B)  $2\epsilon$
- C)  $\frac{\epsilon}{2}$
- D)  $4\epsilon$

Q.44 The coil of area " $A$ " is kept perpendicular in a magnetic field  $\vec{B}$  as shown in following figure. If coil is rotated by

180° such that its axis of rotation is perpendicular to field, then the change in flux will be:

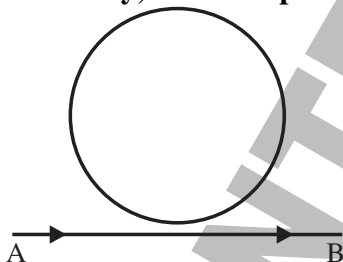


- A) BA  
B) -2BA  
C) Zero  
D) 4BA

Q.45 The north pole of a long horizontal bar magnet is being brought closer to a vertical conducting coil along the perpendicular direction. The direction of the induced current in the conducting coil will be:

- A) Horizontal  
B) Clockwise  
C) Vertical  
D) Anticlockwise

Q.46 An electron starts moving along the line AB, which lies in the same plane as a circular loop of conducting wire as shown in the diagram. What will be the direction of current induced if any, in the loop?



- A) No current will be induced  
B) The current will be clockwise  
C) The current will be anticlockwise  
D) The current will change direction as the electron pass by

Q.47 The coil of area A is kept parallel in a magnetic field B. If coil is rotated by 90° such that its axis is perpendicular to magnetic field, the change in flux will be:

- A) BA  
B) 2BA  
C) Zero  
D) 4BA

Q.48 A 50 turns circular coil has a radius of 3 cm. It is kept in a magnetic field acting normal to the area of the coil. The magnetic field B is increased from 0.10 T to 0.35 T in 2 ms. The average induced emf in the coil is:

- A) 1.77 V  
B) 17.7 V  
C) 177 V  
D) 0.177 V



- Q.49 There is an aerial 1 m long in a car. It is moving from east to west with a velocity  $100 \text{ km h}^{-1}$ . If the horizontal component of earth's magnetic field is  $0.18 \times 10^{-4} \text{ T}$ , then induced emf is:
- A) 0.50 mV                      C) 0.75 mV  
B) 0.25 mV                      D) 1 mV
- Q.50 In a step-up transformer, the turns ratio is 1:10. A resistance of 200 ohm connected across the secondary is drawing a current of 0.5 A. What is the primary voltage and current?
- A) 50 V, 1 A                      C) 25 V, 4 A  
B) 10 V, 5 A                      D) 20 V, 2 A

**ANSWER KEY (Worksheet-04)**

1	B	11	B	21	C	31	A	41	B
2	D	12	A	22	D	32	C	42	B
3	C	13	A	23	D	33	B	43	B
4	A	14	A	24	C	34	B	44	B
5	C	15	C	25	A	35	C	45	D
6	B	16	C	26	B	36	D	46	C
7	D	17	D	27	A	37	D	47	A
8	A	18	D	28	B	38	A	48	B
9	D	19	B	29	A	39	D	49	A
10	D	20	C	30	A	40	D	50	B

**SOLUTIONS****Unit – 8 (WS-04)****Q.1** Answer is “B”

**Solution:-** Since the metallic rod is moving in earth's magnetic field, so motional e.m.f will be produced.

**Q.2** Answer is “D”

**Solution:-** The induced current will flow opposite in both cases as the direction of motion of bar is opposite in both cases. Also, the magnitude of current will be same as the speed of conductor with which it is moving is same.

**Q.3** Answer is “C”

**Solution:-**  $\varepsilon = -vBL \sin \theta \Rightarrow \varepsilon \propto B$

**Q.4** Answer is “A”

**Solution:-**  $\varepsilon = -vBL \sin \theta$

**Q.5** Answer is “C”

**Solution:-**  $\varepsilon = -N \frac{\Delta \phi}{\Delta t}$

**Q.6** Answer is “B”

**Solution:-** Motional e.m.f in a conductor is given as

$$\varepsilon = -vBL \sin \theta$$

**Q.7** Answer is “D”

**Solution:-**  $\varepsilon = -vBL \sin \theta$

**Q.8** Answer is “A”

**Solution:-** Put  $\varepsilon = -\frac{vBL}{2}$  and find “ $\theta$ ”.

**Q.9** Answer is “D”

**Solution:-** Lenz's law

**Q.10** Answer is “D”

**Solution:-** E.m.f is caused by change in flux. The rate of change of flux determines its value.

**Q.11** Answer is “B”

**Solution:-** Induced current opposes the cause which produces it.

**Q.12** Answer is “A”

**Solution:-** First short question of Ch:15.

$$\varepsilon = -N \frac{\Delta \phi}{\Delta t} = \text{constant and } I = \frac{\varepsilon}{R}$$

$$\Rightarrow I \propto \frac{1}{R}$$

**Q.13** Answer is “A”

**Solution:-** As  $I = \frac{\varepsilon}{R}$  and for ring with a cut it acts as open circuit whose  $R = \text{infinite}$ .

**Q.14** Answer is “A”

**Solution:-** As no current is induced so this coil will not become a magnet and hence can't oppose the motion of falling bar magnet which will only fall with  $a = g$ .

**Q.15** Answer is “C”

**Solution:-** Current flows only in close path.

**Q.16 Answer is “C”**

**Solution:-** As now current can be generated so coil will become magnet and will oppose motion of falling magnet.

**Q.17 Answer is “D”**

**Solution:-** In all cases;  $\Delta\phi = 0 \Rightarrow \varepsilon = 0$

**Q.18 Answer is “D”**

**Solution:-** E.m.f induced in one side of coil is given as;

$$\varepsilon = -vBL\sin\alpha$$

Where  $\alpha$  is angle between  $\vec{v}$  and  $\vec{B}$ . In the given figure  $\alpha$  can be expressed as:

$$\alpha = 90^\circ - \theta$$

If  $\theta = 0^\circ$ ,  $\alpha = 90^\circ$

$$\sin 90^\circ = 1 = \max$$

So e.m.f will be maximum when  $\theta = 0^\circ$ .

**Q.19 Answer is “B”**

$$\text{Solution:- } \frac{I_p}{I_s} = \frac{N_s}{N_p} = \frac{1}{\frac{N_p}{N_s}} = \frac{1}{\frac{1}{20}} = \frac{20}{1}$$

**Q.20 Answer is “C”**

**Solution:-** E.m.f produced by generator is given as:

$$\varepsilon = N\omega AB \sin\theta$$

Where  $N\omega AB = \varepsilon_0 = \text{maximum emf}$

$$\text{So, } \varepsilon = \varepsilon_0 \sin\theta$$

**Q.21 Answer is “C”**

**Solution:-**  $\varepsilon = N\omega AB \sin\theta$  For maximum e.m.f in one turn coil, put;  $N=1$ ,  $\theta = 90^\circ$

**Q.22 Answer is “D”**

**Solution:-** An ideal step-up transformer:

- i. Increases voltage level
- ii. Decreases current level
- iii. Keeps  $P_{\text{in}} = P_{\text{out}}$

**Q.23 Answer is “D”**

**Solution:-** A step-up transformer increases voltage level & decreases current level.

**Q.24 Answer is “C”**

**Solution:-**

**Step-I**

$$I_s = \frac{V_s}{Z}$$

**Step-II**

$$\frac{I_p}{I_s} = \frac{V_s}{V_p}$$

**Q.25 Answer is “A”**

**Solution:-**  $P_{\text{in}} = P_{\text{out}}$

$$V_p I_p = 30 \text{ W}$$

**Q.26 Answer is “B”**

$$\text{Solution:- } \frac{N_s}{N_p} = \frac{V_s}{V_p}$$

**Q.27 Answer is “A”**

**Solution:-**  $\phi = BA \cos\theta$

Put  $\phi = \frac{BA}{2}$  and solve

**Q.28 Answer is “B”**

**Solution:-**

$$\text{i. } \phi = \frac{1}{\sqrt{2}} \phi_{\text{max}}$$

$$BA \cos \theta = \frac{1}{\sqrt{2}} BA$$

Solve for  $\theta$ .

- ii. To find angle between plane area and magnetic field use

$$\alpha = 90^\circ - \theta$$

**Q.29** Answer is "A"

**Solution:-** Basic difference between A.C and D.C is direction reversal, otherwise magnitude can change for both A.C and D.C.

**Q.30** Answer is "A"

**Solution:-**  $I = 100 \sin 100\pi t$   
 $50 = 100 \sin 100\pi t$  solve it

**Q.31** Answer is "A"

**Solution:-** Intensity  $\propto I_{\text{rms}}$

**Q.32** Answer is "C"

**Solution:-** Compare  $I_1$  and  $I_2$

**Q.33** Answer is "B"

**Solution:-**

Since  $\phi = 90^\circ$ , so  $I = I_0 \cos\left(\frac{2\pi}{T}t\right)$ , put  
 $I = \frac{I_0}{2}$  & solve it.

**Q.34** Answer is "B"

**Solution:-** In one cycle of A.C, it achieves zero value twice i.e at  $0^\circ$  and at  $180^\circ$ .

**Q.35** Answer is "C"

**Solution:-**  $I_{\text{rms}} = \frac{I_0}{\sqrt{2}}$

**Q.36** Answer is "D"

**Solution:-**  $V_{\text{PP}}$  = sum of +ve & -ve peaks without signs

**Q.37** Answer is "D"

**Solution:-** rms value =  
$$\sqrt{\frac{0 + 9V_0^2 + 0 + V_0^2}{4}}$$

**Q.38** Answer is "A"

**Solution:-**  $I_{\text{rms}} \rightarrow$  effective value of A.C  
i.e it produces same heating effect as produced by equal D.C current.

**Q.39** Answer is "D"

**Solution:-** Usually the value specified of A.C is rms values unless specified that it is peak value.

**Q.40** Answer is "D"

**Solution:-** Mostly voltmeter and ammeters read rms value of alternating voltage and current.

**Q.41** Answer is "B"

**Solution:-**  
When switch is closed, the current in coil-A increases from zero to maximum, so its magnetic flux also increases from zero to maximum, this flux is linked with coil-B. Since the field of coil-A is into the page so to oppose this cause (increasing flux) the field of induced current in coil-B must be out of the page. Hence current in coil B must be in anti-clockwise direction.

**Q.42** Answer is "B"

**Solution:-**  
To oppose the cause i.e increasing flux, the field of coil must be out of page (opposite to increasing field). So, the current in coil will be anticlockwise.

**Q.43** Answer is "B"

**Solution:-**

The relative speed between coil and magnet becomes “2v” so emf induced will also be doubled.

**Q.44 Answer is “B”****Solution:-**

$$\phi_i = BA \cos 0^\circ = BA$$

$$\phi_f = BA \cos 180^\circ = -BA$$

$$\Delta\phi = \phi_f - \phi_i$$

$$\Delta\phi = -BA - BA$$

$$\Delta\phi = -2BA$$

**Q.45 Answer is “D”****Solution:-**

Simply follow the statement of Lenz’s law.

**Q.46 Answer is “C”****Solution:-**

Simple follow the statement of Lenz’s Law keeping in mind that the magnetic field linked with the coil is because of electronic current i.e the direction of magnetic field will be opposite to that obtained by right hand rule.

**Q.47 Answer is “A”****Solution:-**

$$\phi_i = BA \cos 90^\circ = 0$$

$$\phi_f = BA \cos 0^\circ = BA$$

$$\Delta\phi = \phi_f - \phi_i$$

$$\Delta\phi = BA - 0$$

$$\Delta\phi = BA$$

**Q.48 Answer is “B”****Solution:-**

$$\Delta\phi = NA(B_2 - B_1) = 50 \times \frac{22}{7} (3 \times 10^{-2})^2$$

$$\Delta\phi = 353 \times 10^{-4} \text{ Wb}$$

Now

$$\varepsilon = \frac{NA(B_2 - B_1)}{\Delta t}$$

$$\varepsilon = \frac{353 \times 10^{-4}}{2 \times 10^{-3}}$$

$$\varepsilon = 17.7V$$

**Q.49 Answer is “A”****Solution:-**

Magnitude of emf is

$$\varepsilon = vBL \sin 90^\circ$$

$$\varepsilon = \frac{100 \times 1000}{3600} \times 0.18 \times 10^{-4} \times 1$$

$$\varepsilon = 0.5 \text{ mV}$$

**Q.50 Answer is “B”****Solution:-**

i-  $V_s = I_s R$

ii-  $\frac{V_P}{V_S} = \frac{N_P}{N_S} = \frac{1}{10}$

iii-  $\frac{I_P}{I_S} = \frac{N_S}{N_P}$

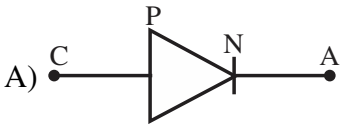


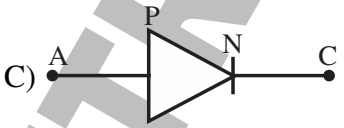
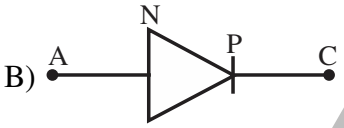


**Worksheet-5**

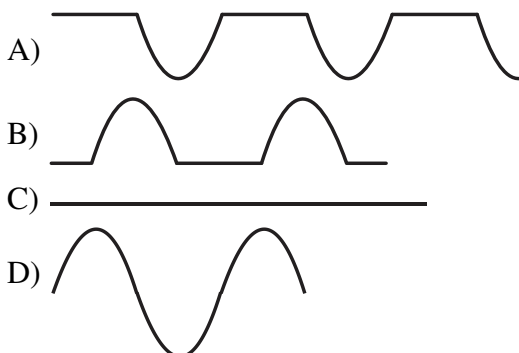
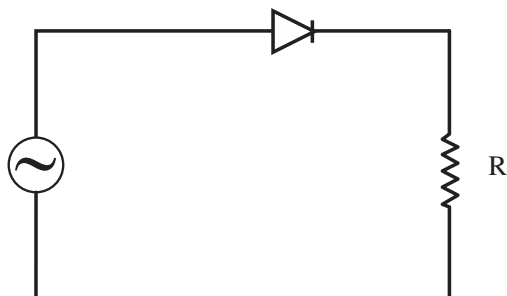
**Topics:- Half and Full Wave Rectification, Operational Amplifier and its Characteristics**

USE THIS SPACE FOR  
SCRATCH WORK

- Q.1** A P-N junction diode is said to be forward biased when:
- A) No potential difference is applied across P and N regions
  - B) A potential difference is applied across P and N regions making P region positive and N region negative
  - C) A potential difference is applied across P and N regions making P region negative and N region positive
  - D) A magnetic field is applied in the region of junction
- Q.2** When a P-N junction is forward biased then width of depletion region.
- A) Increases
  - B) Decreases
  - C) Remains unchanged
  - D) is variable
- Q.3** Circuit used to convert pulsating D.C into pure D.C is called:
- A) Rectifier
  - B) Inverter
  - C) Filter
  - D) Converter
- Q.4** If “A” stands for anode and “C” stands for cathode, then which of following is a correct labeled symbolic diagram of a rectifier.
- A) 

C) 
- B) 

D) None of these
- Q.5** When a diode is reverse biased, then its resistance is of the order of?
- A) ohms
  - B) kilo ohms
  - C) mega ohms
  - D) micro ohms
- Q.6** The time period of output ripple of a full wave rectifier is 40 ms, what will be the input A.C frequency of this rectifier circuit?
- A) 100 Hz
  - B) 50 Hz
  - C) 25 Hz
  - D) 12.5 Hz
- Q.7** The potential drop across the diode in the following circuit during the conduction mode of diode is:



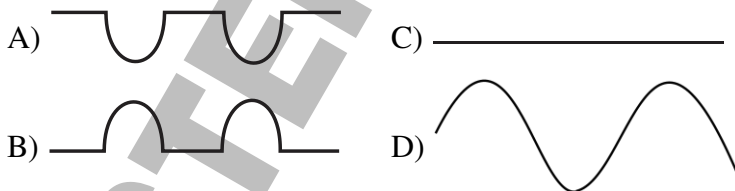
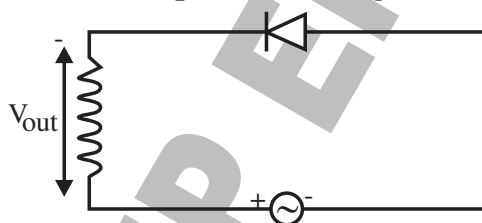
**Q.8 Which of following is not true about half wave rectifier?**

- A) Output ripple has same time period as that of A.C input
- B) It produces pure D.C at output
- C) Diode conducts only for one half of A.C
- D) During reverse Biased mode of rectifier, the output is zero

**Q.9 The similar feature of half wave rectifier and full wave rectifier for same input A.C source is:**

- A) Both produces output ripples of same frequency
- B) Both uses only forward biased mode of diode
- C) Both uses a pair of diodes for operation
- D) Both produces pulsating D.C output

**Q.10 What can be the output of following half wave rectifier?**



**Q.11 For identical external resistors, which of the following will have more value of output voltage, when input**

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SCRATCH WORK

voltage is same;

- A) Non-inverting Op-Amp      C) Both have same output  
B) Inverting Op-Amp          D) None of these

**Q.12 The number of input terminals of an ordinary op-amp are:**

- A) Two                                  C) Four  
B) Three                                D) Eight

**Q.13 The magnitude of "Open loop gain" of an amplifier is of the order of:**

- A)  $10^5 \Omega$                                   C)  $10^5 V$   
B)  $10^5 A$                                   D)  $10^5$

**Q.14 An op-amp can be used as a:**

- A) Inverting and non-inverting amplifier  
B) Comparator  
C) Night switch  
D) All of the above

**Q.15 The Closed loop Gain "G" of the non-inverting amplifier can be expressed by:**

- A)  $G = \frac{-R_2}{R_1}$                                   C)  $G = \frac{R_2}{R_1}$   
B)  $G = 1 + \frac{R_2}{R_1}$                                 D)  $G = 1 - \frac{R_1}{R_2}$

**Q.16 An op-amp will act as an inverting amplifier when the input signal is not connected to:**

- A) Non-inverting terminal      C) Non-Inverting output  
B) Inverting terminal            D) Inverting output

**Q.17 An op-amp will not act as a non-inverting amplifier when input signal is connected to the**

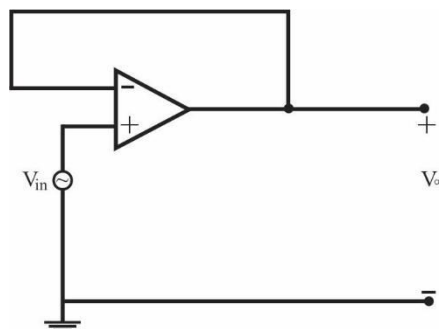
- A) Non-inverting input            C) Non-Inverting output  
B) Inverting input                  D) Inverting out put

**Q.18 The gain of an inverting amplifier having external resistance  $R_1=50 \text{ k}\Omega$  and  $R_2=200 \text{ k}\Omega$  respectively will be**

- A) 4    C) -20  
B) 20                                        D) -4

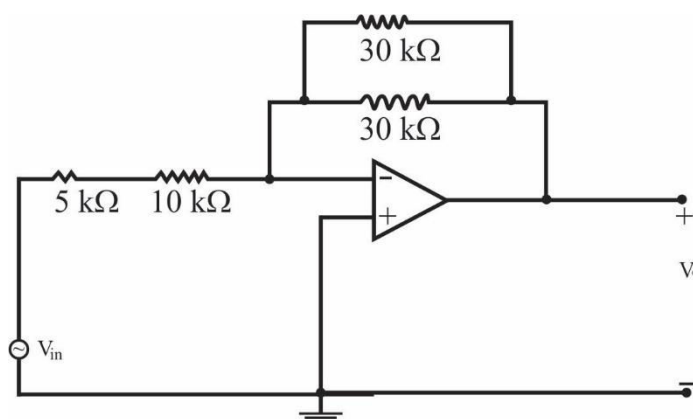
**Q.19 What is gain of Op-Amp shown in figure:**

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SCRATCH WORK



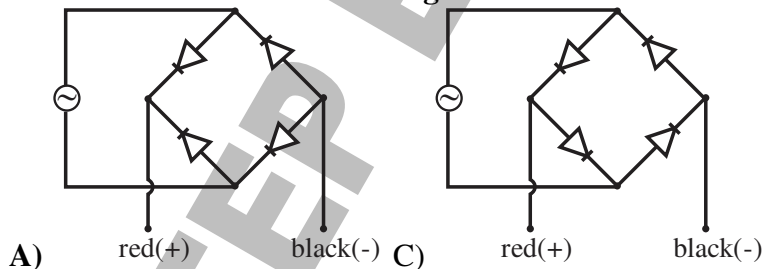
- A) 0  
B)  $10^5$   
C)  $\infty$   
D) 1

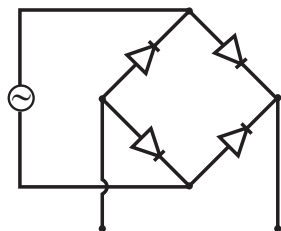
Q.20 What is gain of Op-Amp shown in figure:



- A) -3  
B) -2  
C) -5  
D) None of these

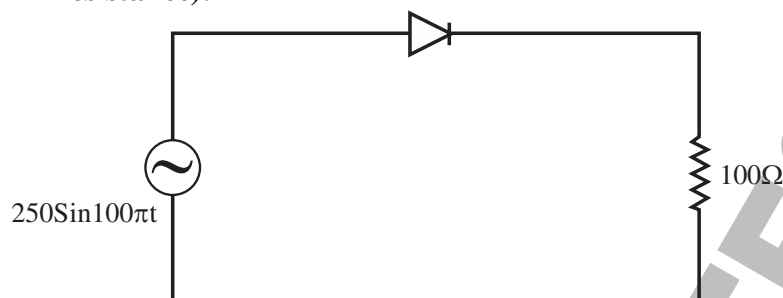
Q.21 Some students were given following instructions.  
“Design a circuit to give a full wave rectifier output from an A.C supply. The positive output must be connected to a red terminal and negative output to a black terminal.”  
Which circuit satisfies the design instructions?





B) red(+) black(-) D) None of these

**Q.22** The rms current flowing through the following circuit will be (where diode has negligible forward biased resistance):



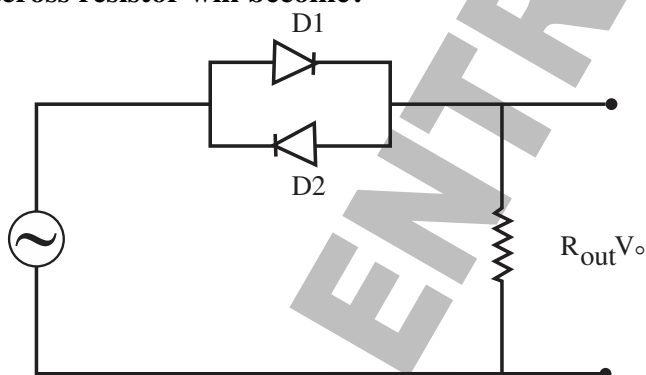
A)  $\frac{5}{2} A$

C)  $\frac{5}{4} A$

B)  $\frac{5}{3} A$

D)  $\frac{5}{6} A$

**Q.23** If the diode  $D_1$  is taken off from the circuit, the output across resistor will become?



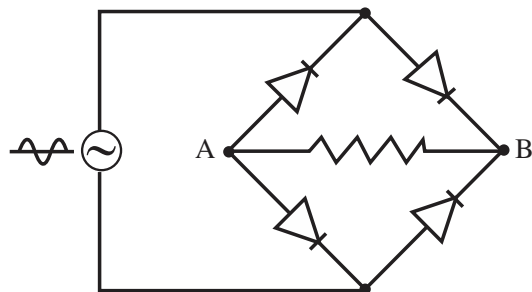
A) Half wave rectified

C) Zero

B) Full wave rectified

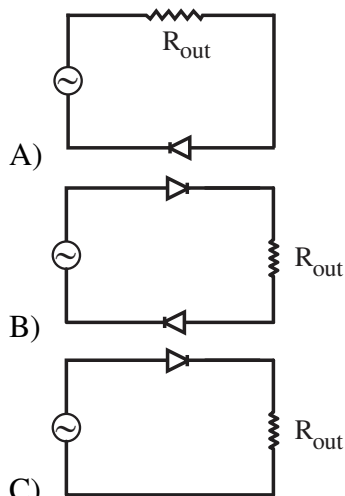
D) A.C

**Q.24** The direction of current through the resistor in the circuit shown during negative half of A.C will be:



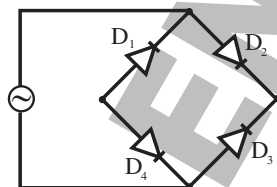
- A) From A to B  
B) From B to A  
C) No current flows during negative half  
D) Both A and B are possible

Q.25 If the source frequency is same in all cases, for which circuit out of the following the ripple frequency is more?



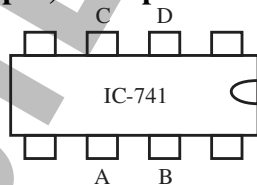
- D) Ripple frequency will be same in all cases

Q.26 What change can be made to convert the following bridge into half wave rectifier?



- A) Replace  $D_1$  by a resistor  
B) Replace  $D_2$  by a resistor  
C) Replace  $D_3$  by a resistor  
D) All of these

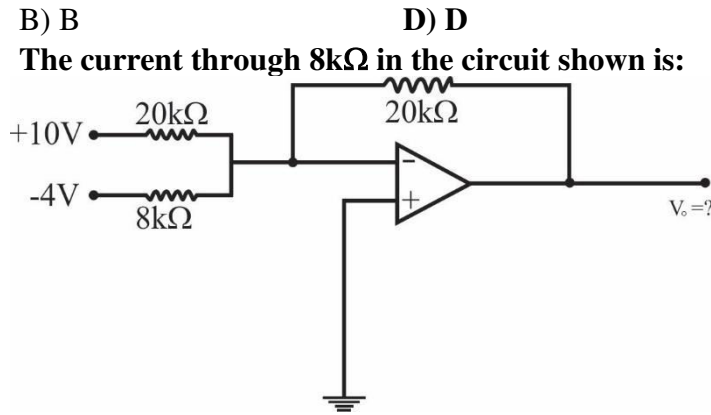
Q.27 An operational amplifier is shown in the diagram, to get an inverted output, the input must be applied at:



- A) A  
B) B  
C) C  
D) D



Q.28 The current through  $8k\Omega$  in the circuit shown is:



A) Zero

B)  $-0.5mA$

C)  $+0.75A$

D) None of these

**ANSWER KEY (Worksheet-05)**

1	B	11	A	21	A
2	B	12	A	22	C
3	C	13	D	23	A
4	C	14	D	24	B
5	C	15	B	25	D
6	D	16	A	26	D
7	C	17	B	27	D
8	B	18	D	28	B
9	D	19	D		
10	A	20	D		

**SOLUTIONS****Unit – 8 (WS-05)****Q.1** Answer is “B”

**Solution:-** A diode is said to be in forward biased mode if its P-side is connected with high potential and N-side is connected with low potential.

**Q.2** Answer is “B”

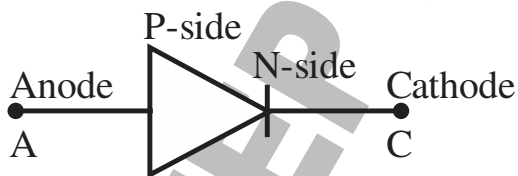
**Solution:-** During forward biased mode the resistance and width of potential barrier drops.

**Q.3** Answer is “C”

**Solution:-** RC-filter is used to produce pure D.C by pulsating D.C.

**Q.4** Answer is “C”

**Solution:-** Correct labeled diagram of rectifier is

**Q.5** Answer is “C”

**Solution:-** Forward biased resistance is of the order of few ohms while reverse

biased resistance is of the order of mega ohms.

**Q.6** Answer is “D”**Solution:-****Step-I**

For full-wave rectifier:

$$T_{A.C} = 2T_{ripple} = 80 \text{ ms}$$

**Step-II**

$$f_{A.C} = \frac{1}{T_{A.C}} = \frac{1}{80 \times 10^{-3}} = 12.5 \text{ Hz}$$

**Q.7** Answer is “C”

**Solution:-** During forward biased mode the potential drop across is negligible.

**Q.8** Answer is “B”

**Solution:-** Half wave rectifier have pulsating D.C at output.

**Q.9** Answer is “D”

**Solution:-** Both rectifiers produces pulsating D.C at output.

**Q.10** Answer is “A”

**Solution:-** This rectifier will conduct for negative half of A.C

**Q.11** Answer is “A”

**Solution:-** For identical resistors

$$G_{non-inverting} = 1 + \frac{R_2}{R_1} = 1 + G_{inverting}$$

$$\therefore G_{inverting} = \frac{-R_2}{R_1}$$

-ve sign just shows

180° shift in output

Q.12 Answer is "A"

**Solution:-** Op-Amp has two input terminals and one output terminal.

Q.13 Answer is "D"

**Solution:-** Open loop gain is of the order of  $10^5$ .

Q.14 Answer is "D"

**Solution:-** Op-Amp can be used for all mentioned operations

Q.15 Answer is "B"

**Solution:-** For non-inverting amplifier

$$G = 1 + \frac{R_2}{R_1}$$

Q.16 Answer is "A"

**Solution:-** Op-Amp acts as inverting amplifier when input is connected to inverting terminal.

Q.17 Answer is "B"

**Solution:-** Op-Amp acts as non-inverting amplifier when input is connected to non-inverting terminal.

Q.18 Answer is "D"

**Solution:-**  $G = -\frac{R_2}{R_1}$

Q.19 Answer is "D"

**Solution:-**  $G = 1 + \frac{R_2}{R_1}$

Q.20 Answer is "D"

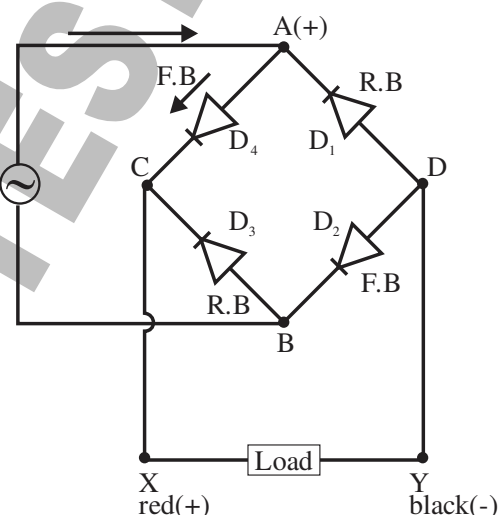
**Solution:-**  $G = -\frac{R_2}{R_1}$

Q.21 Answer is "A"

**Solution:-**

Checking for option "A" during (0-T/2)

During this half  $D_2$  and  $D_4$  will be forward biased. When direction of current is traced, it is from  $X \rightarrow Y$  on output side. Since conventional current flow from high to low potential, so X will be at +ve potential w.r.t Y. As labeled "X" is made red terminal so this satisfies the design conditions. Similarly check for negative half, same result will come, so "A" option is correct.



Q.22 Answer is "C"

**Solution:-**

Finding  $I_o$

$$I_o = \frac{\varepsilon_o}{R} = \frac{250}{100} = \frac{5}{2} A$$

Finding  $I_{rms}$

For half wave rectifier;

$$I_{rms} = \frac{I_o}{2} = \frac{\frac{5}{2}}{2} = \frac{5}{4} A$$

Q.23 Answer is "A"

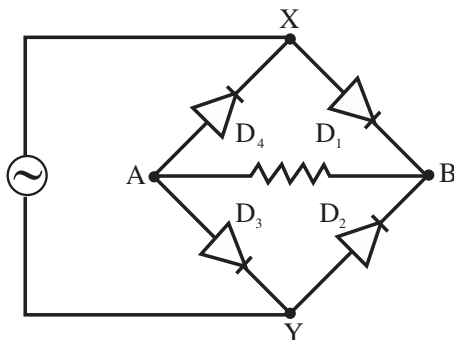
**Solution:-**

Taking  $D_1$  off will result only one diode in circuit, so it will behave as half wave rectifier.

**Q.24** Answer is “B”

**Solution:-**

During negative half, X will become -ve and Y will become +ve. Consequently,  $D_1$  and  $D_3$  will become reverse biased and  $D_2$  &  $D_4$  will become forward biased. The conventional current will flow from Y toward B and then from B towards A.



**Q.25** Answer is “D”

**Solution:-**

All the given circuits are of half wave rectification, so ripple frequency will be same for all.

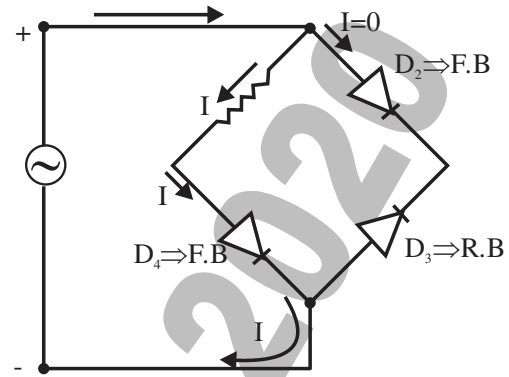
**Q.26** Answer is “D”

**Solution:-**

When anyone out of four diodes is replaced by resistor, the circuit behaves as half wave rectifier. For example, if  $D_1$  is replaced by resistor the circuit for both halves of A.C will be:

**For +ve half**

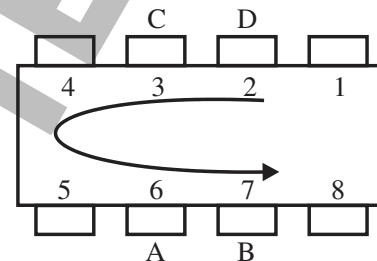
A positive pulse will be output across resistor during this half. Check for negative half, current won't flow as it will not find any close path.



**Q.27** Answer is “D”

**Solution:-**

Op-Amp numbering is done from capsule side in anti-clockwise direction as following:



Pin “2” (D) & “3” (C) represent inverting and non-inverting inputs terminals.

- Pin “6” (A) represents output terminal.
- Pin “4” & “7” represent  $\pm V_{cc}$ .
- Pin “1” & “5” represent offset null terminals.
- Pin “8” represents NC terminal (not connected).

**Q.28** Answer is “B”

**Solution:-**

By ohm's Law

$$I = \frac{\Delta V}{R} = \frac{-4 - V_-}{8k\Omega} \quad (\because V_- \approx V_+ = 0)$$

$$I = \frac{-4 - 0}{8k\Omega} = -0.5mA$$

STEP ENTRY TEST 2020

**Worksheet-06**

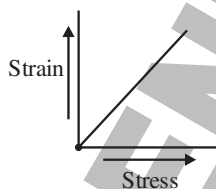
**Topics:- Stress strain & Young's Modulus, Hook's Law, Elastic & Plastic deformation, Strain energy, Energy Band Theory**

- Q.1** The amount of strain energy stored in deformed stretched wire is equal to:
- A)  $\frac{1}{2} \left[ \frac{EAl_1^2}{L} \right]$                       C)  $\frac{1}{2} \left[ \frac{EAl_1}{2} \right]$
- B)  $\frac{1}{2} [EAl_1]^3$                       D)  $\left[ \frac{EAl_1}{2} \right]$
- Q.2** Glass and high carbon steel are examples of:
- A) Hard substances                      C) Brittle substances
- B) Ductile substances                      D) None of these
- Q.3** Substance which break just after the elastic limit is reached, are called:
- A) Brittle substances                      C) Soft substances
- B) Hard substances                      D) Ductile substances
- Q.4** Two bars A and B of circular cross-sectional area and of same volume made of same material are subjected to tension. If the diameter of A is half that of B and if force applied to both rods is the same, the ratio of extension of A to that of B will be:
- A) 16                      C) 4
- B) 8                      D) 2
- Q.5** The substances which undergo plastic deformation until they break are called:
- A) Soft substances                      C) Brittle substances
- B) Ductile substances                      D) Hard substances
- Q.6** The value of stress beyond which the body is permanently deformed is called:
- A) Yield stress                      C) Plastic stress
- B) Minimum stress                      D) None of these
- Q.7** If stress is increased beyond the elastic limit of the material, it becomes permanently changed this behavior is called:
- A) Plasticity                      C) Yield strength
- B) Elasticity                      D) Rigidity
- Q.8** Stress is directly proportional to strain within the elastic limit is:
- A) Newton's law                      C) Hook's law

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SCRATCH WORK



- B) Lenz's law                      D) Faraday's law
- Q.9 S.I unit of modulus of elasticity is/are:**  
A) Pascal                      C) Ampere  
B) Newton                      D) Volt
- Q.10 Temporary deformation is called:**  
A) Elastic deformation                      C) Yield strength  
B) Plastic deformation                      D) Soft deformation
- Q.11 Beyond ultimate tensile stress the stress at which material breaks is called:**  
A) Fracture stress                      C) Volumetric stress  
B) Tensile stress                      D) Rigidity
- Q.12 The units of elastic limit are of:**  
A) Energy density                      C) Both "A" and "B"  
B) Young's modulus                      D) No units
- Q.13 The area under stress-strain graph provides \_\_\_\_\_ stored in deformed object:**  
A) Energy                      C) Modulus of rigidity  
B) Energy density                      D) Energy intensity
- Q.14 The modulus of elasticity depends upon:**  
A) Nature of material                      C) Both "A" and "B"  
B) Temperature                      D) Area of cross section
- Q.15 The slope of the following graph provides:**



- A) Modulus of elasticity                      C) Hardness  
B) Compressibility                      D) Ductility
- Q.16 The units of proportional limit are:**  
A)  $\text{N m}^{-2}$                       C) Both "A" and "B"  
B) Pascal                      D) No units
- Q.17 What is the relation between stress  $\sigma$  and modulus of elasticity (Y) if length of a wire under stress is doubled?**  
A)  $\sigma > Y$                       C)  $\sigma = Y$   
B)  $\sigma < Y$                       D) None of these

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SCRATCH WORK

- Q.18** The stress has same units as that of:
- A) Pressure  
B) Energy density  
C) Bulk modulus  
D) All of these
- Q.19** A wire of radius “r”, breaking force  $F_B$  and breaking stress ( $\sigma_B$ ) is stretched such that its radius becomes half, the new breaking force and stress will be:
- A)  $F_B, \sigma_B$   
B)  $\frac{F_B}{4}, \sigma_B$   
C)  $\frac{F_B}{2}, \frac{\sigma_B}{2}$   
D) None of these
- Q.20** A wire breaks if a load of “W” is suspended with it. Now if it is cut into two equal parts these parts will break if a load of \_\_\_\_\_ is suspended.
- A)  $\frac{W}{2}$   
B) W  
C)  $\frac{W}{4}$   
D)  $\frac{W}{3}$
- Q.21** The breaking stress depends on:
- A) Material of wire  
B) Area of cross section of wire  
C) Length of wire  
D) Diameter of wire
- Q.22** Compressive stress is given by:
- A)  $\frac{F}{\ell}$   
B)  $FA$   
C)  $\frac{F}{V}$   
D)  $\frac{F}{A}$
- Q.23** The breaking force of a wire depends on:
- A) Material of wire  
B) Area of cross section of wire  
C) Change in length of wire when stress is applied  
D) All of these
- Q.24** The ratio of tensile stress to volume stress has units same as that of:
- A) Area  
B) Length  
C) Volume  
D) Refractive index
- Q.25** A wire is stretched so that its length becomes double of initial length. The strain produced is:

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SCRATCH WORK

- A) 2  
B)  $\frac{1}{2}$
- C) 1  
D) 4
- Q.26** A load “W” is suspended with a wire causes an extension of “ $\Delta \ell$ ” in the length of wire. Now if the wire is cut into two equal parts & same load is suspended with each part, the extension caused in each part will be:
- A)  $\Delta \ell$   
B)  $2\Delta \ell$
- C)  $\frac{\Delta \ell}{2}$   
D)  $\frac{\Delta \ell}{4}$
- Q.27** If a stress changes the shape of a crystal by  $45^\circ$ , the strain occurred will be :
- A)  $\frac{1}{\sqrt{2}}$   
B) 1
- C)  $\sqrt{2}$   
D)  $\frac{1}{2}$
- Q.28** If the temperature of a copper wire is increased, its modulus of elasticity \_\_\_\_\_.  
A) Increases  
B) Remains same
- C) Decreases  
D) Becomes infinity
- Q.29** The ratio of compressive stress to compressive strain is called \_\_\_\_\_.  
A) Young’s Modulus  
B) Shear Modulus
- C) Bulk Modulus  
D) Modulus of rigidity
- Q.30** The extension occurred in a wire depends on (For same applied force):  
A) Initial length of wire  
B) Area of cross section of wire  
C) Material of wire  
D) All of these
- Q.31** To cause greater extension a wire should be:  
A) Thin and short  
B) Thin and long
- C) Thick and long  
D) Thick and short
- Q.32** Young’s Modulus is also named as:  
A) Modulus of rigidity  
B) Shear modulus
- C) Bulk modulus  
D) Tensile modulus

USE THIS SPACE FOR  
SCRATCH WORK

**Q.33** The reciprocal of bulk modulus is called:

- A) Stiffness C) Hardness  
B) Toughness D) Compressibility

**Q.34** Shear modulus and Young's modulus for water are:

- A) Undefined C) Zero  
B)  $2.2 \times 10^9 \text{ Nm}^{-2}$  D) None of these

**Q.35** Modulus of rigidity is another name for:

- A) Young's modulus C) Bulk modulus  
B) Shear modulus D) None of these

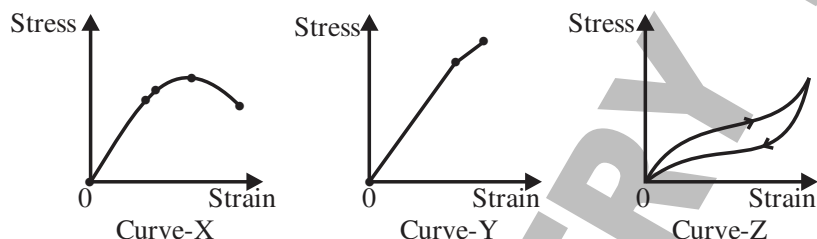
**Q.36** Modulus of elasticity for a perfect elastic/rigid body is:

- A) Zero C) Very large  
B) Very small D) Infinite

**Q.37** Which of following is more elastic?

- A) Rubber C) Glass  
B) Steel D) Lead

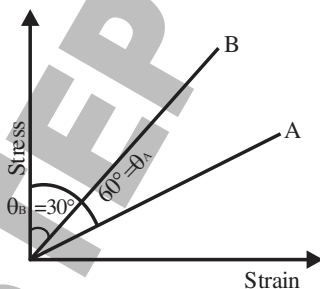
**Q.38** Three stress-strain graph are shown as:



Curve X, Y & Z represent which substance respectively?

- A) Brittle, ductile, rubber  
B) Rubber, brittle, ductile  
C) Ductile, brittle, rubber  
D) None of these

**Q.39** The stress-strain graphs for two wires of A and B are shown as:



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$$\frac{Y_A}{Y_B} = \underline{\hspace{2cm}} ?$$

- A) 1:3  
B)  $\sqrt{3}:1$   
C) 3:1  
D)  $1:\sqrt{3}$

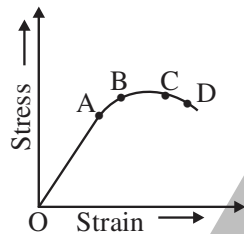
**Q.40** The slope of graph between strain and stress taking strain on y-axis and stress on x-axis represents?

- A) Elastic modulus  
B) Energy density  
C) Tensile stress  
D) Reciprocal of elastic modulus

**Q.41** In a tensile test a wire is stretched such that its radius becomes half of present value when the load suspended is doubled. If the initial value of Young's Modulus is "Y", then new value of Modulus will be:

- A) 2Y  
B) 4Y  
C)  $\frac{Y}{2}$   
D) Y

**Q.42** In the following curve for a ductile substance the plasticity behavior is from:



- A) O to A  
B) O to C  
C) O to B  
D) B to C

**Q.43** Referring to graph shown in Question 42, Hook's law is obeyed from:

- A) O to A  
B) O to C  
C) O to B  
D) B to C

**Q.44** Referring to graph shown in Question 42, the elasticity region is from:

- A) O to A  
B) O to C  
C) O to B  
D) B to C

**Q.45** A stress of  $200 \times 10^5$  Pa is applied on a 2 m long rod through a mass of 5000 Kg. If the linear strain of the rod is  $10^{-4}$  m, the Young's modulus Y is:

- A)  $1.5 \times 10^{-4}$  Pa  
B)  $2 \times 10^5$  Pa  
C)  $1.5 \times 10^4$  Pa  
D)  $200 \times 10^9$  Pa

**Q.46** An iron cube of length 1 m is acted upon by a tangential

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SCRATCH WORK

force of  $10^5$  N due to which the upper face the cube is displaced by 0.02 cm w.r.t the bottom face. Then the shearing stress of the cube will be:

- A) 0.02 Pa  
B)  $0.02 \times 10^5$  Pa  
C)  $10^5$  Pa  
D)  $3 \times 10^5$  Pa

**Q.47** Referring to data in Question 46, what will be the shearing strain?

- A) 0.02  
B)  $0.02 \times 10^{-2}$   
C)  $10^5$   
D)  $2 \times 10^5$

**Q.48** A certain force increases the length of a wire by 1 mm which of the following is required to increase the length by 2 mm:

- A) 2F  
B) 8F  
C) 4F  
D) 16F

**Q.49** Steel has greater modulus of elasticity than rubber thus for larger strain in rubber it requires stress:

- A) Less as compared to steel  
B) Larger as compared to steel  
C) Equal as compared to steel  
D) Very high as compared to steel

**Q.50** A steel wire 12 mm in diameter is stretched by a force of  $36\pi$  N, the tensile stress will be:

- A) 2 MPa  
B)  $0.5 \mu\text{Pa}$   
C) 1 MPa  
D) None of these

**Q.51** A steel wire is loaded by 2 Kg, if the radius of the wire is halved uniformly, then length becomes:

- A) Double  
B) Four times  
C) Half  
D) Remains same

**Q.52** There are two wires A and B of same material and same length while the diameter of wire B is 2 times the diameter of wire A. Then ratio of the extensions produced in the wires by applying the same force will be

- A) 1:1  
B) 3:1  
C) 2:1  
D) None of these

**Q.53** Two wires of the same material and radius but having lengths in the ratio 1:2 are stretched with the same force. The ratio of the work done in the two cases will be:

- A) 1:1  
B) 1:4  
C) 1:2  
D) None of these

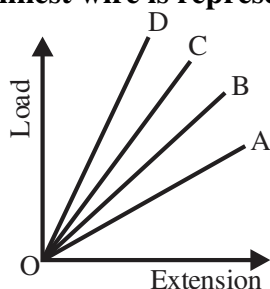
**Q.54** Which of following option contain only Brittle substances?

- A) Cast iron, ice, high carbon steel  
B) Platinum, mild steel, glass  
C) Lead, ice, glass  
D) None of these

USE THIS SPACE FOR  
SCRATCH WORK



- Q.55 If stress is applied on a body then ratio of change in volume to original volume will be:  
A) Polymeric strain C) Volumetric strain  
B) Parallel strain D) Tensile strain
- Q.56 Following four wires of length  $L$  and radius  $r$  are made from same material. Which of the following has largest elongation when same tension is applied?  
A)  $L=50$  cm,  $r=0.25$  mm C)  $L=60$  cm,  $r=0.1$  mm  
B)  $L=50$  cm,  $r=0.5$  mm D)  $L=60$  cm,  $r=1$  mm
- Q.57 The load versus elongation graph for some material is shown. The thinnest wire is represented by:



- A) OB C) OD  
B) OA D) OC
- Q.58 A rubber cord 10m long is suspended vertically. How much stress is applied on it due to its own weight while density of rubber is  $1500 \text{ kgm}^{-3}$  and  $Y = 5 \times 10^8 \text{ Nm}^{-2}$ ?  
A)  $1500 \text{ Nm}^{-2}$  C)  $150000 \text{ Nm}^{-2}$   
B)  $15000 \text{ Nm}^{-2}$  D)  $30000 \text{ Nm}^{-2}$
- Q.59 The Young's Modulus of steel is twice that of brass. Two wires of same length and of same area of cross section, one of steel and other of brass are suspended from same roof. We want the lower ends of the wires to be at the same level, then the weight added to the steel and brass wires must be in the ratio of:  
A) 1:2 C) 4:1  
B) 2:1 D) 1:1
- Q.60 A metal rod of Young's Modulus  $2 \times 10^{10} \text{ Nm}^{-2}$  undergoes an elastic strain of 0.06%. The energy per unit volume stored in  $\text{Jm}^{-3}$  is:  
A) 3600 C) 1800  
B) 7200 D) 900
- Q.61 The electrical properties of solids are successfully explained by \_\_\_\_\_ which is based on \_\_\_\_\_.  
A) Conventional free electron theory, Bohr model  
B) Classical theory, Rutherford model  
C) Energy band theory, Rutherford model

- D) Energy band theory, wave mechanical model
- Q.62 The electrical conductivities of semiconductors ranges from:**
- A)  $10^7$  to  $10^9 (\Omega \text{ m})^{-1}$       C)  $10^{-6}$  to  $10^{-2} (\Omega \text{ m})^{-1}$   
B)  $10^{-20}$  to  $10^{-10} (\Omega \text{ m})^{-1}$       D)  $10^{-6}$  to  $10^{-4} (\Omega \text{ m})^{-1}$
- Q.63 Which one is not similarity between conductors and semiconductors?**
- A) Both have partially fill conduction band  
B) Both have partially fill valence band  
C) Both can conduct current  
D) Both become insulator at zero kelvin
- Q.64 The majority charge carriers in n-type substance are:**
- A) Electrons      C) Positive charges  
B) Holes      D) All of these
- Q.65 The minority charge carriers in p-type substance are:**
- A) Electrons      C) Positive charges  
B) Holes      D) All of these

ANSWER KEY (Worksheet-06)							
1	A	21	A	41	D	61	D
2	C	22	D	42	D	62	D
3	A	23	D	43	A	63	D
4	A	24	D	44	C	64	A
5	B	25	C	45	D	65	A
6	A	26	C	46	C		
7	A	27	B	47	B		
8	C	28	C	48	A		
9	A	29	A	49	A		
10	A	30	D	50	C		
11	A	31	B	51	B		
12	C	32	D	52	D		
13	B	33	D	53	C		
14	C	34	C	54	A		
15	B	35	B	55	C		
16	C	36	D	56	C		
17	C	37	B	57	B		
18	D	38	C	58	C		
19	B	39	A	59	B		
20	B	40	D	60	A		

### SOLUTIONS

#### Unit – 7 (WS-06)

Q.1 Answer is “A”

**Solution:-** Strain Energy =  $\frac{1}{2} \left[ \frac{EA\ell_1^2}{L} \right]$

Here;

$\ell_1 = \Delta\ell$  and  $L$  = Initial Length

$A$  = area of cross section

$E$  = Elastic Modulus

Q.2 Answer is “C”

**Solution:-** The examples of Brittle Substances are; Glass, high carbon steel, cast iron, ice, various ceramics etc.

The examples of ductile substances are; Lead, Copper, Aluminium, Platinum, wrought iron mild steel etc.

Q.3 Answer is “A”

**Solution:-** “The substances which break just after the elastic limit is reached are called brittle substances.”

Q.4 Answer is “A”

**Solution:-**

$V_1 = V_2, F_1 = F_2, Y_1 = Y_2$

Extension is given as:

$$\Delta\ell = \frac{F\ell}{YA} = \frac{F(\ell A)}{YA^2} = \frac{FV}{YA^2}$$

Since

$F$ ,  $V$  and  $Y$  is same, so;

$$\frac{\Delta\ell_1}{\Delta\ell_2} = \frac{A_2^2}{A_1^2} = \frac{d_2^4}{d_1^4}$$

Put  $d_1 = \frac{d_2}{2}$  and solve.

Q.5 Answer is “B”

**Solution:-** “The substances which undergo plastic deformation until they break are called ductile substances.”

Q.6 Answer is “A”

**Solution:-** “The value of stress beyond which a body is permanently deformed is called yield stress.”

Q.7 Answer is “A”

**Solution:-** “The permanent deformation of substances is called plasticity.”

Q.8 Answer is “C”

**Solution:-** Hook’s Law states:

“Within the elastic limits (upto proportional limits) of a substance, the stress applied is directly proportional to strain produced in that substance.”

Q.9 Answer is “A”

**Solution:-**

Modulus of Elasticity =  $\frac{\text{stress}}{\text{strain}} = \frac{N}{m^2}$

Modulus of elasticity = Pascal

Q.10 Answer is “A”

**Solution:-** Temporary deformation is called elastic deformation, while permanent deformation is called plastic deformation.

**Q.11 Answer is “A”**

**Solution:-** “Breaking stress/Fracture stress is the stress at which the structure of material breaks.”

**Q.12 Answer is “C”**

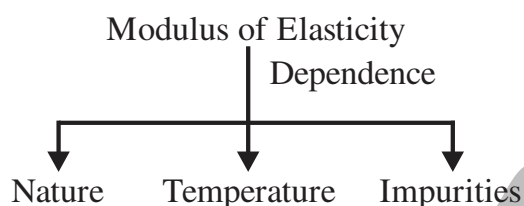
**Solution:-** Elastic limit is basically stress, so it has units of stress, which are same as that of elastic modulus & energy density.

**Q.13 Answer is “B”**

**Solution:-** Area under stress strain curve gives energy density while area under force elongation graph gives energy.

**Q.14 Answer is “C”**

**Solution:-**



**Q.15 Answer is “B”**

**Solution:-**

$$\text{Slope} = \frac{\Delta y}{\Delta x} = \frac{\Delta \text{strain}}{\Delta \text{stress}} = \text{compressibility}$$

**Q.16 Answer is “C”**

**Solution:-** Proportional limit is basically stress, so it has units of stress.

**Q.17 Answer is “C”**

**Solution:-** Doubling the length makes strain=1, So,

$$Y = \frac{\sigma}{\text{strain}} = \sigma$$

**Q.18 Answer is “D”**

**Solution:-** The unit of stress, pressure, elastic modulus and energy density are same i.e  $\text{Nm}^{-2}$  or Pascal.

**Q.19 Answer is “B”**

**Solution:-** Breaking force of a wire is given as

$F_B = \sigma_B A = \sigma_B (\pi r^2)$  this breaking force depends on:

- Breaking stress  $\sigma_B$  (which further depends on the nature of material of wire,  $\sigma_B$  does not depend on dimensions of wire.)
- Area of cross section (which further depend on radius of wire)

Since the radius of wire is halved, so area of cross section of wire and its breaking force becomes  $\frac{1}{4}$  times while breaking stress remains same as material of wire is not changed.

**Q.20 Answer is “B”**

**Solution:-** Breaking Force/Load depends on:

- Breaking stress (which further depend on material of wire)
- Area of cross section (which further depend on radius of wire)

By cutting the wire, neither area of cross section changes nor breaking stress changes, so breaking load remains same.

**Q.21 Answer is “A”**

**Solution:-** Breaking stress is the property of material of wire, so it only depend on the material of wire and not the dimensions of wire.

**Q.22 Answer is “D”**

**Solution:-** All the types of stress have same formula i.e  $\frac{F}{A}$

**Q.23 Answer is “D”**

**Solution:-** Breaking force of a wire is given as:

$$F_B = \sigma_B A = \sigma_B (\pi r^2)$$

It depends on:

- Breaking stress (which further depends on material of wire)
- Area of cross section (which further depend of radius of wire, also if wire is stretched then because of change in length of wire both its radius and area change and hence it will change breaking force as well).

**Q.24** Answer is “D”

**Solution:-**

$$\frac{\text{Tensile stress}}{\text{Volume stress}} = \frac{\left(\frac{F}{A}\right)}{\left(\frac{F}{A}\right)} = \text{unitless}$$

**Q.25** Answer is “C”

**Solution:-**  $\text{Strain} = \frac{\Delta \ell}{\ell} = \frac{2\ell - \ell}{\ell} = 1$

**Q.26** Answer is “C”

**Solution:-**  $\Delta \ell \propto \ell$

**Q.27** Answer is “B”

**Solution:-**  $\text{Shear strain} = \tan \theta$

**Q.28** Answer is “C”

**Solution:-**

$$\text{Modulus of Elasticity} \propto \frac{1}{\text{temperature}}$$

**Q.29** Answer is “A”

**Solution**

$$\text{Tensile/Young's Modulus} = \frac{\text{Tensile (compressive) Stress}}{\text{Tensile (compressive) Strain}}$$

**Q.30** Answer is “D”

**Solution:-**  $\Delta \ell = \frac{FL}{YA}$

**Q.31** Answer is “B”

**Solution:-**  $\Delta \ell = \frac{FL}{YA}$  and  $\frac{\Delta \ell}{\ell} \propto \frac{L}{A}$

**Q.32** Answer is “D”

**Solution:-**

- Modulus of rigidity is another name of shear modulus.
- Tensile modulus is another name of Young's Modulus.

**Q.33** Answer is “D”

**Solution:-** Compressibility is defined as:

$$\text{Compressibility} = \frac{1}{\text{Bulk Modulus}}$$

**Q.34** Answer is “C”

**Solution:-** For fluids both  $Y=0$  and  $G=0$

**Q.35** Answer is “B”

**Solution:-**

- Modulus of rigidity is another name of shear modulus
- Tensile modulus is another name of Young's Modulus

**Q.36** Answer is “D”

**Solution:-** For ideal rigid body

$$\Delta \ell = 0; \Delta V = 0; \Delta \theta = 0 \text{ So, } Y = G = K = \infty$$

**Q.37** Answer is “B”

**Solution:-** Among the given options, rubber is least elastic while steel is most elastic.

**Q.38** Answer is “C”

**Solution:-** Curve-X represents ductile substance as it contains plastic region, Curve-Y represents Brittle substance as it contains only elastic region and Curve-Z represents the loading & unloading of rubber.

**Q.39** Answer is “A”

**Solution:-** Slope of stress-strain graph

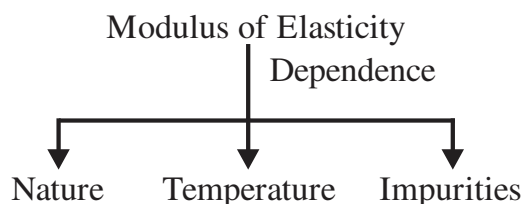
$$\frac{\Delta \text{stress}}{\Delta \text{strain}} = \tan \theta = Y$$

Q.40 Answer is "D"

**Solution:-** Slope  $= \frac{\Delta y}{\Delta x} = \frac{\Delta \text{strain}}{\Delta \text{stress}}$

Q.41 Answer is "D"

**Solution:-**



Q.42 Answer is "D"

**Solution:-**

- From O→A the region is proportional limit region
- From O→B the region is elastic limit region
- From B→C the region is plasticity region

Q.43 Answer is "A"

**Solution:-**

- From O→A the region is proportional limit region
- From O→B the region is elastic limit region
- From B→C the region is plasticity region

Q.44 Answer is "C"

**Solution:-**

- From O→A the region is proportional limit region
- From O→B the region is elastic limit region
- From B→C the region is plasticity region

Q.45 Answer is "D"

**Solution:-**  $Y = \frac{\text{stress}}{\text{strain}}$

Q.46 Answer is "C"

**Solution:-**  $\sigma = \frac{F}{A} = \frac{F}{\ell^2}$

Q.47 Answer is "B"

**Solution:-**  $\gamma = \frac{\Delta a}{a} = \frac{\Delta a}{\ell}$

Q.48 Answer is "A"

**Solution:-**

By Hook's law

$$F \propto x$$

Q.49 Answer is "A"

**Solution:-** Elastic Modulus  $= \frac{\text{Stress}}{\text{Strain}}$

Thus for larger value of strain in less elastic material rubber, the stress will be smaller.

Q.50 Answer is "C"

**Solution:-**  $\sigma = \frac{F}{A} = \frac{F}{\pi r^2}$

Q.51 Answer is "B"

**Solution:-** If radius is halved, area becomes  $\frac{1}{4}$  times, so to keep volume constant length becomes four times.

Q.52 Answer is "D"

**Solution:-**  $\Delta \ell = \frac{F \times L}{A \times Y} \Rightarrow$

For same materials & same loads;

$$\frac{\Delta \ell_A}{\Delta \ell_B} = \frac{L_A A_B}{A_A L_B}$$

Q.53 Answer is "C"

**Solution:-**  $W = \frac{1}{2} F \times \Delta \ell \Rightarrow$

For two wires of same materials and same stretching force;



$$\frac{W_1}{W_2} = \frac{\Delta \ell_1}{\Delta \ell_2}$$

**Q.54** Answer is “A”

**Solution:-** The examples Brittle Substances are; Glass, high carbon steel, cast iron, ice, various ceramics etc.

The examples of Ductile substances are; Lead, Copper, Aluminium, Platinum, wrought iron mild steel etc.

**Q.55** Answer is “C”

**Solution:-** Volumetric strain =  $\frac{\Delta V}{V}$

**Q.56** Answer is “C”

**Solution:-**

Elongation in a wire is given as:

$$\Delta \ell = \frac{F\ell}{YA} = \frac{F\ell}{Y(\pi r^2)}$$

$$\Delta \ell \propto \frac{\ell}{r^2}$$

Since “ $\frac{\ell}{r^2}$ ” is maximum for option “C”, so elongation will be maximum for this wire.

**Q.57** Answer is “B”

**Solution:-**

Slope of this graph is given as:

$$\text{Slope} = \frac{\Delta F}{\Delta \ell} \text{-----(i)}$$

As extension in a wire is given as:

$$\Delta \ell = \frac{F\ell}{YA}$$

$$\frac{F}{\Delta \ell} = \frac{YA}{\ell}$$

From equation (i)

$$\text{Slope} = \frac{\Delta F}{\Delta \ell} = \frac{YA}{\ell}$$

Slope  $\propto A$

Since slope for graph “A is minimum, so wire – A (given in option B) is thinnest.

**Q.58** Answer is “C”

**Solution:-**

Stress is given as:

$$\sigma = \frac{F}{A} = \frac{mg}{A} = \frac{\rho Vg}{A} = \frac{\rho(A\ell)g}{A}$$

$$\sigma = \rho \ell g = 1500 \times 10 \times 10 = 150,000 \text{ N m}^{-2}$$

**Q.59** Answer is “B”

**Solution:-**

The extension is given as:

$$\Delta \ell = \frac{F\ell}{YA}$$

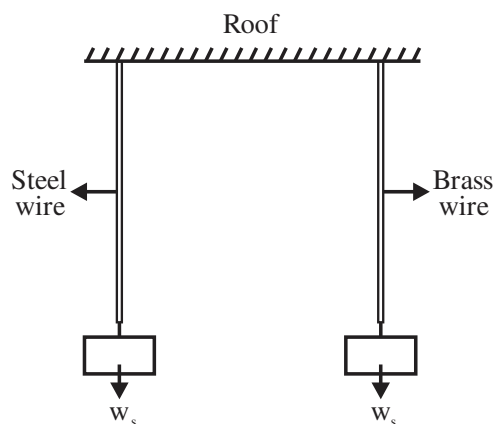
Separating the load/force

$$F = \frac{\Delta \ell YA}{\ell}$$

Applying this formula for both wires;

$$\frac{F_S}{F_B} = \frac{\left(\frac{\Delta \ell YA}{\ell}\right)_S}{\left(\frac{\Delta \ell YA}{\ell}\right)_B}$$

$$\frac{F_S}{F_B} = \frac{Y_S}{Y_B} = \frac{2Y_B}{Y_B} = \frac{2}{1}$$



$$(\therefore \Delta \ell_s = \Delta \ell_B, A_s = A_B, \ell_s = \ell_B)$$

**Q.60** Answer is “A”

**Solution:-**

$$(\text{energy per unit volume}) = \frac{1}{2} \sigma \epsilon = \frac{1}{2} Y \epsilon^2$$

$$= \frac{1}{2} \times 2 \times 10^{10} \times \left( \frac{0.06}{100} \right)^2$$

$$= 10^{10} \times 36 \times 10^{-8}$$

$$(\text{energy per unit volume}) = 3600 \text{ J m}^{-3}$$

**Q.61 Answer is “D”**

**Solution:-** Energy band theory explains the electrical properties of solids and it is based on wave-mechanical model.

**Q.62 Answer is “D”**

**Solution:-** For Semiconductors: Conductivity ranges from  $10^{-6}$  to  $10^{-4}$  ( $\Omega \text{ m}$ )<sup>-1</sup>.

**Q.63 Answer is “D”**

**Solution:-** Conductors don't become insulator at zero kelvin rather they become super conductors.

**Q.64 Answer is “A”**

**Solution:-** In N-type Semiconductors, the majority carriers are electrons.

**Q.65 Answer is “A”**

**Solution:-** Electrons are minority carriers in P-type semiconductor.

## Worksheet-07

**Topics:-** Energy of Photon, Photoelectric Effect,  
de-Broglie Wave Particle Duality

- Q.1** Which of the following light has highest momentum?  
A) Blue C) Yellow  
B) Violet D) Red
- Q.2** If energy of a photon A is twice the energy of photon B, then ratio of their momenta  $\frac{p_A}{p_B} =$   
A) 2 C) 4  
B)  $\frac{1}{2}$  D)  $\frac{1}{4}$
- Q.3** Which of the following properties, the photon does not possess:  
A) Rest mass C) Momentum  
B) Energy D) Frequency
- Q.4** The energy of a photon of frequency  $f$  is given by  $E = hf$ , where  $h$  is Plank's constant. The momentum of a photon of wavelength  $\lambda$  is  $p = \frac{h}{\lambda}$ . Then we may conclude that velocity of light is equal to:  
A)  $\left(\frac{E}{p}\right)^{\frac{1}{2}}$  C)  $Ep$   
B)  $\left(\frac{E}{p}\right)$  D)  $\left(\frac{E}{p}\right)^2$
- Q.5** If the value of  $h$  is  $6.6 \times 10^{-34}$  J s, the energy of a quantum of frequency  $10^{15}$  Hz will be:  
A)  $6.6 \times 10^{-19}$  J C)  $6.6 \times 10^{-49}$  J  
B)  $6.6 \times 10^{-12}$  J D)  $6.6 \times 10^{-41}$  J
- Q.6** If stopping potential is 3 volts. The maximum K.E of photoelectron is:  
A)  $1.6 \times 10^{-19}$  J C)  $4.8 \times 10^{-19}$  J  
B)  $3.2 \times 10^{-19}$  J D)  $6.4 \times 10^{-19}$  J
- Q.7**  $K.E_{\max}$  of photoelectrons depends upon.  
A) Intensity of light C) Energy of light  
B) Frequency of light D) Both B and C

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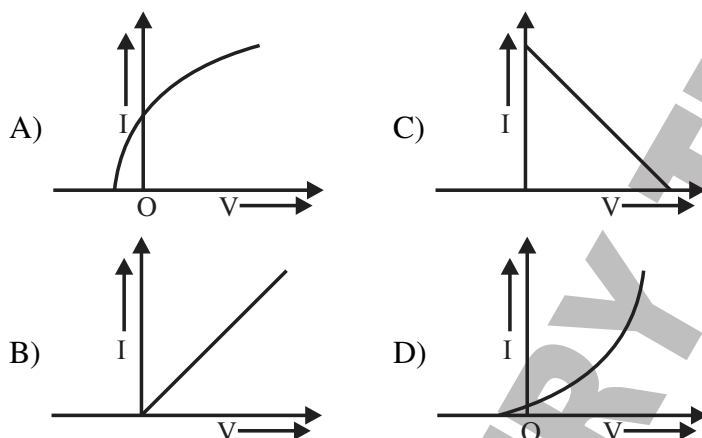
**Q.22** If a proton and an alpha particle are accelerated by same voltage, then the ratio of wavelengths associated with them is:

- A) 4:1  
B) 2:1  
C)  $2\sqrt{2}:1$   
D) 8:1

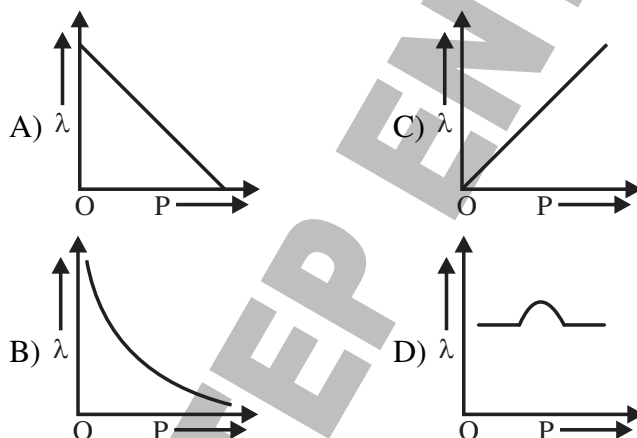
**Q.23** A bullet of mass 40 g and flying with speed  $165 \text{ m s}^{-1}$  will have a de-Broglie wavelength of:

- A)  $1 \times 10^{-34} \text{ m}$   
B)  $2.4 \times 10^{-34} \text{ m}$   
C)  $3.3 \times 10^{-34} \text{ m}$   
D)  $6.6 \times 10^{-34} \text{ m}$

**Q.24** The current-voltage (I-V) curve for a photo-cell is best represented by:



**Q.25** The de-Broglie wavelength ( $\lambda$ ) associated with a moving material particle varies with its momentum  $p$  as:



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**ANSWER KEY (Worksheet-07)**

1	B	11	A	21	D
2	A	12	D	22	C
3	A	13	C	23	A
4	B	14	D	24	A
5	A	15	A	25	B
6	C	16	C		
7	D	17	D		
8	B	18	D		
9	A	19	A		
10	A	20	A		

**SOLUTIONS****Unit – 10 (WS-07)**

Q.1 Answer is “B”

Solution:-  $p = \frac{h}{\lambda}$

Q.2 Answer is “A”

Solution:-  $E = mc^2 = pc$

Q.3 Answer is “A”

Solution:- The rest mass of photon is zero.

Q.4 Answer is “B”

Solution:-  $E = mc^2 = pc$

Q.5 Answer is “A”

Solution:-  $E = hf$

Q.6 Answer is “C”

Solution:-  $K.E = V_e$

Q.7 Answer is “D”

Solution:-  $K.E \propto E_{\text{photon}} \propto f$

Q.8 Answer is “B”

Solution:-  $\phi = hf$

Q.9 Answer is “A”

Solution:-

- Sodium or Potassium cathode emits electrons for visible light.
- Cesium coated oxidized silver emits electrons for infrared light.

Q.10 Answer is “A”

Solution:- Intensity  $\propto$  no. of electrons

Q.11 Answer is “A”

Solution:- Mass of a moving photon:

$$E = mc^2 = \frac{hc}{\lambda}$$

$$m = \frac{h}{\lambda c}$$

Q.12 Answer is “D”

Solution:- See Einstein’s photoelectric equation i.e

$$K.E_{\text{max}} = E_{\text{photon}} - \phi$$

Q.13 Answer is “C”

Solution:-  $V_o \propto f$

Q.14 Answer is “D”

Solution:-  $K.E = E_{\text{photon}} - \phi$

Q.15 Answer is “A”

Solution:-  $\text{Slope} = \frac{\Delta K.E}{\Delta f} = h$

Q.16 Answer is “C”

Solution:-  $\frac{\phi_1}{\phi_2} = \frac{f_1}{f_2} = \frac{\lambda_2}{\lambda_1}$

Q.17 Answer is “D”

Solution:- Stopping potential does not depend on distance and Intensity.

**Q.18** Answer is "D"

**Solution:-** Davisson & Germer experiment shows wave nature of particles.

**Q.19** Answer is "A"

**Solution:-**  $\lambda = \frac{h}{mv} \Rightarrow \lambda \propto \frac{1}{v}$

**Q.20** Answer is "A"

**Solution:-**  $\lambda_1 = \lambda_2 \Rightarrow \frac{h}{m_1 v_1} = \frac{h}{m_2 v_2}$

$$\Rightarrow \frac{v_1}{v_2} = \frac{m_2}{m_1} \Rightarrow v \propto \frac{1}{m}$$

**Q.21** Answer is "D"

**Solution:-**

$$\lambda = \frac{h}{\sqrt{2mVe}}$$

$$\lambda = \frac{h}{\sqrt{2mK.E}}$$

$$\lambda \propto \frac{1}{\sqrt{K.E}}$$

**Q.22** Answer is "C"

**Solution:-**

$$\lambda = \frac{h}{\sqrt{2mVe}} \Rightarrow \frac{\lambda_1}{\lambda_2} = \sqrt{\frac{m_2 e_2}{m_1 e_1}}$$

**Q.23** Answer is "A"

**Solution:-**

$$m = 40 \text{ g} = 0.04 \text{ kg}; \quad v = 165 \text{ m s}^{-1}$$

$$\lambda = \frac{h}{mv} = \frac{6.63 \times 10^{-34}}{0.04 \times 165} = 1 \times 10^{-34} \text{ m}$$

**Q.24** Answer is "A"

**Solution:-** Photoelectric current is zero at stopping potential. When potential

is decreased from stopping potential to zero and then increased on positive side current increase for some time and then becomes constant.

**Q.25** Answer is "B"

**Solution:-**  $\lambda = \frac{h}{mv} = \frac{h}{p} \Rightarrow \lambda \propto \frac{1}{p}$

**Worksheet-08**

**Topics:- Hydrogen Spectrum, Bohr's Model of Hydrogen Atom, X-rays**

- Q.1** Transitions of electrons between the various shells can produce:  
 A) Continuous X – rays      C) Both X-rays  
 B) Characteristic X-rays      D) Soft X-rays
- Q.2** K-series of characteristic X-rays are produced when all the transitions of inner-shell electrons terminate on:  
 A) M-shell      C) K-shell  
 B) N-shell      D) L-shell
- Q.3** The reverse process of photo-electric effect is called:  
 A) Pair production      C) X-rays production  
 B) Compton effect      D) Radioactivity
- Q.4** X-rays were discovered by:  
 A) Compton      C) De-Broglie  
 B) Roentgen      D) Maxwell
- Q.5** X-rays can exhibit the phenomenon of:  
 A) Interference      C) Polarization  
 B) Diffraction      D) All of these
- Q.6** The rest mass of X-rays photon is:  
 A) Infinite      C)  $9.1 \times 10^{-31}$  kg  
 B) Zero      D)  $1.67 \times 10^{-27}$  kg
- Q.7** X-rays are:  
 A) Electromagnetic waves      C) Mechanical waves  
 B) Longitudinal waves      D) Matter waves
- Q.8** The velocity of X-rays is equal to:  
 A)  $\alpha$  – rays      C)  $\beta$  – rays  
 B)  $\gamma$  – rays      D) Sound waves
- Q.9** X-rays can be used to:  
 A) Treat cancer      C) Detect flaws in welding  
 B) Detect bone fractures      D) All of above
- Q.10** X-rays are deflected by:  
 A) Electric field only  
 B) Magnetic field only  
 C) Electric and magnetic field both  
 D) Can't be deflected

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- Q.11 X-Rays are produced in an evacuated glass tube called:**  
 A) Wilson cloud tube                      C) Colloidal tube  
 B) G.M tube                                      D) Coolidge tube
- Q.12 Continuous X-Rays are produced by:**  
 A) Accelerating electrons                  C) Both "A" and "B"  
 B) Decelerating electrons                  D) Inner shell transitions
- Q.13 X-Rays can pass easily through:**  
 A) Aluminum                                      C) Human flesh  
 B) Wood    D) All of these
- Q.14 Which of the following characteristic X-Ray is most energetic:**  
 A)  $K_{\alpha}$     C)  $L_{\alpha}$   
 B)  $K_{\beta}$     D)  $L_{\beta}$
- Q.15 Generally softer X-Rays are used in:**  
 A) CAT scanning                                  C) Industry  
 B) Forensic applications                      D) Both "A" and "B"
- Q.16 Wavelength of characteristics X-ray depend upon:**  
 A) Filament current                              C) Nature of metal  
 B) Accelerating potential                      D) Both "B" and "C"
- Q.17 Minimum wavelength of X-Rays depend upon:**  
 A) Target material  
 B) Accelerating Voltage  
 C) Filament current  
 D) Intensity of incident electrons
- Q.18 In Coolidge tube target material used may be:**  
 A) Aluminum                                      C) Tungsten  
 B) Molybdenum                                  D) Both "B" and "C"
- Q.19 Hydrogen atom is not capable of emitting X-rays because:**  
 A) Its size is small  
 B) It contains infinite energy states  
 C) It's energy levels are very close to each other  
 D) It exists in molecular form
- Q.20 X-Ray region lies between:**  
 A)  $\gamma$ -rays and radio waves                  C)  $\gamma$ -rays and ultraviolet  
 B) Cosmic rays and  $\gamma$ -rays                  D) Visible and Infrared

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- Q.21** If electron of 60 keV strike a heavy target. Then radiation emitted by target will be:  
A) Visible light C) Ultraviolet  
B) Radio waves D) X-rays
- Q.22** When X-rays photograph of patient is taken, then majority of X – Rays are absorbed in?  
A) Flesh C) Bones  
B) Muscles D) All of these
- Q.23** X-rays are not used in RADAR, because:  
A) X-rays are not reflected by target  
B) X-rays are completely absorbed by air  
C) X-rays damage the target  
D) All of the above
- Q.24** X-ray photons are absorbed in tissues, they break molecular bonds and create highly reactive free radicals which in turn can disturb the molecular structure of the proteins and especially:  
A) The genetic material C) Bones  
B) Flesh D) Teeth
- Q.25** For the production of X-rays cathode should have the following properties:  
A) Low value of work function  
B) High value of work function  
C) A low heat capacity  
D) Both “A” and “C”
- Q.26** Computed Tomography is specially used to check the tumor in:  
A) Brain C) Liver  
B) Abdomen D) Lungs
- Q.27** In CAT scanner the beam of X-rays used is of:  
A) Spherical shaped C) Rectangular shape  
B) Fan shaped D) All of these
- Q.28** Which of the following X-rays depend upon target material for their speed?  
A) Characteristic X-rays C) Both “A” and “B”  
B) Continuous X-rays D) None of these

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- Q.29** The hardest photon coming out of X-rays tube must belong to:
- A) Characteristic X-rays      C) Both "A" and "B"  
B) Continuous X-rays      D) Can't be sure
- Q.30** The hardness is:
- A) Directly proportional to " $f$ "  
B) Inversely proportional to " $\lambda$ "  
C) Both "A" and "B"  
D) Directly proportional to " $\lambda$ "
- Q.31** \_\_\_\_\_ deals with the study of wavelength and intensity of electromagnetic radiation spectrum emitted or absorbed by atoms.
- A) Relativity      C) Radioactivity  
B) Spectroscopy      D) Photoelectric effect
- Q.32** Velocity of electron in the first orbit is:
- A)  $2.19 \times 10^6 \text{ m s}^{-1}$       C)  $2.19 \times 10^7 \text{ m s}^{-1}$   
B)  $2.18 \times 10^7 \text{ m s}^{-1}$       D)  $2.2 \times 10^6 \text{ m s}^{-1}$
- Q.33** If a mono-atomic gas is ionized then it shows:
- A) Line spectrum      C) Band spectrum  
B) Continuous spectrum      D) visible spectrum
- Q.34** Velocity of electron in an orbit is \_\_\_\_\_ to/of principal quantum number.
- A) Directly proportional      C) Inversely proportional  
B) Not related      D) Proportional to square
- Q.35** Normally electrons in the hydrogen atom are in the:
- A) Ground state      C) Excited state  
B) Ionized state      D) Meta stable state
- Q.36** Free electron may have energy:
- A) Quantized      C) Integral of  $E_0$   
B) Half of  $E_0$       D) Any amount
- Q.37** Shortest wavelength of Lyman series is:
- A) 91 nm      C) 100 nm  
B) 9.1 nm      D) 10 nm
- Q.38** Radiation with wavelengths longer than red light is:
- A) Ultra violet      C) Visible  
B) X-rays      D) Infrared

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- Q.39** The excitation energy of an electron to send it to  $n = \infty$ , is equal to:
- A) Potential energy                      C) Kinetic energy  
B) Total energy                          D) Ionization energy
- Q.40** The ratio of kinetic energy and the total energy of the electron in the hydrogen atom is.
- A) 1:1    C) 1:2  
B) 1: -1                                      D) 1: -2
- Q.41** Which of these series of hydrogen spectrum lies in the ultra-violet region?
- A) Paschen series                      C) Pfund series  
B) Brackett series                      D) Lyman series
- Q.42** The ratio of longest and shortest wavelengths of Lyman series is:
- A)  $\frac{4}{3}$     C)  $\frac{9}{5}$   
B)  $\frac{9}{4}$     D)  $\frac{16}{5}$
- Q.43** With increasing quantum number, the energy difference between adjacent levels in atoms:
- A) Increases                                  C) Remains constant  
B) Decreases                                  D) Increases only for high Z
- Q.44** If L is angular momentum of electron in the 2<sup>nd</sup> orbit of hydrogen atom then angular momentum in the fourth orbit will be.
- A) 2L    C)  $\frac{3}{L}$   
B)  $\frac{L}{2}$     D)  $\frac{L}{3}$
- Q.45** Photon of smallest wavelength will be absorbed when transition takes place from \_\_\_\_\_ to \_\_\_\_\_ orbit.
- A) 2, 6    C) 3, 6  
B) 1, 6    D) 4, 6
- Q.46** In an electronic transition, atom cannot emit.
- A) UV rays                                      C)  $\gamma$  -rays  
B) Visible light                                  D) Infrared rays

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- Q.47** When an electron in hydrogen atom jumps from second orbit to first orbit then energy of photon emitted is:  
A) 13.6 eV C) 10.2 eV  
B) 3.4 eV D) 10.2 V
- Q.48** The longest wavelength of radiation for the paschen series is:  
A) 1094 nm C) 234 nm  
B) 1875 nm D) 91 nm
- Q.49** The value of principal quantum to find maximum value of wavelength in Pfund series is:  
A) 3 C) 5  
B) 4 D) 6
- Q.50** For the hydrogen atom, the ratio  $\frac{\Delta r_{23}}{\Delta r_{34}} = \text{---}$ , where  
 $\Delta r_{23} = \text{distance between 2}^{\text{nd}}$  and  $3^{\text{rd}}$  shell and  
 $\Delta r_{34} = \text{distance between 3}^{\text{rd}}$  and  $4^{\text{th}}$  shell.  
A)  $\frac{3}{4}$  C)  $\frac{3}{7}$   
B)  $\frac{5}{4}$  D)  $\frac{5}{7}$
- Q.51** Which Postulate of Bohr's Model of the hydrogen atom contradict with classical physics?  
A) 1<sup>st</sup> C) 3<sup>rd</sup>  
B) 2<sup>nd</sup> D) All of these
- Q.52** The ratio of K.E to P.E for an electron in 5<sup>th</sup> shell of hydrogen atom is:  
A) 2:1 C) 5:25  
B) 1:2 D) 3:4
- Q.53** Which one is the example of continuous spectrum?  
A) Atomic spectrum  
B) Molecular spectrum  
C) Black body radiation spectrum  
D) None of these
- Q.54** The excitation energy of electron is \_\_\_\_\_ than/to the ionization energy in Hydrogen atom?  
A) Greater C) Equal  
B) Less D) Any of these

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- Q.55 The Rydberg constant has the dimensions:
- A) Reciprocal of length      C) Reciprocal of time  
B) Reciprocal of wavelength   D) Both A & B

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STEP ENTRY TEST 2020

**ANSWER KEY (Worksheet-08)**

1	B	16	C	31	B	46	C
2	C	17	B	32	A	47	C
3	C	18	D	33	A	48	B
4	B	19	C	34	C	49	D
5	D	20	C	35	A	50	D
6	B	21	D	36	D	51	A
7	A	22	C	37	A	52	B
8	B	23	A	38	D	53	C
9	D	24	A	39	D	54	B
10	D	25	D	40	B	55	D
11	D	26	A	41	D		
12	B	27	B	42	A		
13	C	28	D	43	B		
14	B	29	B	44	A		
15	D	30	C	45	B		

**SOLUTIONS****Unit – 10 (WS-08)****Q.1** Answer is “B”

**Solution:-** Transitions of electrons produce characteristic X-rays while deceleration of electrons produce continuous X-rays.

**Q.2** Answer is “C”

**Solution:-** The name of series is same as the ground state of electrons in that series.

**Q.3** Answer is “C”

**Solution:-** The reverse process of photoelectric effect is X-ray production.

**Q.4** Answer is “B”

**Solution:-** X-rays were discovered by Roentgen in 1895.

**Q.5** Answer is “D”

**Solution:-** X-rays are waves, so they exhibit all wave properties.

**Q.6** Answer is “B”

**Solution:-** Rest mass of any photon is zero.

**Q.7** Answer is “A”

**Solution:-** X-rays are electromagnetic waves as they require no medium for propagation.

**Q.8** Answer is “B”

**Solution:-** X-rays &  $\gamma$ -rays are electromagnetic waves and have same velocity i.e  $c = 3 \times 10^8 \text{ m s}^{-1}$

**Q.9** Answer is “D”

**Solution:-** Uses of X-rays.

**Q.10** Answer is “D”

**Solution:-** X-rays are composed of photons which are neutral.

**Q.11** Answer is “D”

**Solution:-** X-rays are produced in Coolidge tube.

**Q.12** Answer is “B”

**Solution:-** Transitions of electrons produce characteristic X-rays while deceleration of electrons produce continuous X-rays.

**Q.13** Answer is “C”

**Solution:-** X-rays can easily pass through soft media like human flesh.

**Q.14** Answer is “B”

**Solution:-**

Energy order: K-series > L-series > M-series

Further in K-series, the energy order is;

$$K_{\alpha} < K_{\beta} < K_{\gamma}$$

**Q.15 Answer is “D”**

**Solution:-** Uses of X-rays

**Q.16 Answer is “C”**

**Solution:-** Properties of characteristic X-rays depend on nature of material of anode.

**Q.17 Answer is “B”**

**Solution:-**  $\lambda_{\min} = \frac{hc}{Ve}$

**Q.18 Answer is “D”**

**Solution:-** Target material should have high melting point and high conductivity along with high atomic number. Both Tungsten & Molybdenum have these properties.

**Q.19 Answer is “C”**

**Solution:-** Energy gap between shells of hydrogen atom is not sufficient to produce X-rays.

**Q.20 Answer is “C”**

**Solution:-** X-rays lie between U.V and gamma rays.

**Q.21 Answer is “D”**

**Solution:-** Heavy elements usually emit X-rays

**Q.22 Answer is “C”**

**Solution:-** X-rays are absorbed more in hard parts of body like bones.

**Q.23 Answer is “A”**

**Solution:-** X-rays have high penetration power.

**Q.24 Answer is “A”**

**Solution:-** X-rays disturb the structure of genetic material.

**Q.25 Answer is “D”**

**Solution:-** Cathode should have

1. High M.P
2. Low work function
3. Low heat capacity

**Q.26 Answer is “A”**

**Solution:-** CAT-scanning is usually used to check tumor in brain.

**Q.27 Answer is “B”**

**Solution:-** CAT – Scanner produces fan shaped beam of X-rays.

**Q.28 Answer is “D”**

**Solution:-** All X-rays travel with speed of light.

**Q.29 Answer is “B”**

**Solution:-** Hardest photon is that which has maximum energy and it belong to “Continuous X-rays”.

**Q.30 Answer is “C”**

**Solution:-** Hardness  $\propto$  Energy  $\propto f \propto \frac{1}{\lambda}$

**Q.31 Answer is “B”**

**Solution:-** The study of wavelengths and Intensities of electromagnetic radiations emitted by atoms is called spectroscopy.

**Q.32 Answer is “A”**

**Solution:-** In first shell of hydrogen atom, electron moves with  $2.19 \times 10^6 \text{ m s}^{-1}$ .

**Q.33 Answer is “A”**

**Solution:-** Atoms usually give Line spectrum, molecules give Band spectrum and Black body gives continuous spectrum.

**Q.34 Answer is “C”**

**Solution:-**  $v \propto \frac{1}{n}$

**Q.35 Answer is “A”**

**Solution:-** Normally electrons in any atom stay in ground state.

**Q.36 Answer is “D”**

**Solution:-** Free electrons can have any amount of energy

**Q.37 Answer is “A”**

**Solution:-**  $\frac{1}{\lambda} = R_H \left( \frac{1}{1^2} - \frac{1}{n^2} \right)$

For longest wavelength put  $n = 2$ , for shortest wavelength put  $n = \infty$

**Q.38 Answer is “D”**

**Solution:-** Infrared radiation have longer wavelength than red light.

**Q.39 Answer is “D”**

**Solution:-** Energy to send electron to  $n = \infty$  is called Ionization energy.

**Q.40 Answer is “B”**

**Solution:-** Take ratio of final formulae of total energy and K.E.

**Q.41 Answer is “D”**

**Solution:-** Lyman series lies in U.V region.

**Q.42 Answer is “A”**

**Solution:-**  $\frac{1}{\lambda} = R_H \left( \frac{1}{1^2} - \frac{1}{n^2} \right)$

For longest wavelength put  $n = 2$ , for shortest wavelength put  $n = \infty$ .

**Q.43 Answer is “B”**

**Solution:-** Energy difference between adjacent shells decreases while moving away from nucleus.

**Q.44 Answer is “A”**

**Solution:-**  $L_n = n L_1$

**Q.45 Answer is “B”**

**Solution:-** Smallest wavelength corresponds to maximum energy which is emitted when electron moves from  $n=6$  to  $n=1$ .

**Q.46 Answer is “C”**

**Solution:-** Gamma rays are emitted by radioactive decay.

**Q.47 Answer is “C”**

**Solution:-** Simply take energy difference

**Q.48 Answer is “B”**

**Solution:-** Paschen series is;

$$\frac{1}{\lambda} = R_H \left( \frac{1}{3^2} - \frac{1}{n^2} \right)$$

Put  $n = 4$  and solve.

**Q.49 Answer is “D”**

**Solution:-** For  $\lambda_{\max}$ , energy gap should be minimum which is  $n = 6$  for Pfund series.

**Q.50 Answer is “D”**

**Solution:-**  $r_n = n^2 r_1$

**Q.51 Answer is “A”**

**Solution:-** 1<sup>st</sup> Postulate contradicts with classical physics.



Q.52 Answer is “B”

**Solution:-**  $K.E_n = \frac{ke^2}{2r_n} \Rightarrow P.E_n = \frac{ke^2}{r_n}$

Q.53 Answer is “C”

**Solution:-** Atoms usually give line spectrum, molecules give Band spectrum and Black body gives continuous spectrum.

Q.54 Answer is “B”

**Solution:-** Excitation energy is less than ionization energy.

Q.55 Answer is “D”

**Solution:-**  $R_H$  has units reciprocal of wavelength.

## Worksheet-9

**Topics:- Atomic Nucleus, Radio Activity, Nuclear Transmutation, Mass-Defect & Binding Energy**

**Q.1 Isotopes have same:**

- A) Chemical properties      C) Both of these  
B) Physical properties      D) None of these

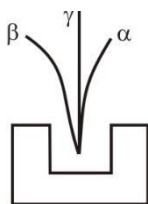
**Q.2 Which of following element has maximum number of isotopes?**

- A) Xenon      C) Nitrogen  
B) Cesium      D) Both A & B

**Q.3 The neutron to proton ratio for  $^{16}_8\text{O}$  is:**

- A) 2:1      C) 1:1  
B) 1:2      D) 8:16

**Q.4 In a radioactive phenomenon observation shown in figure where  $\alpha$  deviates lesser than  $\beta$  in some electric or magnetic field (not shown in the figure). What is the reason of less deviation of  $\alpha$ ?**



- A)  $\alpha$  is charged particle      C)  $\alpha$  is neutral particle  
B)  $\alpha$  is heavier particle      D)  $\alpha$  is lighter particle

**Q.5 What is the charge number of an  $\alpha$ -particle emitted during the phenomena of radioactivity?**

- A)  $-e$       C)  $-2e$   
B)  $+2e$       D)  $+2$

**Q.6 Which one is a container for storing radioactive substance?**

- A) Lead      C) Cadmium  
B) Iron      D) Copper

**Q.7 Which of the following is true for  $\gamma$ -rays?**

	Charge	Rest mass
A)	Positive	$m_0 c^2$
B)	Negative	Zero
C)	Neutral	$m_0 c^2$
D)	Neutral	Zero

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- A) De-excitation of atom      C) De-excitation of nucleus  
B) Excitation of atom      D) Excitation of nucleus

**Q.9 The phenomenon of radioactivity is associated with:**

- A) Decay of nucleus  
B) Fusion of nuclei  
C) Transmission of radio waves  
D) Nuclear reactions caused by cosmic rays

**Q.10 After  $\alpha$ -emission from  $^{226}_{88}\text{Ra}$ , the daughter nucleus will be:**

- A)  $^{226}_{86}\text{Ra}$       C)  $^{226}_{86}\text{Rn}$   
B)  $^{224}_{86}\text{Ra}$       D)  $^{222}_{86}\text{Rn}$

**Q.11 After  $\beta$ -emission from neutron, which particle is found?**

- A) Proton      C) Neutron  
B) Electron      D) Proton and electron

**Q.12 An  $\alpha$ -emission is always accompanied by:**

- A)  $\beta$ -emission      C) Both "A" and "B"  
B)  $\gamma$ -emission      D) Neutron emission

**Q.13 The equation  ${}_Z\text{X}^A \longrightarrow {}_{z+1}\text{Y}^A + {}_{-1}\text{e}^0 + \bar{\nu}$  represents:**

- A)  $\beta$ -decay      C)  $\gamma$ -decay  
B)  $\alpha$ -decay      D) Proton decay

**Q.14 In an  $\alpha$ -decay:**

- A) The parent and daughter nuclei have same number of protons  
B) The daughter nucleus has one proton more than parent nucleus  
C) The daughter nucleus has two protons less than parent nucleus  
D) The daughter nucleus has two neutrons more than parent nucleus

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- Q.15** When a radioactive nucleus emits an  $\alpha$ -particle, the N/Z ratio?
- A) Increases  
B) Decreases  
C) Remains same  
D) Any of these
- Q.16** When a radioactive nucleus emits a  $\beta$ -particle, the mass number of the atom?
- A) Increases by one  
B) Decreases by one  
C) Remains the same  
D) Decreases by four
- Q.17** The decay constant  $\lambda$  of a radioactive sample:
- A) Decreases as the age of atoms increases  
B) Increases as the age of atoms increases  
C) Is independent of the age  
D) Depends on the nature of activity
- Q.18** Half life of a radioactive substance depends upon:
- A) Temperature  
B) Pressure  
C) Nature of substance  
D) Electric & magnetic field
- Q.19** The half life of radium is about 1600 years. If 100 g radium existing now, 25 g will remain un-decayed after:
- A) 4800 years  
B) 6400 years  
C) 6400 years  
D) 3200 years
- Q.20** Half-life of radium is 1600 years. In how many years shall the earth lose all its radium due to radioactive decay?
- A)  $1590 \times 10^6$  years  
B)  $1590 \times 10^{12}$  years  
C)  $1590 \times 10^{24}$  years  
D) Never
- Q.21** The half-life of a certain element is 7 days at S.T.P .If the temperature is doubled and pressure is reduced to half then half-life of the same element will be:
- A) 1.75 days  
B) 7 days  
C) 3.5 days  
D) 14 days
- Q.22** Which of the following rays are more energetic?
- A)  $\alpha$  - rays  
B)  $\gamma$  - rays  
C)  $\beta$  - rays  
D) All of these

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- Q.23** Due to emission of  $\beta^+$ -rays:
- A) Mass of the Nucleus Increases
  - B) Mass of the Nucleus Decreases
  - C) Charge on the Nucleus Increases
  - D) Charge on the Nucleus Decreases
- Q.24** The Uranium Nucleus  ${}_{92}^{238}\text{U}$  undergoes successive decays, emitting respectively  $\alpha$ -particle,  $\beta$ -particle and  $\gamma$ -ray. What is the atomic number and atomic mass of the resulting nucleus?
- A) 90, 238
  - B) 92, 236
  - C) 91, 234
  - D) 92, 238
- Q.25** A nucleus  ${}_{81}^{210}\text{X}$  decays to another nucleus  ${}_{82}^{\text{A}}\text{Y}$  in four successive radioactive decays. Each decay involves, the emission of either an  $\alpha$ -decay or  $\beta$ -decay. What is the value of A?
- A) 210
  - B) 206
  - C) 208
  - D) 204
- Q.26** A Radioactive Isotope  ${}_{92}^{238}\text{U}$  decays to  ${}_{92}^{234}\text{U}$  the particles emitted are:
- A) One  $\alpha$  and one  $\beta$
  - B) One  $\alpha$  and two  $\beta$
  - C) Two  $\alpha$  and one  $\beta$
  - D) Two  $\alpha$  and two  $\beta$
- Q.27** Which one of the following radiation possesses maximum penetrating power?
- A)  $\alpha$ -rays
  - B)  $\gamma$ -rays
  - C)  $\beta$ -rays
  - D) All have equal penetrating power
- Q.28** After  $\alpha$ -decay, the parent and daughter nuclei are called:
- A) Isomers
  - B) Isotones
  - C) Isobars
  - D) Isodiapheres
- Q.29** The emission of  $\beta$ -particle results in:
- A) Isomers
  - B) Isotones
  - C) Isobars
  - D) Isodiapheres

**Q.30 Which one is not true about radioactivity?**

- A) Radioactivity is a stochastic process
- B) Half-life only depends on nature of element
- C) Decay rate decreases exponentially with time
- D) None of these

**Q.31 The number of atoms decayed in four half-lives are:**

- A)  $\frac{N_0}{16}$
- B)  $\frac{7N_0}{8}$
- C)  $\frac{N_0}{8}$
- D)  $\frac{15N_0}{16}$

**Q.32 If the half-life of an element is 10 second, the mean life will be:**

- A) 14.4 sec
- B) 10 sec
- C) 9.93 sec
- D) Can't be predicted

**Q.33 The mass defect per nucleon \_\_\_\_\_ as the atomic number increases till iron, for iron the mass defect per nucleon \_\_\_\_\_ and after iron the mass defect per nucleon \_\_\_\_\_ as atomic number increases further.**

- A) Decreases, minimum, increases
- B) Decreases, maximum, decreases
- C) Increases, maximum, decreases
- D) None of these

**Q.34 Among the following which nucleus has maximum mass defect and binding energy:**

- A) Fe
- B) Kr
- C) He
- D) U

**Q.35 Mass defect of  $^{10}\text{u}$  is equal to:**

- A)  $1.66 \times 10^{-27}$  kg
- B)  $1.66 \times 10^{-26}$  kg
- C)  $166 \times 10^{-28}$  kg
- D) Both B and C

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**ANSWER KEY (Worksheet-09)**

1	A	11	A	21	B	31	D
2	D	12	B	22	A	32	A
3	C	13	A	23	D	33	C
4	B	14	C	24	C	34	D
5	D	15	A	25	B	35	D
6	A	16	C	26	B		
7	D	17	C	27	B		
8	C	18	C	28	D		
9	A	19	D	29	C		
10	D	20	D	30	D		

**SOLUTIONS****Unit – 11 (WS-09)****Q.1** Answer is “A”

**Solution:-** Isotopes have same chemical properties while their physical properties are different.

**Q.2** Answer is “D”

**Solution:-** Both Xenon and Cesium have maximum number of isotopes (Both have 36 isotopes).

**Q.3** Answer is “C”

**Solution:-** For  ${}^{16}_8\text{O}$ ;  $Z=8$ ,  $N=8$

**Q.4** Answer is “B”

**Solution:-** Heavier particles deflect lesser.

**Q.5** Answer is “D”

**Solution:-** Charge no. for  $\alpha$  particle is “+2”, but charge is “+2e”.

**Q.6** Answer is “A”

**Solution:-** Lead absorbs radiations without becoming unstable.

**Q.7** Answer is “D”

**Solution:-** Gamma rays are photons, so their rest mass and charge both are zero.

**Q.8** Answer is “C”

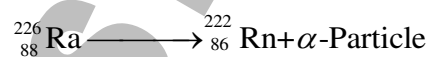
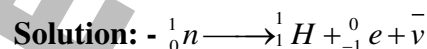
**Solution:-**  $\gamma$ -rays are emitted due to de-excitation of nucleus.

**Q.9** Answer is “A”

**Solution:-** Radioactivity is purely a nuclear phenomenon.

**Q.10** Answer is “D”

**Solution:-**

**Q.11** Answer is “A”**Q.12** Answer is “B”

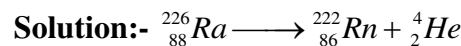
**Solution: -**  $\alpha$  and  $\beta$  emissions are always accompanied by  $\gamma$ -emission.

**Q.13** Answer is “A”

**Solution: -** The given equation represents a negative beta decay.

**Q.14** Answer is “C”

**Solution: -** In  $\alpha$ -decay, the daughter nucleus has 2 protons less than parent nucleus.

**Q.15** Answer is “A”

Check  $\frac{N}{Z}$  ratio for parent and daughter nucleus.

**Q.16** Answer is “C”

**Solution:-** The mass number remains same whether  $\beta^+$  is emitted or  $\beta^-$  is emitted.

**Q.17** Answer is “C”

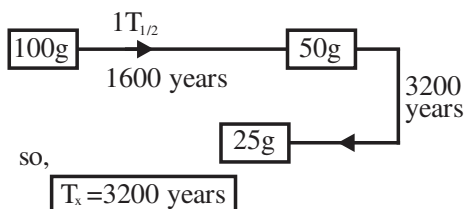
**Solution:-** “ $\lambda$ ” only depend on nature of element.

**Q.18** Answer is “C”

**Solution:-** Half-life only depend on Nature of substance.

**Q.19** Answer is “D”

**Solution:-**



**Q.20** Answer is “D”

**Solution:-** Complete life of any radioactive element is always infinite.

**Q.21** Answer is “B”

**Solution:-** Half-life only depends on nature of element.

**Q.22** Answer is “A”

**Solution:-** Usually  $\alpha$ -radiations are most energetic and  $\gamma$ -rays are least energetic.

**Q.23** Answer is “D”

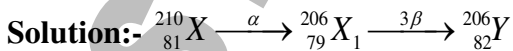
**Solution:-** During  $\beta^+$  decay the charge number of daughter nucleus is one less than parent nucleus.

**Q.24** Answer is “C”

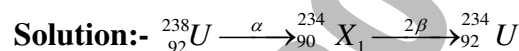
**Solution:-**



**Q.25** Answer is “B”



**Q.26** Answer is “B”



**Q.27** Answer is “B”

**Solution:-** Penetration power of  $\gamma$ -rays is maximum and it is minimum for  $\alpha$ -particles.

**Q.28** Answer is “D”

**Solution:-** Isodiapheres are nuclei which have same neutron excess.

**Q.29** Answer is “C”

**Solution:-**  $\alpha$ -Particle emission results in isodiapheres,  $\beta$ -particle emission results in isobars and  $\gamma$ -rays emission result in isomers.

**Q.30** Answer is “D”

**Solution:-** All given options A, B & C are true.

**Q.31** Answer is “D”

**Solution:-**

$$\text{No. of decayed atoms} = N_0 - \left(\frac{1}{2}\right)^n N_0$$

**Q.32** Answer is “A”

$$\text{Solution:- } T_{\text{mean}} = 1.44T_{\frac{1}{2}}$$

**Q.33** Answer is “C”

**Solution:-** See graph from book

**Q.34** Answer is “D”

**Solution:-** (Mass defect of nucleus)

$$= A \times (\text{Mass defect per nucleon})$$

So, total mass defect of uranium nucleus will be greater than other options.

**Q.35** Answer is “D”

$$\text{Solution:- } 1 \text{ u} = 1.66 \times 10^{-27} \text{ kg}$$

## Worksheet-10

**Topics:- Nuclear Fission & Fusion Reactions,  
Elementary Particles**

- Q.1** Proton belongs to:
- A) Leptons                                      C) Mesons  
B) Baryons                                      D) Neutrinos
- Q.2** Which of following belong to leptons?
- A) Electrons                                      C) Neutrinos  
B) Protons                                      D) Both A & C
- Q.3** Which of following has mass smaller than proton:
- A) Baryon                                      C) Neutron  
B) Meson                                      D) None of these
- Q.4** Which of following is not an elementary particle?
- A) Photons                                      C) Leptons  
B) Hadrons                                      D) Muons
- Q.5** A proton is assumed to be made up of \_\_\_\_\_ quarks.
- A)  $2u+1d$                                       C)  $2u+2d$   
B)  $2d+1u$                                       D)  $3u+1d$
- Q.6** In any nuclear reaction, the energy is released if the binding of reactants is \_\_\_\_\_ than binding energy of products:
- A) Less                                      C) Equal  
B) Greater                                      D) Any of these
- Q.7** If an  $\alpha$ -particle moving with energy 1 MeV strikes with Nitrogen atom  ${}^{14}_7N$ , the product formed is  ${}^{14}_7N + {}^4_2He \rightarrow$  \_\_\_\_\_?
- A)  ${}^{16}_8O + {}^1_1H + {}^1_0n$                                       C)  ${}^{17}_8O + {}^1_0n + {}^0_{+1}e$   
B)  ${}^{17}_8O + {}^1_1H$                                       D) Reaction can't happen
- Q.8** The missing particle in following nuclear reaction is:
- ${}^9_4Be + {}^4_2He \rightarrow {}^{12}_6C +$  \_\_\_\_\_
- A)  ${}^1_1H + {}^0_{-1}e$                                       C)  ${}^1_0n$   
B)  ${}^1_1H + {}^0_{+1}e$                                       D) None of these

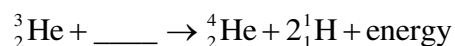
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**Q.18** In Karachi nuclear power plant \_\_\_\_\_ is used as moderator.

- A) Water  
B) Heavy water  
C) Hydrocarbons  
D) None of these

**Q.19** The missing reactant in the reaction is:



- A)  ${}_1^2\text{H}$   
B)  ${}_2^3\text{He}$   
C)  ${}_1^3\text{H}$   
D)  ${}_1^2\text{H}$

**Q.20** The temperature of core of sun is:

- A) 10 million degree Celsius  
B) 6000 degree Celsius  
C) 20 million degree Celsius  
D) None of these

**Q.21** The number of protons taking part in P-P reaction:

- A) 4  
B) 6  
C) 5  
D) 2

**Q.22** The number of protons used in one complete P-P reaction:

- A) 4  
B) 6  
C) 5  
D) 2

**Q.23** In the P-P reaction, the energy given out per nucleon is:

- A) 25.7 MeV  
B) 17.6 MeV  
C) 4.0 MeV  
D) 6.4 MeV

**Q.24** In the following reaction, the energy given out is:



- A) 17.6 MeV  
B) 3.3 MeV  
C) 24 MeV  
D) 4.0 MeV

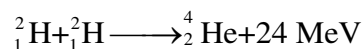
**Q.25** The sun is primarily composed of:

- A) Hydrogen  
B) Oxygen  
C) Helium  
D) Neon

USE THIS SPACE FOR  
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**ANSWER KEY (Worksheet-10)**

1	B	11	B	21	B
2	D	12	D	22	A
3	B	13	B	23	D
4	B	14	C	24	A
5	A	15	B	25	A
6	A	16	A		
7	D	17	C		
8	C	18	B		
9	B	19	B		
10	B	20	C		

**SOLUTIONS****Unit – 11 (WS-10)****Q.1 Answer is “B”****Solution:-** Particles with mass equal or greater than protons belong to baryons.**Q.2 Answer is “D”****Solution:-** Electrons, muons and neutrinos are leptons.**Q.3 Answer is “B”****Solution:-** Particles with mass less than protons belong to mesons.**Q.4 Answer is “B”****Solution:-** Hadrons are not elementary particles but are composed of elementary particles called Quarks.**Q.5 Answer is “A”****Solution:-** A proton is made up of two up one down quark.**Q.6 Answer is “A”****Solution:-** Energy released =  $B.E_P - B.E_R$ **Q.7 Answer is “D”****Solution:-** For this nuclear reaction, minimum energy of  $\alpha$ -particle must be 1.13 MeV.**Q.8 Answer is “C”****Solution:-** Balance mass on both sides**Q.9 Answer is “B”****Solution:-****Q.10 Answer is “B”****Solution:-** The mass of uranium used in atomic bomb is greater than critical mass.**Q.11 Answer is “B”****Solution:-** In a nuclear reactor, the quantity of uranium is increased from 2 to 4%, this process is called enrichment.**Q.12 Answer is “D”****Solution:-** Moderators can be water, heavy water, carbon or hydrocarbon etc.**Q.13 Answer is “B”****Solution:-** The temperature of the core is about 500 °C. The temperature of the steam coming out of the turbine is about 300 °C.**Q.14 Answer is “C”****Solution:-** Fast reactors are designed to make use of U-238, which is about 99% content of natural Uranium.**Q.15 Answer is “B”****Solution:-** The reaction in which two deuterons are fused to form helium is**Q.16 Answer is “A”****Solution:-** Unfortunately, there is no proper arrangement of the disposal of the nuclear waste. This cannot be dumped



into oceans or left in any place where they will contaminate the environment, such as through the soil or the air. They must not be allowed to get into the drinking water. The best place so far found to store these wastes is in the bottom of old salt mines.

**Q.17 Answer is “C”**

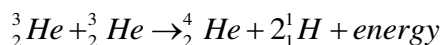
**Solution:-** In a nuclear reactor the mass of uranium used is equal to critical mass to carry fission chain reaction at constant speed.

**Q.18 Answer is “B”**

**Solution:-** In Karachi nuclear power plant (KANUP), heavy water is used as a moderator and for the transportation of heat also from the reactor core to heat exchanger, heavy water is used.

**Q.19 Answer is “B”**

**Solution:-**



**Q.20 Answer is “C”**

**Solution:-** The temperature of core of sun is 20 million degree Celsius.

**Q.21 Answer is “B”**

**Solution:-** The no. of protons taking part in P-P reaction are 6 while no. of protons used in one P-P reaction are 4.

**Q.22 Answer is “A”**

**Solution:-** The no. of protons taking part in P-P reaction are 6 while no. of protons used in one P-P reaction are 4.

**Q.23 Answer is “D”**

**Solution:-** In P-P reaction, the energy given out per nucleon is 6.4 MeV.

**Q.24 Answer is “A”**

**Solution:-** In this given fusion reaction the energy released is 17.6 MeV.

**Q.25 Answer is “A”**

**Solution:-** The sun is primarily composed of Hydrogen.

## Worksheet-11

Topics:- Physical Quantities, Units, Errors, Uncertainties & Prefixes

Q.1 Supplementary units are:

- A) Two C) Four  
B) Three D) Five

Q.2 A set of supplementary units are:

- A) radian, kilogram C) radian, steradian  
B) radian, mole D) second and meter

Q.3 Example of Base quantity is:

- A) Area C) Velocity  
B) Light year D) Volume

Q.4 S.I unit of plane angle is:

- A) steradian C) candela  
B) radian D) unitless

Q.5 Which one is not the principal characteristic of an ideal standard?

- A) Accessible C) Both A and B  
B) Invariable D) Variable

Q.6 How many kinds of units are there in SI-Unit system?

- A) Seven C) Five  
B) Three D) Two

Q.7 S.I unit of amount of substance is:

- A) ampere C) mole  
B) candela D) joule

Q.8 The units of pressure in base units are:

- A)  $\text{kg m}^{-1} \text{s}^{-2}$  C)  $\text{kg m}^{-2} \text{s}^{-2}$   
B)  $\text{kg m s}^{-2}$  D)  $\text{kg}^2 \text{m s}^{-2}$

Q.9 Which of the following is the least sub-multiple?

- A) pico C) atto  
B) femto D) nano

Q.10 The units of  $\frac{X}{Y}$ , where  $X = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$  and  $Y = \frac{E}{B}$ , where

E=electric intensity and B=magnetic intensity is:

- A)  $\text{kg}^0 \text{m s}^{-1}$  C)  $\text{kg}^0 \text{m}^0 \text{s}^0$   
B)  $\text{kg}^0 \text{m}^0 \text{s}^{-1}$  D)  $\text{kg m s}$

Q.11 Which one is the biggest unit of plane angle?

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- A) radian  
B) revolution  
C) steradian  
D) degree
- Q.12 The units of force are:**  
A)  $\text{kg m}^2 \text{s}^{-2}$   
B)  $\text{kg}^2 \text{m}^2 \text{s}^{-2}$   
C)  $\text{kg m s}^{-2}$   
D)  $\text{kg m}^2 \text{s}^{-1}$
- Q.13 The angle subtended at the centre of football by an area of its surface equal to one half of total area will be:**  
A)  $\pi \text{ sr}$   
B)  $3\pi \text{ sr}$   
C)  $2\pi \text{ sr}$   
D)  $4\pi \text{ sr}$
- Q.14 The units of power are:**  
A)  $\text{kg m}^2 \text{s}^{-2}$   
B)  $\text{kg m}^{-1} \text{s}^{-1}$   
C)  $\text{kg m}^2 \text{s}^{-3}$   
D)  $\text{kg m}^{-2} \text{s}^{-2}$
- Q.15 The base units of torque are:**  
A)  $\text{kg m}^{-1} \text{s}$   
B)  $\text{kg m}^2 \text{s}^{-1}$   
C)  $\text{kg m}^2 \text{s}^{-2}$   
D) None of these
- Q.16 The units of viscosity are:**  
A)  $\text{kg m}^{-1} \text{s}$   
B)  $\text{kg m}^2 \text{s}^{-1}$   
C)  $\text{kg m}^{-1} \text{s}^{-1}$   
D)  $\text{kg m}^{-1} \text{s}^{-2}$
- Q.17 Units of impulse are same as of:**  
A) Momentum  
B) Force  
C) Power  
D) Torque
- Q.18 The base units of gravitational constant G are:**  
A)  $\text{kg m}^2 \text{s}^{-2}$   
B)  $\text{kg}^{-1} \text{m}^3 \text{s}^{-2}$   
C)  $\text{kg}^2 \text{m}^{-1} \text{s}^{-2}$   
D)  $\text{kg m}^{-2} \text{s}^{-1}$
- Q.19 One dyne is equal to:**  
A)  $10^{-5} \text{ N}$   
B)  $10^{+5} \text{ N}$   
C)  $10^{-4} \text{ N}$   
D)  $10^{+4} \text{ N}$
- Q.20 In the relation of Bernoulli's equation**  
 $P + \frac{1}{2}\rho v^2 + \rho gh = \text{constant}$  **which term has same units as that of stress?**  
A) P  
B)  $\frac{1}{2}\rho v^2$   
C)  $\rho gh$   
D) All of these
- Q.21 Which of the following have same units as that of the**

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energy density (energy per unit volume)?

- A) Pressure  
B) Young's modulus  
C) P.E per unit volume  
D) All of these

**Q.22** In the relation  $E = \sigma T^4$ , the units of E are same as that of:

- A) Solar constant  
B) Energy intensity  
C) Energy  
D) Both "A" & "B"

**Q.23** Three different readings are taken by three instruments Vernier caliper, meter rod and screw gauge. Which reading will be more precise?

- A) Vernier caliper's reading  
B) Screw gauge's reading  
C) Meter rod reading  
D) All have same precision

**Q.24** Two measurements have fractional uncertainties 0.04 and 0.02, which measurement will be more accurate?

- A) Measurement with 0.04 uncertainty  
B) Measurement with 0.02 uncertainty  
C) Both are equally accurate  
D) Can't be predicted

**Q.25** Diameter of a wire is measured by screw gauge. Which of following can be the possible value?

- A) 8.1 mm  
B) 8.12 mm  
C) 8.125 mm  
D) 8.1250 mm

**Q.26** Two measurements  $x_1 = 10.5 \pm 0.1$  cm &  $x_2 = 26.8 \pm 0.2$  cm are being subtracted. The uncertainty in final answer will be:

- A) Zero  
B) 0.1 cm  
C) 0.2 cm  
D) 0.3 cm

**Q.27** In a square plate on increasing temperature, error in the length is 1%. The percentage error in area will be:

- A) 1%  
B) 2%  
C) 3%  
D) 4%

**Q.28** If % age errors in moment of inertia and angular velocity are 2% and 4% respectively then % age error in rotational K.E is:

- A) 2%  
B) 10%  
C) 4%  
D) 8%

**Q.29** The time for 20 vibrations of simple pendulum is recorded by a stop watch of least count 0.1 s is 54.6 s. The uncertainty in time period will be:

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- 1 s  
0.001 s
- C) 0.005 s  
D) 0.003 s
- power factor formulae like  $V = \frac{4\pi r^3}{3}$ , %age
- uncertainty in  $V = \underline{\hspace{2cm}}$ .
- % uncertainty in  $r^3$  C)  $\frac{\% \text{ uncertainty in } r}{3}$   
D) % uncertainty in  $r^3$
- to = \_\_\_\_\_ giga?
- $10^{-18}$  C)  $10^{-12}$   
 $10^{-15}$  D)  $10^{-24}$
- ident measures the length & diameter of cylinder by  
v gauge both readings have an error of "0.05 mm",  
h type of error is in these readings:
- random error C) Systematic error  
personal error D) All of these
- f following which have same power in base units of  
sity and spring constant?
- etre C) Both A & B  
cond D) kilogram
- ratio of units of surface tension & spring constant  
uces the units same as that of:
- refractive index C) Both A & B  
agnification D) Plank's constant
- h of following pair have same base units?
- rain, relative permittivity  
urface tension, spring constant  
ress, energy density  
ll of these

## ANSWER KEY (Worksheet-11)

1	A	11	B	21	D	31	D
2	C	12	C	22	D	32	C
3	B	13	C	23	B	33	D
4	B	14	C	24	B	34	C
5	D	15	C	25	B	35	D
6	B	16	C	26	D		
7	C	17	A	27	B		
8	A	18	B	28	B		
9	C	19	A	29	C		
10	C	20	D	30	B		

## SOLUTIONS

## Unit – 1 (WS-11)

Q.1 Answer is “A”

**Solution:-** There are two supplementary units named “Radian” and “Steradian”.

Q.2 Answer is “C”

**Solution:-** There are two supplementary units named “Radian” and “Steradian”.

Q.3 Answer is “B”

**Solution:-** Light year is the distance covered by light in one year. As light year is distance, so it is measured in metres which is a base unit.

Q.4 Answer is “B”

**Solution:-**

- SI-unit of plane angle is radian.
- SI-unit of solid angle is steradian.

Q.5 Answer is “D”

**Solution:-** An ideal standard has two characteristics:

- Accessible
- Invariable

Q.6 Answer is “B”

**Solution:-** The kinds of units in system International are three i-e base units, derived units and supplementary units.

Q.7 Answer is “C”

**Solution:-** The amount of substance is measured in mole.

Q.8 Answer is “A”

**Solution:-**

$$P = \frac{F}{A} = \frac{N}{m^2} = \frac{kg \ m \ s^{-2}}{m^2} = kg \ m^{-1} \ s^{-2}$$

Q.9 Answer is “C”

**Solution:-**

- 1 atto =  $10^{-18}$
- 1 femto =  $10^{-15}$
- 1 pico =  $10^{-12}$
- 1 nano =  $10^{-9}$

Q.10 Answer is “C”

**Solution:-** Both relations  $Y = \frac{E}{B}$  and

$$X = \frac{1}{\sqrt{\mu_0 \epsilon_0}} \text{ represent speed, } X$$

represents speed of light while Y represents speed of a charge particle in velocity selector. So, the ratio X/Y will surely be unit-less.

Q.11 Answer is “B”

**Solution:-** Plane angle (2D-angle) is measured in radian (SI-unit), degree and revolution. These units can be arranged in descending order as:

revolution > radian > degree

Q.12 Answer is “C”

**Solution:-**  $F = ma = kg \ m \ s^{-2}$

Q.13 Answer is “C”

**Solution:-** The general formula for solid (3D-angle) angle is:

$$\theta = \frac{\text{Area of Patch}}{\text{Square of radius}} = \frac{A}{r^2} (\text{sr})$$



For half football

$$A = 2\pi r^2 \quad (\text{for full sphere; } A = 4\pi r^2)$$

So,

$$\theta = \frac{2\pi r^2}{r^2} = 2\pi \text{ sr}$$

**Q.14** Answer is “C”

$$\text{Solution:- } P = \frac{W}{t} = \frac{J}{\text{sec}} = \frac{N \cdot m}{s}$$

$$P = \frac{\left(kg \frac{m}{s^2}\right)m}{s} = kg \cdot m^2 \cdot s^{-3}$$

**Q.15** Answer is “C”

**Solution:-**

$$\tau = N \cdot m = \left(kg \frac{m}{s^2}\right)m$$

$$\tau = kg \cdot m^2 \cdot s^{-2}$$

**Q.16** Answer is “C”

$$\text{Solution:- } \eta = \frac{N \cdot s}{m^2} = \frac{\left(kg \frac{m}{s^2}\right)s}{m^2}$$

$$\eta = kg \cdot m^{-1} \cdot s^{-1}$$

**Q.17** Answer is “A”

**Solution:-** As impulse is equal to change in momentum, so its units are same as that of momentum. i.e

$$\text{Impulse} = F \cdot t = mv_f - mv_i$$

$$\text{Impulse} = kg \cdot m \cdot s^{-1}$$

**Q.18** Answer is “B”

**Solution:-**

$$F = G \frac{Mm}{r^2}$$

$$G = \frac{Fr^2}{Mm}$$

$$G = \frac{Nm^2}{kg^2} = \frac{(kg \cdot m \cdot s^{-2})m^2}{kg^2}$$

$$G = kg^{-1} \cdot m^3 \cdot s^{-2}$$

**Q.19** Answer is “A”

**Solution:-** Dyne is the C.G.S unit of force and it is related with SI unit of force as;

$$1 \text{ dyne} = 1 \text{ gm cm s}^{-2}$$

$$1 \text{ dyne} = (10^{-3} \text{ kg})(10^{-2} \text{ m})(s^{-2})$$

$$1 \text{ dyne} = 10^{-5} \text{ N}$$

**Q.20** Answer is “D”

**Solution:-** In the Bernoulli's equation, all the terms are pressures i.e

P=static pressure

$$\frac{1}{2} \rho v^2 = \text{dynamic Pressure}$$

$\rho gh$  = Pressure in depth

So, all terms have units of pressure which are same as that of stress.

**Q.21** Answer is “D”

**Solution:-** All these quantities pressure, stress, energy density, P.E per unit volume, K.E per unit volume and elastic modulus have same units which are  $N \cdot m^{-2}$  or pascal.

**Q.22** Answer is “D”

**Solution:-** In the given relation ‘E’ is not energy rather it is energy intensity (energy per second per unit area). Also the solar constant is measured in the same units as that of energy intensity.

**Q.23** Answer is “B”

**Solution:-** A precise measurement is the one which has least absolute uncertainty i.e least count.

**Q.24 Answer is “B”**

**Solution:-** An accurate measurement is the one which has least fractional or percentage uncertainty.

**Q.25 Answer is “B”**

**Solution:-** A screw gauge measures up to second decimal value in (mm) unit. So, the reading which contains two digits after decimal fraction is correct.

**Q.26 Answer is “D”**

**Solution:-** U.C of final result in addition & subtraction = sum of absolute U.Cs of individual measurements.

**Q.27 Answer is “B”**

**Solution:-** Use relation,  $A = \ell^2$ , Also in power factor we simply multiply percentage error with power.

**Q.28 Answer is “B”**

**Solution:-** Use relation;

$$K.E_{\text{rot}} = \frac{1}{2} I \omega^2$$

% U.C in  $K.E_{\text{rot}} = (\% \text{ U.C in moment of inertia}) + 2(\% \text{ U.C in angular velocity})$

**Q.29 Answer is “C”**

**Solution:-**

$$\text{U.C in time period} = \frac{\text{L.C}}{\text{no. of vibrations}}$$

**Q.30 Answer is “B”**

**Solution:-** Simple power factor rule i.e

% U.C in  $V = 3(\% \text{ U.C in radius})$

**Q.31 Answer is “D”**

**Solution:-**  $\frac{1 \text{ femto}}{1 \text{ giga}} = \frac{10^{-15}}{10^{+9}} = 10^{-24}$

**Q.32 Answer is “C”**

**Solution:-** Both readings have equal error when measured by same instrument, this is the definition of systematic error i.e

“System error refers to an effect that influences all measurements of a particular quantity equally.”

**Q.33 Answer is “D”**

**Solution:-**

$$\begin{aligned} \text{Viscosity} &= \text{N s m}^{-2} = (\text{kg m s}^{-2}) \text{s m}^{-2} \\ &= \text{kg m}^{-1} \text{s}^{-1} \end{aligned}$$

$$\text{Spring constant} = \text{N m}^{-1} = (\text{kg m s}^{-2}) \text{m}^{-1} = \text{kg s}^{-2}$$

So, kg has same power in base units of viscosity and spring constant.

**Q.34 Answer is “C”**

**Solution:-** Both Spring constant and surface tension have same units i.e  $\text{N m}^{-1}$ , so their ratio is unit less just like refractive index and magnification.

**Q.35 Answer is “D”**

**Solution:-**

A) Both are unit less

B) Both have units  $\text{N m}^{-1}$

C) Both have units  $\text{N m}^{-2}$

Worksheet-12

**Topics:-** Displacement, Velocity, Acceleration, Velocity-time Graph, Equations of Motion, Laws of Motion, Momentum and Conservation of Momentum, Impulse, Projectile Motion, Elastic & Inelastic Collisions

**Q.1** Pull of earth on a mass of 20 kg at surface of earth is:

- A) 196 N  
B) 1960 N  
C) 20 N  
D) 19.6 N

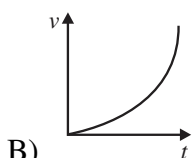
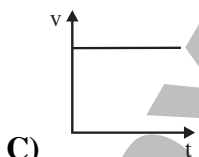
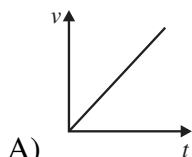
**Q.2** Time rate of change of momentum is equal to:

- A) Force  
B) Impulse  
C) Velocity  
D) Force constant

**Q.3** Distance covered by a freely falling body in 2 seconds will be:

- A) 4.9 m  
B) 19.6 m  
C) 39.2 m  
D) 9.8 m

**Q.4** For which of the following graph/graphs, both velocity and acceleration are constant:



D) None of these

**Q.5** 1<sup>st</sup> law of motion gives definition of:

- A) Mass  
B) Inertia  
C) Force  
D) Momentum

**Q.6** One Newton is the force:

- A) Of gravity on  $\frac{1}{g}$  kg body  
B) Of gravity on a 1 g body  
C) That gives a 1 kg body an acceleration of  $1 \text{ m s}^{-2}$   
D) Both "A" and "C"

**Q.7** A 7.0 kg ball experiences a net force of 7.0 N what will be its acceleration?

- A)  $10 \text{ m s}^{-2}$   
B)  $5.0 \text{ m s}^{-2}$   
C)  $1 \text{ m s}^{-2}$   
D)  $35.0 \text{ m s}^{-2}$

**USE THIS SPACE FOR  
SCRATCH WORK**

**Q.8** A force  $2F$  acting on a particle of mass  $10\text{ kg}$  produces an acceleration of  $60\text{ m s}^{-2}$ . A force  $5F$  acting on a particle of mass  $M$  produces an acceleration of  $50\text{ m s}^{-2}$ . What is the mass  $M$ ?

- A)  $3.3\text{ kg}$  C)  $21\text{ kg}$   
B)  $4.8\text{ kg}$  D)  $30\text{ kg}$

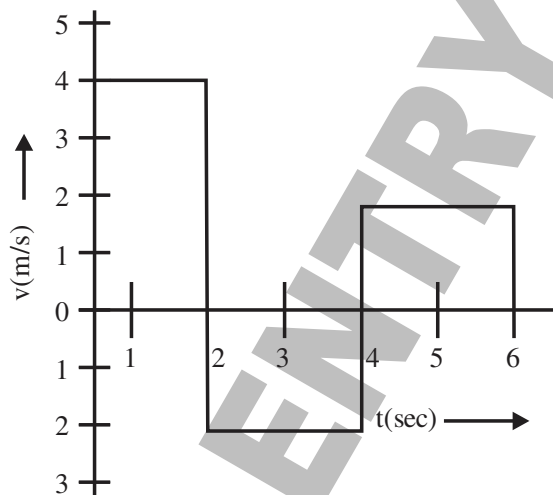
**Q.9** The Newton's 2<sup>nd</sup> law:

- A) Defines force C) Balances force  
B) Measures force D) All of these

**Q.10** A ball of mass  $m_1$  and another ball of  $m_2$  are dropped from equal heights. If  $m_1$  is twice as compared to  $m_2$ , then time taken by the balls  $t_1$  and  $t_2$  are related as:

- A)  $t_1 = \frac{t_2}{2}$  C)  $t_1 = 4t_2$   
B)  $t_1 = t_2$  D)  $t_1 = \frac{t_2}{4}$

**Q.11** The velocity-time graph of a body moving in a straight line is shown in the figure. The displacement and distance travelled by the body in  $6\text{ sec}$ , are respectively.



- A)  $8\text{ m}$ ,  $16\text{ m}$  C)  $16\text{ m}$ ,  $8\text{ m}$   
B)  $16\text{ m}$ ,  $16\text{ m}$  D)  $8\text{ m}$ ,  $8\text{ m}$

**Q.12** A steel ball covers half the distance with velocity  $v_i$  and the other half with velocity  $v_f$  in the same straight line. The average velocity of ball is:

- A)  $\frac{v_i + v_f}{2}$  C)  $\frac{v_i v_f}{v_i + v_f}$

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SCRATCH WORK**

B)  $v_i + v_f$                       D)  $\frac{2v_i v_f}{v_i + v_f}$

**Q.13** A 60 m long train is moving in a direction with speed  $20 \text{ m s}^{-1}$ . Another train moving with  $30 \text{ m s}^{-1}$  in the opposite direction and 40 m long crosses the first train in:

- A) 5 s                                  C) 2 s  
B) 6 s                                  D) 4 s

**Q.14** A car covers  $\frac{2}{3}$  distance with  $60 \text{ m s}^{-1}$  and  $\frac{1}{3}$  distance with  $20 \text{ m s}^{-1}$ . Average speed is:

- A)  $36 \text{ m s}^{-1}$                       C)  $66 \text{ m s}^{-1}$   
B)  $46 \text{ m s}^{-1}$                       D)  $56 \text{ m s}^{-1}$

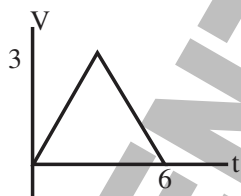
**Q.15** A person standing on a horizontal floor feels two forces: The downward pull of gravity and the upward supporting force from the floor. These two forces:

- A) Have equal magnitude and form an action/reaction pair  
B) Have equal magnitude but do not form an action/reaction pair  
C) Have unequal magnitudes  
D) Are equal forces

**Q.16** An object with a constant speed:

- A) Is not accelerated  
B) Might be accelerated  
C) Is always accelerated  
D) Also has a constant velocity

**Q.17** In the figure, distance covered is:



- A) 9 units                              C) 3 units  
B) 6 units                              D) 18 units

**Q.18** The ratio of distance to magnitude of displacement when a body covers a semicircle is:

- A)  $\frac{\pi}{2}$                                   C)  $\frac{1}{\pi}$   
B)  $\pi R$                               D)  $\frac{\pi}{4}$

**Q.19** Distance travelled by a body falling freely starting from rest in the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> seconds are in the ratio:

- A) 1:4:9                              C) 1:2:3

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- B) 1:3:5 D) 1:2:5
- Q.20** Throwing a package onto shore from a boat that was previously at rest causes the boat to move outward from shore, is explained by:
- A) Newton's 1<sup>st</sup> law of motion  
B) Newton's 2<sup>nd</sup> law of motion  
C) Newton's 3<sup>rd</sup> law of motion  
D) Conservation of momentum
- Q.21** A body is released from a height of 5 m. If friction is ignored then its velocity just before striking the ground will be ( $g = 10 \text{ m s}^{-2}$ ):
- A)  $5 \text{ m s}^{-1}$  C)  $15 \text{ m s}^{-1}$   
B)  $10 \text{ m s}^{-1}$  D)  $20 \text{ m s}^{-1}$
- Q.22** If momentum is increased by 20% then K.E. increases by:
- A) 44% C) 66%  
B) 55% D) 77%
- Q.23** A boy throws a ball with velocity  $10 \text{ m s}^{-1}$  in vertically upward direction. If  $g = 10 \text{ m s}^{-2}$ , the ball rises to a height
- A) 2 m C) 10 m  
B) 5 m D) 25 m
- Q.24** Two bodies of different masses  $m_1$  and  $m_2$  are dropped from two different heights  $h_1$  and  $h_2$ . The ratio of times taken by the two bodies through these distances is:
- A)  $h_1:h_2$  C)  $\sqrt{h_1}:\sqrt{h_2}$   
B)  $\frac{m_1}{m_2}:\frac{h_2}{h_1}$  D)  $h_1^2:h_2^2$
- Q.25** The distance traveled by a body dropped from the top of a tower is proportional to:
- A) Mass of the body  
B) Height of the tower  
C) Weight of the body  
D) Square of the time elapses
- Q.26** An object is released from a height  $h$  above the ground reaches the ground in 8 s. The time taken by the object to cover the first half distance is:
- A)  $2\sqrt{2} \text{ s}$  C)  $4\sqrt{2} \text{ s}$

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B)  $\frac{4}{\sqrt{52}} \text{ s}$

D)  $8\sqrt{2} \text{ s}$

**Q.27** If a body starts from a point and returns back to the same point then its:

- A) Average speed is zero but not average velocity
- B) Average speed and velocity depend on the path
- C) Both average speed and velocity are zero
- D) Average velocity is zero but not average speed

**Q.28** Which pair contains one scalar & one vector:

- A) Acceleration, force
- B) Momentum, velocity
- C) Force, K.E
- D) Work, P.E

**Q.29** All statements are correct about third law of motion except:

- A) Forces have equal magnitude
- B) Both forces have opposite direction
- C) Both forces are applied on different bodies
- D) Both are applied on same body maintaining equilibrium

**Q.30** If R is the maximum horizontal distance of projectile then the greatest height attained by projectile in this condition is:

- A) R
- B)  $\frac{R}{2}$
- C) 2R
- D)  $\frac{R}{4}$

**Q.31** During projectile motion if  $H = R$  then angle of projection with horizontal is

- A)  $\tan^{-1}(4)$
- B)  $\tan^{-1}(\sqrt{4})$
- C)  $\tan^{-1}\left(\frac{1}{4}\right)$
- D)  $\tan^{-1}\left(\frac{1}{\sqrt{4}}\right)$

**Q.32** Range of projectile is R when angle of projection is  $60^\circ$ , then the value of other angle of projection for same range is:

- A)  $40^\circ$
- B)  $30^\circ$
- C)  $50^\circ$
- D)  $20^\circ$

**Q.33** A person can throw a stone to maximum range of 100 m. The greatest height with same conditions to which he can make the stone to rise is:

- A) 50 m
- B) 150 m
- C) 100 m
- D) 25 m

**Q.34** During projectile motion the quantities that remain

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constant are:

- A) Acceleration,  $v_x$                       C) Force, velocity  
B) Acceleration, K.E                      D) Acceleration, Momentum

**Q.35 The path of projectile is:**

- A) Hyperbola                      C) Parabola  
B) Straight line                      D) Ellipse

**Q.36 Motion of projectile is \_\_\_\_\_ dimensional.**

- A) One                      C) Two  
B) Three                      D) Four

**Q.37 Four projectiles are launched at angles  $20^\circ$ ,  $30^\circ$ ,  $40^\circ$  and  $50^\circ$  respectively. Which of these projectiles will have maximum range?**

- A) Projectile launched at  $20^\circ$   
B) Projectile launched at  $50^\circ$   
C) Projectile launched at  $30^\circ$   
D) Both projectiles launched at  $40^\circ$  and  $50^\circ$

**Q.38 Which component of the velocity of projectile remains constant throughout the motion?**

- A)  $v_x$                       C)  $a_x$   
B)  $v_y$                       D)  $a_y$

**Q.39 Which of the following factors in a projectile motion remains same?**

- A)  $v_x$                       C)  $a_x$   
B)  $a_y$                       D) All of these

**Q.40 At which angle when a projectile is launched  $R=H$ ?**

- A)  $45^\circ$                       C)  $76^\circ$   
B)  $30^\circ$                       D)  $60^\circ$

**Q.41 At which angle when a projectile is launched  $H = \frac{R}{4}$ ?**

- A)  $45^\circ$                       C)  $76^\circ$   
B)  $30^\circ$                       D)  $60^\circ$

**Q.42 The angle between velocity of projectile and acceleration at the highest point becomes:**

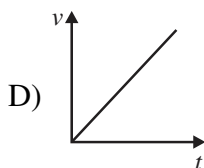
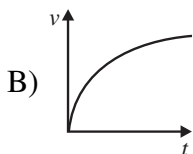
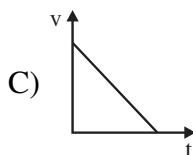
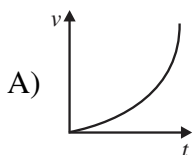
- A)  $90^\circ$                       C)  $0^\circ$   
B)  $180^\circ$                       D)  $76^\circ$

**Q.43 A person moving in a car at a constant velocity throws an apple vertically upwards. If we ignore air friction and suppose car to move with same velocity then according to an observer standing outside.**

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- A) Apple will follow a parabolic path and will fall again in car  
B) Apple will follow a parabolic path but will fall behind car  
C) Apple will follow a linear path and will fall again in car  
D) Apple will follow a parabolic path but will fall before car
- Q.44 Two balls are thrown at angles of  $\theta$  and  $(90^\circ - \theta)$  with the horizontal with same speed. Ratio of their time of flights is:**
- A)  $\tan^2 \theta : 1$                       C)  $\tan \theta : 1$   
B)  $1 : \tan \theta$                       D)  $1 : 1$
- Q.45 A bomber drops its bomb when it is vertically above the target, it misses the target due to (falls ahead):**
- A) Air resistance  
B) Horizontal component of velocity  
C) Vertical component of velocity  
D) Gravity
- Q.46 The maximum height of projectile has the largest value for which of the following angles of projection?**
- A)  $0^\circ$                       C)  $30^\circ$   
B)  $60^\circ$                       D)  $75^\circ$
- Q.47 A body drops a coin from the window of a moving train. The path of coin according to a stationary observer inside the train will be:**
- A) Vertical straight line              C) Parabolic  
B) Elliptical                      D) Circular
- Q.48 A ball whose K.E is E, is projected at an angle of  $45^\circ$  with vertical then, its K.E at maximum height is**
- A) E                      C)  $\frac{E}{2}$   
B)  $\frac{E}{\sqrt{2}}$                       D)  $2E$
- Q.49 In a competition, fielders are required to throw the cricket hard ball as far as possible. Under ideal conditions, the optimum throwing angle is  $45^\circ$ . What should this angle, with respect to ground, be in (i) Strong winds against the direction of throw; and (ii) Strong winds in the direction of throw?**
- A) (i) more than  $45^\circ$ , (ii) less than  $45^\circ$   
B) (i) less than  $45^\circ$ , (ii) more than  $45^\circ$   
C)  $45^\circ$  in both cases  
D) Depends on throwing speed
- Q.50 Which of the following is decreasing acceleration graph?**

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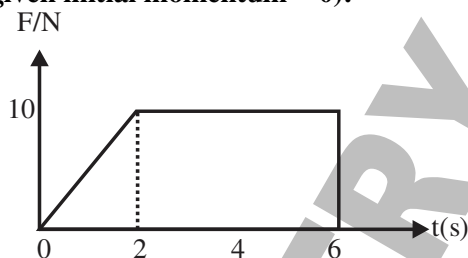
**Q.51** A collision in which K.E of system remains constant is called:

- A) Elastic Collision                      C) Partially elastic Collision  
B) Inelastic Collision                  D) Any of these

**Q.52** In the head on elastic collision of a heavy vehicle moving with a velocity of  $20 \text{ m s}^{-1}$  and a small stone at rest, the stone will fly away with a velocity equal to

- A)  $5 \text{ m s}^{-1}$                                       C)  $20 \text{ m s}^{-1}$   
B)  $10 \text{ m s}^{-1}$                                   D)  $40 \text{ m s}^{-1}$

**Q.53** A body of mass  $3 \text{ kg}$  is acted upon by a force which varies as shown in the graph below. The momentum acquired during  $6 \text{ s}$  is given by (given initial momentum =  $0$ ):



- A) Zero    C)  $5 \text{ N s}$   
B)  $30 \text{ N s}$                                       D)  $50 \text{ N s}$

ANSWER KEY (Worksheet-12)									
1	A	11	A	21	B	31	A	41	A
2	A	12	D	22	A	32	B	42	A
3	B	13	C	23	B	33	D	43	A
4	C	14	A	24	C	34	A	44	C
5	C	15	B	25	D	35	C	45	B
6	D	16	B	26	C	36	C	46	D
7	C	17	A	27	D	37	D	47	A
8	D	18	A	28	C	38	A	48	C
9	B	19	B	29	D	39	D	49	C
10	B	20	C	30	D	40	C	50	B

### SOLUTIONS

#### Unit – 2 (W-12)

Q.1 Answer is “A”

Solution:-  $w = mg$

Q.2 Answer is “A”

Solution:-  $F = \frac{\Delta p}{\Delta t}$

Q.3 Answer is “B”

Solution:-  $S = \frac{1}{2}gt^2$

Q.4 Answer is “C”

Solution:-

- For option A, acceleration is constant but velocity is increasing uniformly.
- For option B, both velocity and acceleration are increasing.
- For option C, velocity is constant, so acceleration is zero which is also a constant.

Q.5 Answer is “C”

Solution:- First law of motion defines force while 2<sup>nd</sup> law of motion measures force.

Q.6 Answer is “D”

Solution:-

- One newton force in terms of  $g$  (gravitational acceleration)

$$F = mg = 1 \text{ N}$$

$$m = \frac{1}{g} \text{ kg}$$

- One newton force by 2<sup>nd</sup> law of motion

$$F = ma \text{ if } m = 1 \text{ kg and } a = 1 \text{ m s}^{-2} \text{ then } F = 1 \text{ N}$$

Q.7 Answer is “C”

Solution:-  $F = ma$

Q.8 Answer is “D”

$$\text{Solution:- } \frac{F_1}{F_2} = \frac{M_1 a_1}{M_2 a_2}$$

Q.9 Answer is “B”

Solution:- First law of motion defines force while 2<sup>nd</sup> law of motion measures force.

Q.10 Answer is “B”

Solution:- All objects (massive or light) reach on earth with same acceleration “ $g$ ” when dropped from same heights. Their free fall time is given as:

$$t = \sqrt{\frac{2S}{g}}$$

$$\text{So } t_1 = t_2$$

Q.11 Answer is “A”

Solution:- Both distance and displacement given as:

$$\text{Distance} = (4 \times 2) + (2 \times (4 - 2)) + (2 \times (6 - 4))$$

$$\text{Displacement} = (4 \times 2) + (-2 \times (4 - 2)) + (2 \times (6 - 4))$$

Q.12 Answer is “D”

Solution:-

$$v_{\text{avg}} = \frac{\text{total distance}}{\text{total time}}$$

$$\Rightarrow v_{\text{avg}} = \frac{d_1 + d_2}{t_1 + t_2}$$

$$\Rightarrow v_{\text{avg}} = \frac{\frac{d}{2} + \frac{d}{2}}{\frac{2}{v_i} + \frac{2}{v_f}}$$

$$\text{Simplify it } \Rightarrow v_{\text{avg}} = \frac{2v_i v_f}{v_i + v_f}$$

**Q.13** Answer is “C”

$$\text{Solution:- } t = \frac{\text{Total distance}}{\text{relative speed}}$$

$$\Rightarrow t = \frac{60 + 40}{30 + 20}$$

**Q.14** Answer is “A”

$$\text{Solution:- } v_{\text{avg}} = \frac{\frac{d_1 + d_2}{\frac{d_1}{v_1} + \frac{d_2}{v_2}}}$$

**Q.15** Answer is “B”

**Solution:-** Since both of these forces act on one body, so these cannot make action-reaction pair as according to Newton's 3<sup>rd</sup> law of motion action reaction never act on same body.

**Q.16** Answer is “B”

**Solution:-** An object moving with constant speed may or may not be accelerated.

**Case-I**

When object is moving with constant speed in same direction its acceleration is zero.

**Case-II**

When object is moving with constant speed on a circular path, its direction changes which results in centripetal acceleration which is not zero.

**Q.17** Answer is “A”

**Solution:-** Simply find area under curve

**Q.18** Answer is “A”

$$\text{Solution:- } \frac{S}{d} = \frac{\pi R}{2R}$$

**Q.19** Answer is “B”

**Solution:-** Distance covered in n<sup>th</sup> second is:

$$S = \frac{g}{2}(2n-1)$$

**Q.20** Answer is “C”

**Solution:-** This is well according to Newton's 3<sup>rd</sup> law, the action force acts on package towards shore while the reaction force acts away from shore on boat.

**Q.21** Answer is “B”

$$\text{Solution:- } v = \sqrt{2gh}$$

**Q.22** Answer is “A”

$$\text{Solution:- Use relation } P = \sqrt{2mE}$$

**Q.23** Answer is “B”

**Solution:-** Use 3<sup>rd</sup> equation of motion

**Q.24** Answer is “C”

$$\text{Solution:- } S = \frac{1}{2}gt^2$$

**Q.25** Answer is “D”

$$\text{Solution:- } y = \frac{1}{2}gt^2$$

**Q.26** Answer is “C”

**Solution:-**

$$\text{i. } S = \frac{1}{2}gt^2$$

$$S = \frac{1}{2} \times 10 \times 8^2$$

$$S = 320 \text{ m}$$

$$\text{ii. } \frac{S}{2} = 160 \text{ m}; t_x = ?$$



$$\left(\frac{S}{2}\right) = \frac{1}{2}gt_x^2$$

Solve it

$$t_x = 4\sqrt{2} \text{ sec}$$

**Q.27 Answer is “D”**

**Solution:-** In a closed path distance  $\neq$  zero but displacement = 0

**Q.28 Answer is “C”**

**Solution:-**

A) Acceleration and force both are vectors.

B) Momentum and velocity both are vectors.

C) Force is vector while K.E is scalar.

D) Work and P.E both are scalars.

**Q.29 Answer is “D”**

**Solution:-** In action reaction forces;

- Both forces have equal magnitudes but opposite directions.
- Both forces are applied on different bodies.
- As both forces acts on different bodies, so these cannot maintain equilibrium.

**Q.30 Answer is “D”**

**Solution:-** When  $\theta = 45^\circ$ ,  $R = \text{max}$  then

$$H = \frac{R}{4}$$

**Q.31 Answer is “A”**

**Solution:-** For a projectile;

If  $R = nH$  then

$$\theta = \tan^{-1}\left(\frac{4}{n}\right) = \tan^{-1}\left(\frac{4}{1}\right) = 76^\circ$$

For given question

$$R = 1H \Rightarrow \theta = \tan^{-1}\left(\frac{4}{1}\right)$$

**Q.32 Answer is “B”**

**Solution:-** If sum of two angles is  $90^\circ$ , the ranges at those angles are equal if projected with same speed.

**Q.33 Answer is “D”**

**Solution:-** The maximum range and height are related as;

$$R = \frac{v_i^2}{g} \sin 2\theta ; \quad h = \frac{v_i^2 \sin 2\theta}{2g}$$

As range is maximum at  $\theta = 45^\circ$ , so;

$$R_{\max} = \frac{v_i^2}{g} ; \quad h = \frac{v_i^2}{2g} (\sin 45^\circ)^2$$

$$R_{\max} = \frac{v_i^2}{g} ; \quad h = \frac{v_i^2}{4g}$$

$$h = \frac{R_{\max}}{4}$$

Just remember this formula. This formula says at maximum range height is four times less than maximum range.

**Q.34 Answer is “A”**

**Solution:-** As friction is ignored so  $v_x = \text{constant}$  also  $a_x = 0 = \text{constant}$

And  $a_y = g = \text{constant}$

**Q.35 Answer is “C”**

**Solution:-** Usually we consider ideal case in which air friction is ignored, so path of projectile is parabola.

**Q.36 Answer is “C”**

**Solution:-** Projectile motion is a two dimensional motion under constant acceleration due to gravity.

**Q.37 Answer is “D”**

**Solution:-** The range of projectile is maximum at  $45^\circ$ . But among given option  $45^\circ$  is not present, so range among given options will be maximum at that angle which is closest to  $45^\circ$  (no matter whether

it is closer with value less than  $45^\circ$  or greater than  $45^\circ$ ). As  $40^\circ$  and  $50^\circ$  are equally closest to  $45^\circ$ , so range will be maximum at these angles.

**Q.38 Answer is "A"**

**Solution:-** As air friction is ignored in projectile motion, so no force acts along horizontal direction, hence horizontal component of velocity remains constant and horizontal component of acceleration remains zero. i.e

$$v_x = \text{constant} ; a_x = \frac{\Delta v_x}{\Delta t} = 0$$

**Q.39 Answer is "D"**

**Solution:-**  $v_x = \text{constant}$ ,

$$a_x = 0 = \text{constant}, a_y = g = \text{constant}$$

**Q.40 Answer is "C"**

**Solution:-** For a projectile;

$$\text{If } R=nH \text{ then } \theta = \tan^{-1}\left(\frac{4}{n}\right)$$

For given question

$$R = 1H \Rightarrow \theta = \tan^{-1}\left(\frac{4}{n}\right) = \tan^{-1}(4) = 76^\circ$$

**Q.41 Answer is "A"**

**Solution:-** If  $R = nH$

$$\text{then } \theta = \tan^{-1}\left(\frac{4}{n}\right)$$

**Q.42 Answer is "A"**

**Solution:-** At highest point  $v_y = 0$  so

$$v = v_x \text{ is } \perp \text{ to } a = g$$

**Q.43 Answer is "A"**

**Solution:-** Car will provide it horizontal component and person a vertical so combination makes a parabolic path.

**Q.44 Answer is "C"**

**Solution:-**

$$\frac{t_1}{t_2} = \frac{\left(\frac{2v_i \sin \theta}{g}\right)}{\left(\frac{2v_i \sin(90-\theta)}{g}\right)} = \frac{\sin \theta}{\sin(90-\theta)}$$

$$\frac{t_1}{t_2} = \frac{\sin \theta}{\cos \theta} = \tan \theta$$

**Q.45 Answer is "B"**

**Solution:-**

Because of horizontal component of velocity, the bomb undergoes projectile motion rather than vertically downward motion so it misses the target.

**Q.46 Answer is "D"**

**Solution:-** Height of projectile is given

as;

$$h = \frac{v_i^2 \sin^2 \theta}{2g}$$

It is maximum at  $90^\circ$ , among given options  $90^\circ$  is not present, so height will be maximum at that angle which is closer to  $90^\circ$ .

**Q.47 Answer is "A"**

**Solution:-** The path will be projectile for an observer standing outside the train, while for an observer within the train the path will be straight line.

**Q.48 Answer is "C"**

**Solution:-**

Use relation;  $K.E_H = K.E_i \times \cos^2 \theta$

For  $P.E_H = K.E_i \times \sin^2 \theta$

**Q.49** Answer is “C”

**Solution:-** Range can only be maximum at  $\theta=45^\circ$ .

**Q.50** Answer is “B”

**Solution:-** The slope of velocity time graph gives acceleration. As the slope of v-t graph decreases to zero in option-B, so acceleration will also be decreasing in this case, while in option “C” the slope is negative but it is constant.

**Q.51** Answer is “A”

**Solution:-** A Collision in which K.E of system remains constant is called elastic collision.

**Q.52** Answer is “D”

**Solution:-** When a massive body collides with a light body then after collision velocity of light body is twice the initial velocity of massive body.

**Q.53** Answer is “A”

**Solution:-**

Area of F-t graph = change in momentum

$$\text{Area of F-t graph} = \frac{1}{2}(2)(10) + (6-2)(10) = 50 \text{ N s}$$

STEP ENTRY TEST 2020

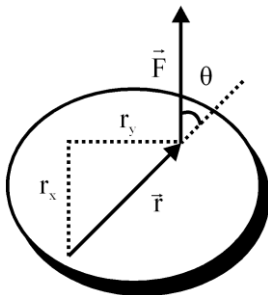
## Worksheet-13

Topics:- Moment of Force, Equilibrium &amp; Conditions

Q.1 The torque acting on a body will be half of maximum value when angle between force and position vector is:

- A)  $30^\circ$  C)  $60^\circ$   
B)  $45^\circ$  D)  $90^\circ$

Q.2 The torque in following figure is:



- A)  $r_x F \hat{n}$  C)  $r \cos \theta F \hat{n}$   
B)  $r_y F \hat{n}$  D) Both "A" and "B"

Q.3 If the centre of gravity of a body does not shift when it is disturbed then the body is said to be in?

- A) Stable equilibrium C) Neutral equilibrium  
B) Unstable equilibrium D) Rotational equilibrium

Q.4 Which one is true statement:

- A) A body in equilibrium implies that it is neither moving nor rotating  
B) If coplanar forces acting on a body form a closed polygon, then body is said to be in complete equilibrium  
C) A body in equilibrium may move or rotate  
D) Both "B" and "C"

Q.5 Torque is analogous to force for:

- A) Translatory motion C) Rotational motion  
B) Vibratory motion D) Linear motion

Q.6 The direction of torque in earth considering it to be an inertial frame of reference is:

- A) Anti-clock wise C) Along axis of rotation  
B) Clock wise D) Has no torque

Q.7 The torque produced by the weight of the body about the centre of gravity will be:

- A)  $mgr$  C)  $\vec{\omega} \times \vec{r}$   
B) Zero D)  $\vec{r} \times \vec{F}$

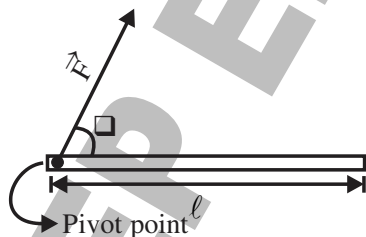
Q.8 Work done by torque will be equal to:

- A)  $Fd$  C)  $I\alpha$

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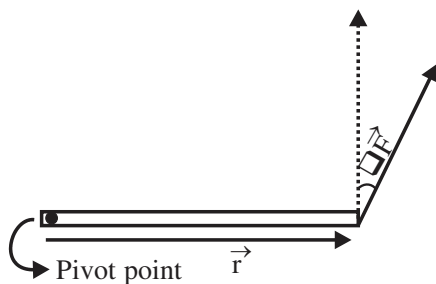
- B)  $r\theta$  D)  $\tau\theta$
- Q.9 As for translational motion we use relation  $F=ma$  similarly for angular motion this relation appears as:
- A)  $\tau = m\alpha$  C)  $\tau = I\alpha$   
B)  $\tau = Ia$  D)  $\tau = mr^2a$
- Q.10 If the line of action of force passes through the axis of rotation, then the value of torque will be:
- A) Maximum C) Negative  
B) Zero D) Positive
- Q.11 What is not true of the two forces that give rise to couple?
- A) They act in opposite direction  
B) They both act on the same body  
C) They both act at the same point  
D) They both have the same magnitude
- Q.12 When a body is disturbed from it's equilibrium state such that it is said to be in stable equilibrium then?
- A) It returns to equilibrium position if released  
B) It's P.E increases  
C) It's line of action of weight remains within same base area  
D) All of these
- Q.13 For which value of " $\theta$ " in the figure shown torque becomes maximum?



- A)  $0^\circ$  C)  $180^\circ$   
B)  $90^\circ$  D) No torque is produced
- Q.14 A force  $\vec{F}$  acts on a rod as shown in the figure. What is the relation for torque in it?

**USE THIS SPACE FOR  
SCRATCH WORK**



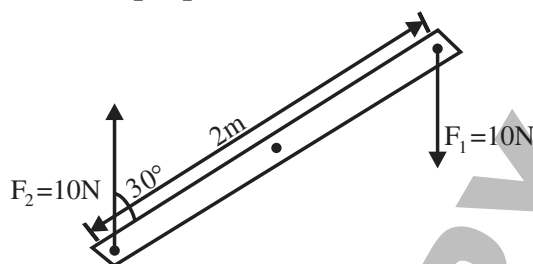


- A)  $\tau = rF \sin \theta$                       C)  $\tau = rF \tan \theta$   
B)  $\tau = rF \cos \theta$                       D)  $\tau = rF \cot \theta$

**Q.15** In above Question for which value of “ $\theta$ ” torque becomes maximum?

- A)  $\theta = 90^\circ$                                   C) Both “A” and “B”  
B)  $\theta = 270^\circ$                               D)  $\theta = 0^\circ$

**Q.16** Consider the figure in which two forces act on a single rod of length 2 m as shown. What will be the value of moment of couple produced?



- A) 20 N m                                      C) 5 N m  
B) 10 N m                                      D) 30 N m

**Q.17** The rate of change of angular momentum is equal to:

- A) Linear momentum                      C) Torque  
B) Force    D) None of these

**Q.18** The angular momentum of an object changes from 100 J s to 300 J s in 2 s. What will be the torque acting on it?

- A) 100 N m                                      C) 150 N m  
B) 300 N m                                      D) 0 N m

**Q.19** Two objects having moment of inertia  $I_1:I_2=2:1$ . What will be the ratio of their respective rate of change of angular momenta (consider first object to be in equilibrium)?

- A) 2:1    C) 0  
B) 1:2    D)  $\infty$

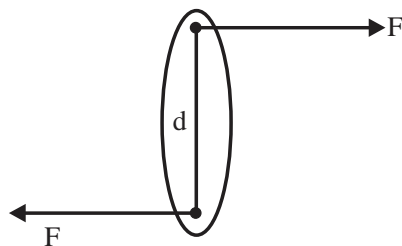
**Q.20** An object is said to be in complete equilibrium if:

- A)  $\sum \vec{F} = 0, \sum \vec{\tau} \neq 0$                       C)  $\sum \vec{F} = 0, \sum \vec{\tau} = 0$

**USE THIS SPACE FOR  
SCRATCH WORK**

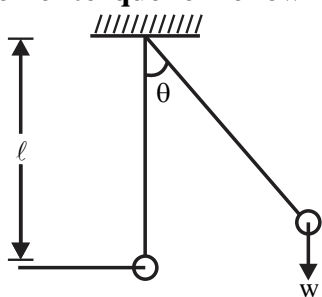
B)  $\sum \vec{F} \neq 0, \sum \vec{\tau} = 0$       D)  $\sum \vec{F} \neq 0, \sum \vec{\tau} \neq 0$

Q.21 What will be expression for moment of couple in the figure:



- A)  $dF$       C)  $2dF$   
B)  $dF/2$       D)  $dF \cos \theta$

Q.22 The expression of torque for following figure will be:



- A)  $mg \ell \cos \theta$       C)  $mg \ell$   
B)  $mg \ell \sin \theta$       D)  $mg \ell \tan \theta$

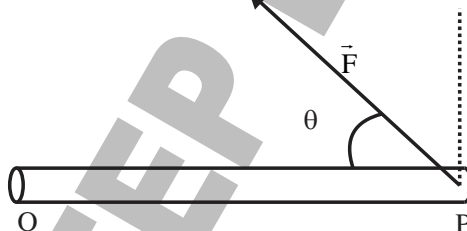
Q.23 The tyres of a car moving on road with constant velocity in a straight line are in \_\_\_\_\_ equilibrium.

- A) Translational      C) Dynamic  
B) Rotational      D) All of these

Q.24 The unit of “couple of forces” is same as that of:

- A) Force      C) Moment of couple  
B) Torque      D) Both B & C

Q.25 A force  $F$  is acting at point ‘P’ of uniform rod capable to rotate about ‘O’ what is the torque about ‘O’:



- A)  $OPF \sin \theta$       C)  $OPF \tan \theta$   
B)  $OPF \cos \theta$       D)  $OPF$

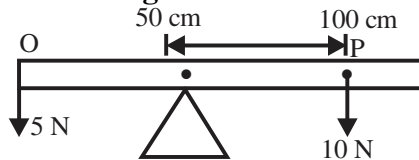
Q.26 A door requires a minimum torque of 100 N m in order to open it. What is the minimum distance of the handle from the hinge, if the door is to be pulled open with a

**USE THIS SPACE FOR  
SCRATCH WORK**

force at the handle not greater than 50 N.

- A) 0.33 m                      C) 0.71 m  
B) 2.0 m                      D) 1.54 m

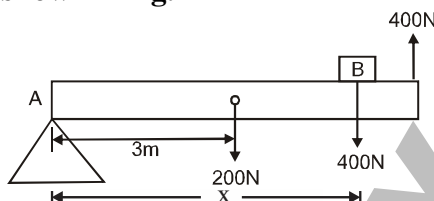
- Q.27** Two forces 5 N and 10 N are acting at 'O' and 'P' respectively on a uniform rod of length 100 cm suspended at the position of centre of gravity 50 cm mark as shown in figure.



What is the position of P on meter rod?

- A) 80 cm                      C) 75 cm  
B) 70 cm                      D) 65 cm

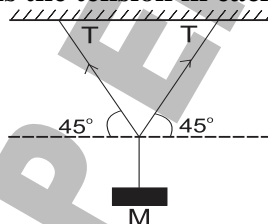
- Q.28** A uniform beam of 200 N is supported horizontally as show in fig. If the breaking tension of the rope is 400 N, how far can the block B of weight 400 N from point A on the beam as shown in fig.



- A) 75 cm                      C) 400 cm  
B) 300 cm                      D) 450 cm

- Q.29** A uniform rod 30 cm long is pivoted at its centre. A 40-newton weight is hung 5 cm from the left end. Where must a 50-newton weight be hung to maintain equilibrium?  
A) 5 cm from right end                      C) 6 cm from right end  
B) 7 cm from right end                      D) 8 cm from right end

- Q.30** A block of mass M shown in the figure below hangs motionless. What is the tension in each of the ropes?



- A)  $Mg$                       C)  $\frac{Mg}{\sqrt{2}}$   
B)  $\frac{Mg}{2}$                       D)  $2Mg$

## ANSWER KEY (Worksheet-13)

1	A	11	C	21	A
2	B	12	D	22	B
3	C	13	D	23	D
4	C	14	B	24	A
5	C	15	D	25	A
6	D	16	B	26	B
7	B	17	C	27	C
8	D	18	A	28	D
9	C	19	C	29	B
10	B	20	C	30	C

## SOLUTIONS

## Unit – 2 (WS-13)

Q.1 Answer is “A”

**Solution:-** Magnitude of torque is given as:

$$\tau = rF \sin \theta \rightarrow (i)$$

$$\text{Given } \tau = \frac{\tau_{\max}}{2} = \frac{rF}{2}$$

Putting in (i)

$$\frac{rF}{2} = rF \sin \theta$$

$$\frac{1}{2} = \sin \theta$$

$$\theta = 30^\circ$$

Q.2 Answer is “B”

**Solution:-** As  $\vec{r}_x$  is parallel to  $\vec{F}$ , so torque due to this component is zero. All the torque produced will be due to  $\vec{r}_y$ .

Q.3 Answer is “C”

**Solution:-** If center of gravity of a body does not shift when it is disturbed then the body is said to be in neutral equilibrium.

Q.4 Answer is “C”

**Solution:-** By definition of equilibrium, a body is said to be in equilibrium if it is at rest or moving with constant velocity i.e its acceleration is zero, this means that a moving body or rotating body can be in equilibrium if its acceleration is zero.

Q.5 Answer is “C”

**Solution:-** Torque is the rotational analogous of force. It plays the same role in angular motion as the force plays in linear motion. Force produces linear acceleration & torque produces angular acceleration

Q.6 Answer is “D”

**Solution:-**  $\tau = I\alpha$ ,

As  $\omega = \text{constant}$  so  $\alpha = 0, \tau = 0$

Q.7 Answer is “B”

**Solution:-** The weight of body is the force that passes through centre of gravity (which is the pivot point as well). So, the moment arm becomes zero, hence

$$\tau = rF \sin \theta$$

$$r = 0$$

$$\tau = 0$$

Q.8 Answer is “D”

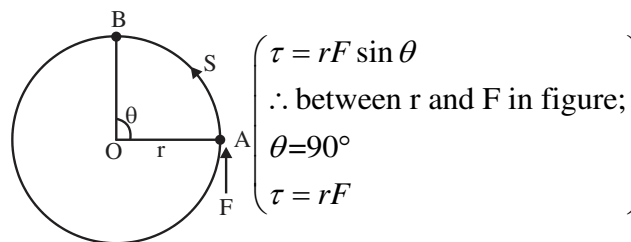
**Solution:-** Work done is given as:

$$W = FS$$

$$W = F(r\theta)$$

$$W = (rF)\theta$$

$$W = \tau\theta$$



**Q.9 Answer is “C”****Solution:-** 2<sup>nd</sup> law of motion for translational motion is;

$$F = ma$$

2<sup>nd</sup> law of motion for angular motion is;

$$\tau = I\alpha$$

**Q.10 Answer is “B”****Solution:-** When the line of action of force passes through pivot, moment arm becomes zero, so torque becomes zero.**Q.11 Answer is “C”****Solution:-** Two forces acting on a body will give rise to couple if:

- Both forces have same magnitude.
- Both forces have opposite direction.
- Both forces have different lines of action.

**Q.12 Answer is “D”****Solution:-** When a body in stable equilibrium is disturbed its P.E increases as its C.G point rises. Also the C.G point remains in the same base area.**Q.13 Answer is “D”****Solution:-** As moment arm is zero so  $\tau = 0$ **Q.14 Answer is “B”****Solution:-** Here angle between  $\vec{F}$  and  $\vec{r}$  is  $90^\circ - \theta$ , which makes

$$\tau = rF \sin(90^\circ - \theta) = rF \cos \theta$$

**Q.15 Answer is “D”****Solution:-** As the torque for given figure is;

$$\tau = rF \cos \theta$$

If  $\theta = 0^\circ$ 

$$\tau = rF \cos 0^\circ$$

$$\tau = rF = \max$$

**Q.16 Answer is “B”****Solution:-** $\tau_{\text{couple}} = (\text{perpendicular distance between lines of action of forces}) (\text{magnitude of one force})$ 

$$\tau_{\text{couple}} = (r \sin \theta)(F_1)$$

**Q.17 Answer is “C”****Solution:-** As  $F = \frac{\Delta p}{\Delta t}$  so  $\tau = \frac{\Delta L}{\Delta t}$ **Q.18 Answer is “A”****Solution:-** Torque in terms of angular momentum is given as;

$$\tau = \frac{\Delta L}{\Delta t} = \frac{L_f - L_i}{\Delta t}$$

$$\tau = \frac{300 - 100}{2} = \frac{200}{2}$$

$$\tau = 100 \text{ N m}$$

**Q.19 Answer is “C”****Solution:-**  $\tau = \text{rate of change of angular momentum} = I\alpha$ 

As First body is in equilibrium:

$$\alpha_1 = 0 \quad \text{so,} \quad \frac{\tau_1}{\tau_2} = \frac{0}{\tau_2} = 0$$

**Q.20 Answer is “C”****Solution:-** For complete equilibrium of a body, both conditions of equilibrium must be satisfied i.e

$$\sum \vec{F} = \vec{0} \quad \text{and} \quad \sum \vec{\tau} = \vec{0}$$

**Q.21 Answer is “A”**

**Solution:-** Moment of couple = (perpendicular distance between lines of action of forces) (magnitude of one force)

**Q.22 Answer is “B”**

**Solution:-** Basic relation. Here moment arm =  $\ell$ , and  $F = mg \sin \theta$  so put in  $r \times F$ .

**Q.23 Answer is “D”**

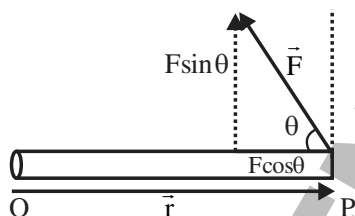
**Solution:-** The tyres of car spin about their axis with constant angular velocity and move in straight line with constant linear velocity, so both accelerations in body are zero and body is in translational, rotational and dynamic equilibrium.

**Q.24 Answer is “A”**

**Solution:-** Couple of forces has same units as that of force while moment of couple has the units same as that of torque.

**Q.25 Answer is “A”**

**Solution:-**



Torque is produced due to that component of force which is perpendicular to position vector  $\vec{r}$ . In the given figure  $F \sin \theta$  is perpendicular to  $\vec{r}$  or  $\overline{OP}$ , so

$$\tau = \overline{OP} F \sin \theta$$

**Q.26 Answer is “B”**

**Solution:-** Use relation;  $\tau = rF$

**Q.27 Answer is “C”**

**Solution:-**

**Step-I**

Find distance “x” of “P” point from pivot by using

$$\tau_{\text{clockwise}} = \tau_{\text{anticlockwise}}$$

**Step-II**

Find distance of “P” from “O” by adding 50 cm in “x”.

**Q.28 Answer is “D”**

**Solution:-**

Find distance x of “B” from pivot by using

$$\tau_{\text{clockwise}} = \tau_{\text{anticlockwise}}$$

**Q.29 Answer is “B”**

**Solution:-**

Find distance of 50 N weight from pivot by using

$$\tau_{\text{clockwise}} = \tau_{\text{anticlockwise}}$$

Then see what is the distance from right end.

**Q.30 Answer is “C”**

**Solution:-** Use relation;  $2T_y = Mg$



**Worksheet-14**

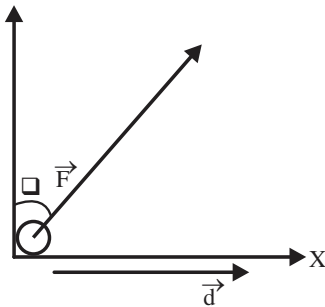
**Topics:-** Work, Kinetic & Potential Energy, Inter Conversion of K.E & P.E, Power, Angular Displacement, Angular Velocity, Centripetal Force & Geostationary Orbits, Radian

- Q.1** When a person lifts a body from ground work done by the lifting force is?  
A) Positive C) Negative  
B) Zero D) Half of positive maximum
- Q.2** When a person lifts a body from ground work done by force of gravity is?  
A) Positive C) Half of negative maximum  
B) Negative D) Zero
- Q.3** A force of  $3\hat{i} + 4\hat{j}$  N displaces the body through  $4\hat{i} + 3\hat{j}$  m the work done will be:  
A) 12 J C) 28 J  
B) 24 J D) - 12 J
- Q.4** The following four particles have same K.E, then which of them has maximum momentum:  
A) Proton C) Positron  
B) Electron D)  $\alpha$ -particle
- Q.5** The power of a pump which can pump 100 kg of water to a height of 100 m in 5 sec is:  
A) 20 kW C) 40 kW  
B) 200 kW D) 4 kW
- Q.6** 1 MWh is equal to:  
A) 3.6 kJ C) 3.6 MJ  
B) 3.6 J D) 3.6 GJ
- Q.7** Work done is equal to:  
A) Change in K.E C) Change in elastic P.E  
B) Change in P.E D) All of these
- Q.8** Which of the following is unit of P.E:  
A) eV C) joule  
B) calorie D) All of these
- Q.9** Slope of energy time graph is equal to:  
A) Acceleration C) Power  
B) Momentum D) Work

USE THIS SPACE FOR  
SCRATCH WORK



**Q.20** Consider the figure in which a force  $\vec{F}$  acts on a body through displacement  $\vec{d}$  :



**For which value of “ $\theta$ ” work is said to be maximum?**

- A)  $0^\circ$   
B)  $180^\circ$   
C) Both "A" & "B"  
D)  $90^\circ$

**Q.21** Considering figure of Q.20 what will be the mathematical formula for the calculation of work?

- A)  $W = Fd \cos \theta$   
B)  $W = Fd \sin \theta$   
C)  $W = Fd \tan \theta$   
D) None of these

**Q.22** A force of 2 N acts on body for 1 m distance, the maximum work done is:

- A) 2 units  
B) 3 units  
C) 5 units  
D) 6 units

**Q.23** A mass is lifted to a height in 10 sec. Now if the same mass is lifted to the same height in 20 sec then work done in two cases are in the ratio:

- A) 1:2  
B) 2:1  
C) 1:1  
D) 4:1

**Q.24** A body is released from a height of 5 m. If friction is ignored then its velocity just before striking the ground will be ( $g = 10 \text{ m s}^{-2}$ ):

- A)  $5 \text{ m s}^{-1}$       C)  $15 \text{ m s}^{-1}$   
B)  $10 \text{ m s}^{-1}$       D)  $20 \text{ m s}^{-1}$

**Q.25 The direction of angular displacement is:**

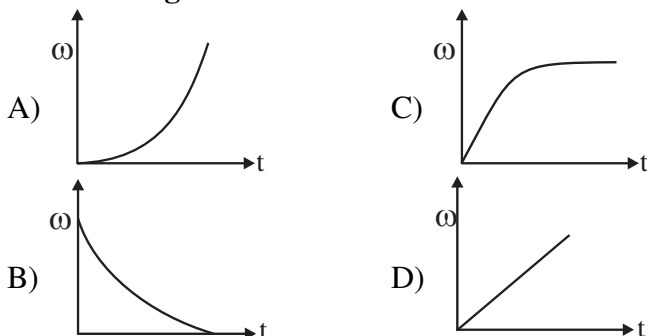
- A) Along axis of rotation  
B) In the plane of rotation  
C) Perpendicular to plane of rotation  
D) Both A and C

**Q.26** The angular velocity of spin motion of earth is:

- A)  $\frac{\pi}{12} \text{ rev min}^{-1}$       C)  $\frac{\pi}{4} \text{ rev min}^{-1}$   
B)  $\frac{\pi}{6} \text{ rad h}^{-1}$       D)  $\frac{\pi}{12} \text{ rad h}^{-1}$

**USE THIS SPACE FOR**  
**SCRATCH WORK**

**Q.27** The angular velocity time graph which corresponds to constant angular acceleration is:



**Q.28** The ratio of units of angular acceleration to angular velocity gives units of:

- A) Time  
B) Length  
C) Frequency  
D) Mass

**Q.29** An electric fan rotating at  $3 \text{ rev s}^{-1}$  is switched off. It comes to rest in 18 s. What will be the deceleration produced?

- A)  $0.5 \text{ rev s}^{-2}$   
B)  $0.25 \text{ rev s}^{-2}$   
C)  $0.2 \text{ rev s}^{-2}$   
D)  $0.16 \text{ rev s}^{-2}$

**Q.30** If the radius of a circle is doubled keeping same angular velocity, then centripetal force becomes:

- A) Double  
B) Remains same  
C) Half  
D) Reduces by four times

**Q.31** Time period of the orbital motion of a geostationary satellite is:

- A) 5060 sec  
B) 84 min  
C) 24 hour  
D) Any of these

**Q.32** Which one is not true about communication satellites?

- A) They use microwaves to communicate  
B) Minimum three correctly positioned satellites are required for global coverage.  
C) Their orbital speed is greater than orbital speed of low flying satellites  
D) None of these

**Q.33** An object is moving with a velocity of  $15 \text{ m s}^{-1}$  such that a constant force acts on it of 3 N. What must be the power developed in this case?

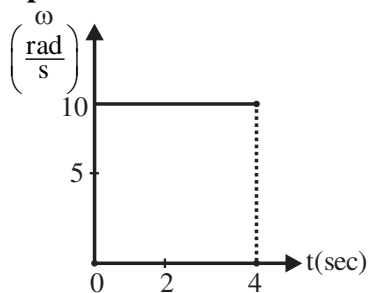
- A) 5 W  
B) 15 W  
C) 30 W  
D) 45 W

**Q.34** The angular displacement covered by hour hand of a clock while moving from 12 O'clock to 3 O'clock is:

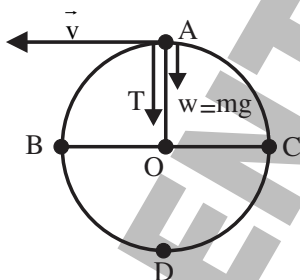
- A)  $90^\circ$   
B)  $75^\circ$   
C)  $135^\circ$   
D)  $45^\circ$

USE THIS SPACE FOR  
SCRATCH WORK

- Q.35 The angular displacement covered by a body in the following graph is:



- A) 40 rev  
B) 30 rad  
C) 20 rev  
D) 40 rad
- Q.36 Which statement is incorrect about two points “A” & “B” present on a spinning body having unequal distances from axis of rotation?
- A) Both points have same angular acceleration  
B) Both points have different velocity  
C) Both points have same axis of rotation  
D) Both points have same acceleration
- Q.37 If  $\vec{r} = 4\hat{i}$  and  $\vec{\omega} = 4\hat{k}$  then  $\vec{v}$  is:
- A)  $16\hat{k}$   
B)  $16\hat{j}$   
C)  $16\hat{i}$   
D)  $-16\hat{k}$
- Q.38 A ball tied to the end of a string, is swung in a vertical circle of radius “r” under the action of gravity as shown in figure. What will be tension in string at “A”?



- A) Zero  
B) Equal to centripetal force  
C) Equal to weight  
D) None of these
- Q.39 The angular displacement covered by earth while orbiting around sun in a time equal to half of one year is:
- A)  $\frac{\pi}{2}$  rad  
B)  $\pi$  rad  
C)  $\frac{3\pi}{2}$  rad  
D)  $2\pi$  rad
- Q.40 The orbital speed of a geostationary satellite is:
- A)  $7.9 \text{ km s}^{-1}$   
B)  $3.1 \text{ km s}^{-1}$   
C)  $11.1 \text{ km s}^{-1}$   
D)  $5.9 \text{ km s}^{-1}$

USE THIS SPACE FOR  
SCRATCH WORK

**ANSWER KEY (Worksheet-14)**

1	A	11	C	21	B	31	C
2	B	12	D	22	A	32	C
3	B	13	A	23	C	33	D
4	D	14	B	24	B	34	A
5	A	15	C	25	D	35	D
6	D	16	D	26	D	36	D
7	D	17	A	27	D	37	C
8	D	18	A	28	C	38	A
9	C	19	C	29	D	39	B
10	C	20	D	30	A	40	B

**SOLUTIONS****Unit – 3 (WS-14)****Q.1** Answer is “A”

**Solution:-** As  $\vec{F}$  &  $\vec{d}$  are parallel so  
 $W = +ve$

**Q.2** Answer is “B”

**Solution:-**  $\vec{F}$  &  $\vec{d}$  are anti-parallel so  
 $W = -ve$

**Q.3** Answer is “B”

**Solution:-** Simply use relation;  $W = \vec{F} \cdot \vec{d}$   
 $W = F_x d_x + F_y d_y + F_z d_z$

**Q.4** Answer is “D”

**Solution:-** Use relation;  $p = \sqrt{2mE}$

As  $E = \text{same}$  so  $p \propto \sqrt{m}$

**Q.5** Answer is “A”

**Solution:-**  $P = \frac{W}{t} = \frac{mgh}{t}$

**Q.6** Answer is “D”

**Solution:-** Mega watt hour is related with joule as:

$$1\text{MWh} = 1 \times 10^6 \times 3600 \text{ W s}$$

$$= 3.6 \times 10^9 \text{ J}$$

$$1\text{MWh} = 3.6 \text{ GJ}$$

**Q.7** Answer is “D”

**Solution:-** According to work-energy principle

“Work done on a body is equal to change in its K.E or change in its P.E or change in both energies.”

i.e  $W = \Delta K.E$  or  $\Delta P.E$  or both

**Q.8** Answer is “D”

**Solution:-** The different units of energy and their relation with SI-unit is as following:

- 1 kWh = 3.6 MJ
- 1 eV =  $1.6 \times 10^{-19}$  J
- 1 calorie = 4.18 J
- 1 erg =  $10^{-7}$  J

**Q.9** Answer is “C”

**Solution:-**

$$\text{Slope} = \frac{\Delta y}{\Delta x} = \frac{\Delta \text{Energy}}{\Delta \text{time}} = \text{Power}$$

**Q.10** Answer is “C”

**Solution:-** It may be moving on plane surface, so its P.E with reference to that plane surface will be zero.

**Q.11** Answer is “C”

**Solution:-** The base units of power are:

$$P = \frac{\Delta W}{\Delta t} = \frac{J}{s} = \frac{N \cdot m}{s} = \frac{kg \cdot m \cdot s^{-2} \cdot m}{s}$$

$$P = kg \cdot m^2 \cdot s^{-3}$$

**Q.12** Answer is “D”

**Solution:-** Whenever greater or smaller work is to be decided, compare all given options without their signs, the negative or positive signs just indicate the angle between the force & displacement, i.e

- $W = +ve$  , if  $\theta < 90^\circ$
- $W = -ve$  , if  $\theta > 90^\circ$
- $W = 0 = \text{minimum}$  , if  $\theta = 90^\circ$



**Q.13 Answer is "A"****Solution:-** When force and displacement are parallel, then;

$$W = Fd \cos \theta$$

$$\theta = 0^\circ; \cos 0^\circ = +1 = \text{positive maximum}$$

$$W = +Fd = \text{positive maximum}$$

**Q.14 Answer is "B"****Solution:-** When force and displacement are antiparallel, then;

$$W = Fd \cos \theta$$

$$\theta = 180^\circ; \cos 180^\circ = -1 = \text{negative maximum}$$

$$W = -Fd = \text{negative maximum}$$

**Q.15 Answer is "C"****Solution:-** Work done is positive maximum when  $\vec{F}$  and  $\vec{d}$  are parallel and it is negative maximum when  $\vec{F}$  and  $\vec{d}$  are anti-parallel. Physically both +ve maximum work and -ve maximum work are equal, -ve work does not mean work is less than zero.**Q.16 Answer is "D"****Solution:-** Use relation;  $W = Fd \cos \theta$ **Q.17 Answer is "A"****Solution:-**

$$W = \frac{W_{\max}}{2} = \frac{Fd}{2}$$

$$Fd \cos \theta = \frac{Fd}{2}$$

$$\cos \theta = \frac{1}{2}$$

$$\theta = \cos^{-1}\left(\frac{1}{2}\right)$$

$$\theta = 60^\circ$$

**Q.18 Answer is "A"****Solution:**

According to Work-Energy Principle

$$\Delta K.E = W_{\text{friction}}$$

$$\Delta K.E = Fd \cos \theta$$

$$\text{Stopping distance} = d$$

Since both cars have same K.E, so their stopping distances are also equal.

**Q.19 Answer is "C"****Solution:-** When gravity does -ve work "h" increases hence P.E increases**Q.20 Answer is "D"****Solution:-** Making  $\theta = 90^\circ$ ,  $\vec{F}$  becomes parallel to the  $\vec{d}$ **Q.21 Answer is "B"****Solution:-** Here angle between  $\vec{F}$  &  $\vec{d}$  is  $90^\circ - \theta$  which makes

$$W = Fd \cos(90^\circ - \theta) = Fd \sin \theta$$

**Q.22 Answer is "A"****Solution:-** Simply use relation;

$$W = \text{maximum} = Fd$$

**Q.23 Answer is "C"****Solution:-** Work done does not depend upon time.**Q.24 Answer is "B"****Solution:-** Use relation  $v = \sqrt{2gh}$ **Q.25 Answer is "D"****Solution:-** All angular quantities have same direction most of the time & is along axis of rotation.**Q.26 Answer is "D"**

$$\text{Solution:- } \omega = \frac{\theta}{t} = \frac{2\pi}{24} \text{ rad h}^{-1}$$

**Q.27 Answer is "D"****Solution:-** Slope of  $\omega$ -t graph =  $\alpha$ **Q.28 Answer is "C"**

$$\text{Solution:- } \frac{\alpha}{\omega} = \frac{\text{rad s}^{-2}}{\text{rad s}^{-1}} = \text{s}^{-1} \text{ or Hz}$$

**Q.29 Answer is "D"**

**Solution:-** Use relation;  $\alpha = \frac{\omega_f - \omega_i}{t}$  take  
 $\omega_f = 0 \text{ rad s}^{-1}$

**Q.30 Answer is "A"**

**Solution:-** Use relation  $F_c = m r \omega^2$

**Q.31 Answer is "C"**

**Solution:-** The time period of a geostationary satellite is 24 hour which is exactly same as the time period of spin motion of earth.

**Q.32 Answer is "C"**

**Solution:-** Communication satellites are usually geostationary satellites for which orbital speed is  $3.1 \text{ km s}^{-1}$  while the orbital speed of low flying satellites is  $7.9 \text{ km s}^{-1}$  which is greater than communication satellites.

**Q.33 Answer is "D"**

**Solution:-** The power developed in terms of force & velocity is:

$$P = \vec{F} \cdot \vec{v} = Fv \cos \theta$$

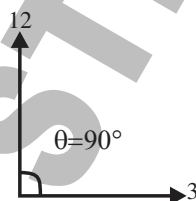
**Here:**  $F = 3 \text{ N}, v = 15 \text{ m s}^{-1}, \theta = 0^\circ$

$$P = 3 \times 15 \cos 0^\circ$$

$$P = 45 \text{ W}$$

**Q.34 Answer is "A"**

**Solution:-** When hour hand moves from 12 O'clock to 3 O'clock, it covers an angle of  $90^\circ$ .



**Q.35 Answer is "D"**

**Solution:-** Magnitude of angular displacement = Area of  $\omega$ -t graph

$$\theta = \omega t$$

$$\theta = (10)(4) = 40 \text{ rad}$$

**Q.36 Answer is "D"**

**Solution:-** All the point on a spinning rigid body have;

- Same angular parameters
- Different linear parameters

**Q.37 Answer is "C"**

**Solution:-**

$$\vec{v} = \vec{\omega} \times \vec{r} = (4\hat{k}) \times (4\hat{i})$$

$$\vec{v} = 16(\hat{k} \times \hat{i}) (\because \hat{k} \times \hat{i} = \hat{j})$$

$$\vec{v} = 16\hat{j}$$

**Q.38 Answer is "A"**

**Solution:-** At the highest point of vertical circle

$$T + w = \frac{mv^2}{r}$$

$$T = \frac{mv^2}{r} - w$$

$$T = m \left( \frac{v^2}{r} - g \right)$$

$$\therefore \text{At highest point } g = \frac{v^2}{r},$$

so, tension =  $T = 0$

**Q.39 Answer is "B"**

**Solution:-** In one year (complete revolution) the earth covers an angular displacement =  $2\pi$

In half year (half revolution) the earth covers an angular displacement

$$= \frac{2\pi}{2} = \pi \text{ rad}$$

**Q.40 Answer is "B"**

**Solution:-** Orbital speed for geostationary satellite is  $3.1 \text{ km s}^{-1}$ .

STEP ENTRY TEST 2020

## Worksheet-15

**Topics:-** SHM, SHM and Uniform Circular Motion, Simple Pendulum, Conservation of Energy in SHM, Free and Forced Oscillations, Resonance & its Applications, Principle of Superposition, Electromagnetic Spectrum

**Q.1** The product of angular frequency ( $\omega$ ) and time period will be:

- A) 1  
B)  $\frac{\pi}{2}$   
C)  $2\pi$   
D)  $\pi$

**Q.2** A simple pendulum is oscillating in a lift. If the lift starts moving upwards with a uniform acceleration then the time period will:

- A) Remain unaffected  
B) Be shorter  
C) Be longer  
D) May be "B" or "C"

**Q.3** A particle is executing S.H.M, then the graph of velocity as a function of displacement is:

- A) Straight line  
B) Circle  
C) Ellipse  
D) Hyperbola

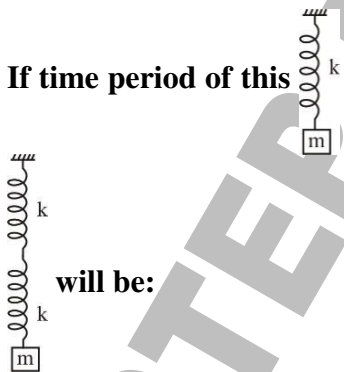
**Q.4** A particle is executing S.H.M, then the graph of acceleration as a function of displacement is:

- A) Straight line  
B) Circle  
C) Ellipse  
D) Hyperbola

**Q.5** A particle executing SHM has an acceleration of  $64 \text{ cm s}^{-2}$  when its displacement is 4 cm, its period in seconds is:

- A)  $\frac{\pi}{2}$   
B)  $\frac{\pi}{4}$   
C)  $\pi$   
D)  $2\pi$

**Q.6** If time period of this is T, then the time period of this




will be:

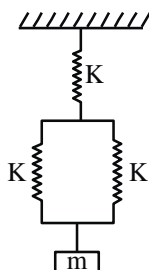
- A)  $T/\sqrt{2}$   
C)  $T/2$

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B)  $\sqrt{2} T$

D)  $2T$

Q.7 If the time period of  is  $T$ , then the time period of this



this will be:

A)  $\frac{T}{\sqrt{2}}$

C)  $\sqrt{2} T$

B)  $\frac{T}{2}$

D)  $\sqrt{\frac{3}{2}} T$

Q.8 At  $t = 0$  a body performing SHM is at mean position, when  $t = \frac{T}{4}$  it will be at:

- A) At extreme position
- B) Between mean and extreme position
- C) Beyond extreme position
- D) Again at mean position

Q.9 The displacement of particle in SHM in one time period if its amplitude of vibration is " $a$ " will be:

- A) Zero
- B)  $a$
- C)  $2a$
- D)  $4a$

Q.10 A system can vibrate only if it has:

- A) Inertia
- B) Restoring force
- C) Plasticity
- D) Both "A" and "B"

Q.11 The maximum velocity of harmonic oscillator is  $10 \text{ cm s}^{-1}$ . If its amplitude is  $10 \text{ cm}$ . What is its maximum acceleration?

- A)  $100 \text{ cm s}^{-2}$
- B)  $1 \text{ cm s}^{-2}$
- C)  $10 \text{ cm s}^{-2}$
- D)  $0.1 \text{ cm s}^{-2}$

Q.12 The time in which a body executing SHM is at a distance of  $\frac{x_0}{2}$  from the mean position is (where  $T$  is its time period):

- A)  $\frac{T}{2}$
- C)  $\frac{T}{8}$

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B)  $\frac{T}{4}$

D)  $\frac{T}{12}$

**Q.13** A particle execute SHM with a time period of 2 s and amplitude 5 cm. Maximum value of its velocity is:

A)  $10 \pi \text{ cm s}^{-1}$

C)  $2.5 \pi \text{ cm s}^{-1}$

B)  $20 \pi \text{ cm s}^{-1}$

D)  $5 \pi \text{ cm s}^{-1}$

**Q.14** The time period of simple pendulum measured inside a stationary lift is T. If the lift starts moving upward with an acceleration of g, what will be the time period?

A)  $\frac{T}{3}$

C)  $\sqrt{\frac{3}{2}}T$

B)  $\frac{T}{\sqrt{2}}$

D)  $\frac{\sqrt{3}}{2}T$

**Q.15** The bob of a simple pendulum of period T is given a negative charge. If it is allowed to oscillate above a positively charged plate, the new time period will be:

A) Equal to T

C) Less than T

B) More than T

D) Infinite

**Q.16** The relation of restoring force in a simple pendulum if it makes an angle “ $\theta$ ” with horizontal is:

A)  $mg \sin \theta$

C)  $mg \cos \theta$

B)  $mg \tan \theta$

D)  $mg \cot \theta$

**Q.17** The time period of variation in total energy of a simple harmonic oscillator is:

A) 2T

C) 0

B)  $\frac{T}{2}$

D) Infinite

**Q.18** The frequency of variation in K.E or P.E of a simple harmonic oscillator is:

A)  $f$

C)  $3f$

B)  $2f$

D)  $\frac{f}{2}$

**Q.19** The maximum number of equal parts in which time period of a simple harmonic oscillator can be divided are (when displacement is equal in each part):

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- A) 4  
B) 6  
C) 8  
D) Infinite

**Q.20** The relation for time period of a horizontal mass spring system is  $T = 2\pi\sqrt{\frac{x}{g}}$ . What will be its time period if taken on moon (at moon  $g_m = \frac{g}{6}$ ).

- A) T will increase  
B) T will remain same  
C) T will decrease  
D) T may increase or decrease

**Q.21** k is spring constant, its unit is same as that of:

- A) Pressure  
B) Tension  
C) Surface tension  
D) Energy

**Q.22** The spring constant of two springs are added for maximum equivalent when they are connected in:

- A) Series  
B) Parallel  
C) Perpendicular  
D) None of these

**Q.23** When a spring of spring constant k is cut into two parts of same length, then the effective value of spring constant is:

- A) 2k  
B) k  
C)  $\frac{k}{2}$   
D)  $\frac{k}{4}$

**Q.24** If the displacement in SHM is written by equation  $x = x_0 \cos \omega t$  the value of initial phase in this case is:

- A)  $0^\circ$   
B)  $45^\circ$   
C)  $90^\circ$   
D)  $180^\circ$

**Q.25** Spring constant of a spring and its length are related as:

- A)  $k \propto l$   
B)  $k \propto l^{-1}$   
C)  $k \propto \sqrt{l}$   
D)  $k \propto l^{-\frac{1}{2}}$

**Q.26** A simple pendulum has frequency of 2 Hz. How long does it take to move from mean to extreme position:

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- A) 0.12 s                      C) 0.5 s  
B) 0.2 s                      D) 0.05 s
- Q.27** Equation for displacement in SHM is  $x = x_0 \sin \omega t$ . The value of acceleration at instant  $t = \frac{T}{4}$  is:
- A)  $x_0 \omega$                       C)  $x_0 \sqrt{\omega}$   
B)  $x_0 \omega^2$                       D)  $x_0 \frac{\omega}{2}$
- Q.28** The relation for instantaneous velocity for a simple harmonic oscillator is:
- A)  $v = \omega \sqrt{x_0^2 - x^2}$                       C)  $v = \sqrt{\frac{k}{m}} (x_0^2 - x^2)$   
B)  $v = \sqrt{\frac{g}{\ell}} (x_0^2 - x^2)$                       D) All of these
- Q.29** Which of the following can be true for “ $\omega$ ”?
- A)  $\sqrt{\frac{k}{m}}$                       C)  $\sqrt{\frac{g}{\ell}}$   
B)  $\frac{2\pi}{T}$                       D) All of these
- Q.30** For a simple harmonic oscillator which of the following is true for maximum acceleration?
- A)  $a = -\omega^2 x_0$                       C)  $a = \frac{-k}{m} x_0$   
B)  $a = \frac{-g}{\ell} x_0$                       D) All of these
- Q.31** The ratio of maximum velocity and maximum acceleration for simple harmonic oscillator can be written as:
- A)  $\frac{T}{2\pi}$                       C)  $\sqrt{\frac{\ell}{g}}$   
B)  $\sqrt{\frac{m}{k}}$                       D) All of these
- Q.32** The displacement covered by a simple harmonic oscillator in a time of  $\frac{3}{2}T$  while starting from extreme position with amplitude “a”:

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- A) Zero C) 4a  
B) 2a D) 6a
- Q.33 Referring to data in Q.32, the distance covered is:**  
A) Zero C) 4a  
B) 2a D) 6a
- Q.34 The time taken by a simple harmonic oscillator to travel from extreme to half of mean  $\left(x = \frac{x_0}{2}\right)$  is:**  
A)  $\frac{T}{4}$  C)  $\frac{T}{8}$   
B)  $\frac{T}{12}$  D)  $\frac{T}{6}$
- Q.35 A simple harmonic oscillator starts its journey from mean and moves towards +ve extreme then what is true?**  
A) Its initial phase is zero  
B) We use  $x = x_0 \cos \theta$  for it  
C) We use  $x = x_0 \sin \theta$  for it  
D) Both "A" & "C"
- Q.36 Which of the following equations can be used for a simple harmonic oscillator?**  
A)  $x = x_0 \sin \theta$  C)  $x = x_0 \cos \theta$   
B)  $x = -x_0 \cos \theta$  D) All of these
- Q.37 A uniform circular motion is:**  
A) A periodic motion only  
B) A simple harmonic motion only  
C) Both periodic and harmonic motion  
D) Neither periodic nor harmonic motion
- Q.38 In SHM when K.E is maximum then which of the following is incorrect?**  
A) P.E is zero C) Displacement is zero  
B) Acceleration is zero D) None of these
- Q.39 A pendulum has time period T on earth. As the value of g on the surface of moon is  $\frac{1}{6}$ th times than on earth, then the time period of such a pendulum on the moon's surface will be:**  
A)  $\sqrt{6}T$  C)  $\frac{T}{6}$

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B)  $\frac{T}{\sqrt{6}}$  D)  $6T$

**Q.40** A simple pendulum is present in a lift which is accelerated downwards by  $g$ , then its time period in lift will become:

A)  $\frac{1}{\sqrt{2}}$  times C)  $\frac{2}{\sqrt{3}}$  times  
B) 2 times D) Infinite

**Q.41** In SHM when displacement is equal to  $\frac{x_o}{2}$ , then the ratio of P.E to K.E is:

A) 2:3 C) 3:2  
B) 1:3 D) 3:1

**Q.42** In simple pendulum at any instant tension of string is \_\_\_\_\_ when it makes angle " $\theta$ " with horizontal is:

A)  $T = mg$  C)  $T = mg \sin \theta$   
B)  $T = mg \cos \theta$  D)  $T = -mg \sin \theta$

**Q.43** In SHM how many times does K.E and P.E become equal during one period?

A) 1 time C) 3 times  
B) 2 times D) 4 times

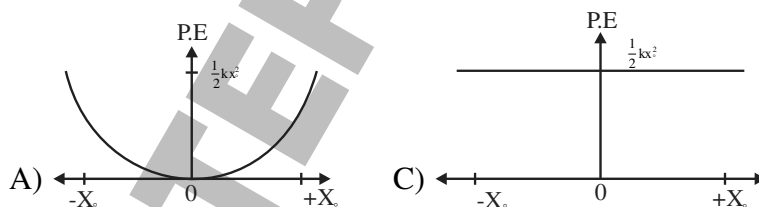
**Q.44** When K.E and P.E in SHM become equal the displacement is?

A)  $\frac{x_o}{2}$  C)  $\sqrt{2}x_o$   
B)  $\frac{x_o}{\sqrt{2}}$  D)  $\frac{\sqrt{3}x_o}{2}$

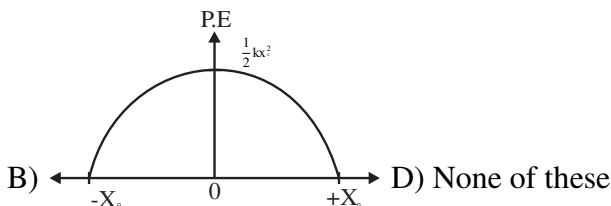
**Q.45** The time period of a simple pendulum is independent of:

A) Length of pendulum C) Value of gravity  
B) Centre of mass D) None of these

**Q.46** The graph of P.E vs displacement for a harmonic oscillator is:



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**Q.47** A body performing SHM has displacement  $x = x_0 \sin(\omega t + \phi)$ , when  $t=0, x = x_0$ . What is the value of phase initial?

- A)  $\pi$  C)  $\frac{\pi}{2}$   
B)  $\frac{\pi}{4}$  D)  $\frac{\pi}{3}$

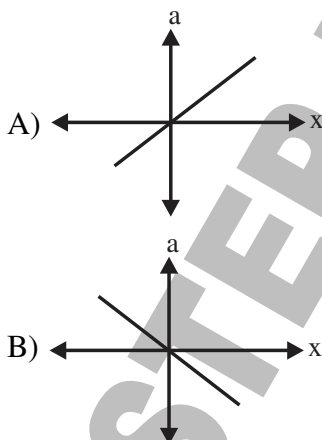
**Q.48** Angular displacement of a point moving in a circle of radius 10 cm, when displacement of projection of this point along vertical diameter of circle is 8.66 cm, will be:

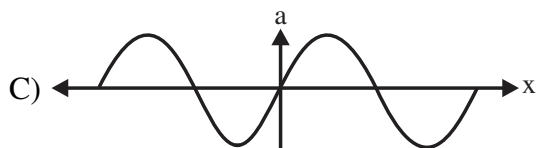
- A)  $30^\circ$  C)  $75^\circ$   
B)  $45^\circ$  D)  $60^\circ$

**Q.49** In mass spring system, mass “m” is attached with spring of constant “k” with time period “ $T_1$ ”, then mass is replaced with “5m” with same spring. What will be the time period  $T_2$  now:

- A)  $T_2 = \sqrt{5}T_1$  C)  $T_2 = 5T_1$   
B)  $T_2 = T_1$  D)  $T_2 = \frac{T_1}{\sqrt{5}}$

**Q.50** The acceleration of a body executing SHM varies with instantaneous displacement as:





D) None of these

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**ANSWER KEY (Worksheet-15)**

1	C	11	C	21	C	31	D	41	B
2	B	12	D	22	B	32	B	42	C
3	C	13	D	23	A	33	D	43	D
4	A	14	B	24	C	34	D	44	B
5	A	15	C	25	B	35	D	45	D
6	B	16	C	26	A	36	D	46	A
7	D	17	D	27	B	37	A	47	C
8	A	18	B	28	D	38	D	48	D
9	A	19	A	29	D	39	A	49	A
10	D	20	B	30	D	40	D	50	B

**SOLUTIONS**

**Unit – 4 (WS-15)**

**Q.1** Answer is “C”

**Solution:-**  $T = \frac{2\pi}{\omega} \Rightarrow T\omega = 2\pi$

**Q.2** Answer is “B”

**Solution:-** Use relation,  $T = 2\pi\sqrt{\frac{\ell}{g+a}}$

**Q.3** Answer is “C”

**Solution:-** The shapes of different graphs for a body executing SHM are:

- Graph between velocity & displacement is an ellipse.
- Graph between K.E/P.E & displacement is a parabola.
- Graph between total energy & displacement is a straight line.
- Graph between force/acceleration & displacement is straight line.
- Graph between displacement & time a sinusoid.

**Q.4** Answer is “A”

**Solution:-** The shapes of different graphs for a body executing SHM are:

- Graph between velocity & displacement is an ellipse.
- Graph between K.E/P.E & displacement is a parabola.

iii. Graph between total energy & displacement is a straight line.

iv. Graph between force/acceleration & displacement is straight line.

v. Graph between displacement & time a sinusoid.

**Q.5** Answer is “A”

**Solution:-** Use relation;  $a = \omega^2 x$  also put  $\omega = \frac{2\pi}{T}$  and solve:

**Q.6** Answer is “B”

**Solution:-** In series use formula  $k_{eq} = \frac{k}{n}$

**Q.7** Answer is “D”

**Solution:-** The equivalent spring constant of the final combination of springs:

$$k_{eq} = \frac{(2k)(k)}{2k+k} = \frac{2}{3}k \quad \text{so,}$$

$$T' = 2\pi\sqrt{\frac{m}{k_{eq}}} = 2\pi\sqrt{\frac{m}{\frac{2}{3}k}} = \sqrt{\frac{3}{2}}\left(2\pi\sqrt{\frac{m}{k}}\right)$$

$$T' = \sqrt{\frac{3}{2}}T$$

**Q.8** Answer is “A”

**Solution:-** In  $\frac{T}{4}$  time the body covers a distance equal to the amplitude, now as the body starts moving from mean position, it will reach to extreme position in  $\frac{T}{4}$ .

**Q.9** Answer is “A”

**Solution:-** In one time period the particle returns back to same position from where it starts moving, so displacement becomes zero.

**Q.10** Answer is “D”

**Solution:-** A body vibrates because of inertia and restoring force. Restoring force brings the body back to mean

position while inertia does not allow the body to stop at mean position.

**Q.11 Answer is “C”**

**Solution:-**  $a_o = \omega^2 x_o$  ;

$$v_o = x_o \omega \Rightarrow a_o = \frac{v_o^2}{x_o}$$

**Q.12 Answer is “D”**

**Solution:-** Use relation:-  $x = x_o \sin \theta$  and

put  $x = \frac{x_o}{2}$  and solve

**Q.13 Answer is “D”**

**Solution:-**

Use relation:-  $v_o = \omega x_o = \frac{2\pi}{T} \times x_o$ .

**Q.14 Answer is “B”**

**Solution:-** Use relation:  $T' = 2\pi \sqrt{\frac{\ell}{g+a}}$

put  
 $a = g$  and solve

**Q.15 Answer is “C”**

**Solution:-** Attraction is produced, due to which pendulum moves faster towards mean position, hence “T” decreases and “f” increases.

**Q.16 Answer is “C”**

**Solution:-** Normally pendulum makes an angle “ $\theta$ ” with vertical then  $F_r = mg \sin \theta$ , but in this case as it makes angle “ $\theta$ ” with horizontal so relation becomes

$$F_r = mg \cos \theta$$

**Q.17 Answer is “D”**

**Solution:-** As total energy never changes so it may take an infinite time to be zero.

**Q.18 Answer is “B”**

**Solution:-** In a single oscillation two times K.E or P.E are completely converted into each other.

**Q.19 Answer is “A”**

**Solution:-** If we make four parts of time period each of value  $\frac{T}{4}$ , then in each part equal displacement i.e  $x = x_o$  is covered. If we make more than four parts of time period. Then equal displacement will not be covered in each part, e.g body takes  $\frac{T}{12}$  time to cover  $\frac{x_o}{2}$  distance from mean position and  $\frac{T}{6}$  to cover  $\frac{x_o}{2}$  distance from extreme position.

**Q.20 Answer is “B”**

**Solution:-** At moon when  $g' = \frac{g}{6}$  then  $x'$  also becomes  $\frac{x}{6}$ . So according to formula

$$T = 2\pi \sqrt{\frac{x}{g}} = \text{constant}.$$

**Q.21 Answer is “C”**

**Solution:-** The units of spring constant and surface tension are same i.e  $\text{N m}^{-1}$ .

**Q.22 Answer is “B”**

**Solution:-** In parallel combination of springs;

$$k_{eq} = k_1 + k_2 + k_3 + \dots$$

$$k_{eq} > k_1, k_2, \dots$$

**Q.23 Answer is “A”**

**Solution:-** When a spring of spring constant “k” is divided into “n” equal

parts then spring constant of each part is given as:

$$k_{part} = nk$$

**Q.24 Answer is “C”**

**Solution:-** The general equation of instantaneous displacement for projection is:

$$x = x_0 \sin(\theta + \phi)$$

$$\text{If } \phi = 90^\circ$$

$$x = x_0 \cos \theta$$

**Q.25 Answer is “B”**

**Solution:-** Longer the spring, larger will be change in its length i.e “x”, smaller will be the spring constant.

i.e

$$k = \frac{F}{x} \quad (\because x = \Delta \ell \propto \ell)$$

$$k \propto \frac{1}{x}$$

$$k \propto \frac{1}{\ell}$$

**Q.26 Answer is “A”**

**Solution:-**

**Step-I**

$$T = \frac{1}{f}$$

**Step-II**

From mean to extreme position body will take to  $\frac{T}{4}$ .

**Q.27 Answer is “B”**

**Solution:-** For the given displacement equation, initial phase is zero which means body is initially at mean position.

In time  $\frac{T}{4}$  it will move from mean to extreme position i.e x becomes  $x_0$ , so

$$a = \omega^2 x = \omega^2 x_0$$

**Q.28 Answer is “D”**

**Solution:-** The instantaneous velocity of projection of a body moving on a circular path is

$$v = \omega \sqrt{x_0^2 - x^2}$$

For mass spring system

$$\omega = \sqrt{\frac{k}{m}} \text{ so, } v = \sqrt{\frac{k}{m}} (x_0^2 - x^2)$$

For simple pendulum

$$\omega = \sqrt{\frac{g}{\ell}} \text{ so, } v = \sqrt{\frac{g}{\ell}} (x_0^2 - x^2)$$

**Q.29 Answer is “D”**

**Solution:-** Angular frequency of projection is

$$\omega = \frac{2\pi}{T}$$

Angular frequency of mass spring system is

$$\omega = \sqrt{\frac{k}{m}}$$

Angular frequency of simple pendulum is

$$\omega = \sqrt{\frac{g}{\ell}}$$

**Q.30 Answer is “D”**

**Solution:-** Maximum acceleration of projection, simple pendulum and mass spring system is given as respectively;

$$a = -\omega^2 x_0$$

$$a = -\frac{g}{\ell} x_0$$

$$a = -\frac{k}{m} x_0$$

**Q.31 Answer is “D”**

**Solution:-** The different relations of maximum velocity and accelerations are;

$$v_0 = \omega x_0 = x_0 \sqrt{\frac{k}{m}} = x_0 \sqrt{\frac{g}{\ell}}$$

$$a_0 = \omega^2 x_0 = x_0 \left( \sqrt{\frac{k}{m}} \right)^2 = x_0 \left( \sqrt{\frac{g}{\ell}} \right)^2$$

Just take ratio.

**Q.32 Answer is “B”**

**Solution:-** In one time period  $T$  the body will move from the extreme position to other extreme position and back to the same extreme position, so displacement will be zero in “ $T$ ”. In next  $\frac{T}{2}$  the body will move from extreme position to other extreme covering a displacement of  $2x_0$ .

**Q.33 Answer is “D”**

**Solution:-** Total distance in one time period  $T = 4x_0$ .

$$\text{Total distance in } \frac{3T}{2} = \frac{3}{2}(4x_0)$$

$$\text{Total distance in } \frac{3T}{2} = 6x_0$$

**Q.34 Answer is “D”**

**Solution:-**

Use relation  $x = x_0 \cos \theta$

put  $x = \frac{x_0}{2}$  and solve

**Q.35 Answer is “D”**

**Solution:-**  $\phi = 0^\circ$ ,  $x = x_0 \sin(\theta + \phi)$

**Q.36 Answer is “D”**

**Solution:-** The general equation of instantaneous displacement is:

$$x = x_0 \sin(\theta + \phi)$$

- If  $\phi = 0^\circ$

$$x = x_0 \sin \theta$$

- If  $\phi = 90^\circ$

$$x = x_0 \sin(\theta + 90^\circ)$$

$$x = x_0 \cos \theta$$

- If  $\phi = 180^\circ$

$$x = x_0 \sin(\theta + 180^\circ)$$

$$x = -x_0 \sin \theta$$

- If  $\phi = 270^\circ$

$$x = x_0 \sin(\theta + 270^\circ)$$

$$x = -x_0 \cos \theta$$

**Q.37 Answer is “A”**

**Solution:-** It's only periodic not S.H.M

**Q.38 Answer is “D”**

**Solution:-** K.E is maximum at mean position i.e  $x=0$ . At  $x=0$ ;

$$a = -\omega^2 x = 0$$

$$x = 0$$

$$P.E = \frac{1}{2} kx^2 = 0$$

All these A, B & C option are correct informations

**Q.39 Answer is “A”**

**Solution:-** At moon  $g = \frac{g}{6}$  use relation

$$T = 2\pi\sqrt{\frac{\ell}{g}}$$

**Q.40 Answer is "D"**

**Solution:-** Use relation:  $T = 2\pi\sqrt{\frac{\ell}{g-a}}$

$$\therefore a = g$$

$$\text{So } T = \infty$$

**Q.41 Answer is "B"**

**Solution:-** At  $x = \frac{x_0}{2}$

$$P.E = \frac{1}{2}k\left(\frac{x_0}{2}\right)^2$$

$$P.E = \frac{1}{4}E_T \text{ ----- (i)}$$

$$K.E \text{ at } x = \frac{x_0}{2}$$

$$K.E = E_T - P.E$$

$$K.E = E_T - \frac{1}{4}E_T$$

$$K.E = \frac{3}{4}E_T \text{ ----- (ii)}$$

Dividing equation (i) by (ii)

$$\frac{P.E}{K.E} = \frac{1}{3}$$

**Q.42 Answer is "C"**

**Solution:-** Generally string makes " $\theta$ " with vertical, so have that angle with vertical is  $90^\circ - \theta$ , so tension becomes;  $T = mg \sin \theta$ .

**Q.43 Answer is "D"**

**Solution:-** In  $\frac{T}{4}$  time when body moves from mean to extreme position, K.E and P.E become equal once at  $x = \frac{x_0}{\sqrt{2}}$ . So in "T" time K.E and P.E will become equal four times.

**Q.44 Answer is "B"**

**Solution:-** Put K.E = P.E and find "x".

**Q.45 Answer is "D"**

**Solution:-** Time period of simple pendulum is

$$T = 2\pi\sqrt{\frac{\ell}{g}}$$

$$\Rightarrow T \propto \sqrt{\ell}; T \propto \frac{1}{\sqrt{g}}$$

Furthermore, length of pendulum depends on position of centre of mass of bob.

**Q.46 Answer is "A"**

**Solution:-** The instantaneous P.E of a harmonic oscillator is;

$$P.E = \frac{1}{2}kx^2$$

$\downarrow$ at $x = 0$ $P.E = 0$	$\downarrow$ at $x = +x_0$ or $x = -x_0$ $P.E = \frac{1}{2}kx_0^2$
---	--

**Q.47 Answer is "C"**

**Solution:-** Given  $t = 0; x = x_0$ , putting in following equation;

$$x = x_0 \sin(\omega t + \phi)$$

$$x_0 = x_0 \sin(0 + \phi)$$

$$1 = \sin \phi$$

$$\phi = \sin^{-1}(1) = 90^\circ$$

**Q.48 Answer is "D"**

**Solution:-** Radius  $= r = x_0 = 10 \text{ cm}$

Inst. Displacement  $= x = 8.66 \text{ cm}$

$$\theta = ?$$

As we know

$$x = x_0 \sin \theta$$

$$8.66 = 10 \sin \theta$$

solving

$$\theta = 60^\circ$$

Q.49 Answer is “A”

**Solution:-** Time period of mass spring system is given as;

$$T = 2\pi\sqrt{\frac{m}{k}}$$

$$T \propto \sqrt{m}$$

Q.50 Answer is “B”

**Solution:-** For a body executing SHM;

$$a \propto -x$$



## Worksheet-16

**Topics:- Mechanical Waves, Stationary Waves in Air Columns and Stretched String, Doppler's Effect & its Applications, Principle of Superposition, Electromagnetic Spectrum**

- Q.1 Doppler's effect applies to:**  
A) Sound wave only  
B) Light wave only  
C) Both sound and light waves  
D) Neither sound nor light waves
- Q.2 When the source of sound approaches the listener at rest, the frequency or pitch of sound received by him is:**  
A) Less than the frequency of sound produced by source  
B) Greater than the frequency of sound produced by source  
C) Same as that produced by source  
D) Can't be predicted
- Q.3 When the source of sound moves away from a stationary listener there is:**  
A) An apparent increase in wavelength  
B) An apparent decrease in frequency  
C) An apparent decrease in wavelength  
D) Both "A" & "B"
- Q.4 Which phenomenon can be applied to estimate the velocity of star with respect to earth:**  
A) Doppler's effect  
B) Interference  
C) Stationary waves  
D) All of these
- Q.5 The phase change of  $180^\circ$  is equal to the path difference of:**  
A)  $\lambda$   
B)  $\frac{\lambda}{2}$   
C)  $2\lambda$   
D)  $3\lambda$
- Q.6 In the following properties of a wave, the one that is independent of the others is:**  
A) Velocity  
B) Amplitude  
C) Frequency  
D) Wavelength
- Q.7 When you speak to your friend, and he speaks to you, which of following quantity is same in their sounds:**  
A) Amplitude  
C) Frequency

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- B) Speed D) Wavelength
- Q.8 Wave motion cannot transfer:**  
A) Energy C) Mass  
B) Momentum D) All of these
- Q.9 The stationary waves produced in stretched string are \_\_\_\_\_ in nature.**  
A) Transverse C) Electromagnetic  
B) Longitudinal D) None of these
- Q.10 An explosion takes place on the surface of a planet, a person at surface of earth:**  
A) Can see only but can't hear explosion  
B) Can't see but only hear explosion  
C) Both see and hear explosion  
D) Can't be predicted
- Q.11 The waves which need medium for their propagation are called:**  
A) Electromagnetic waves C) Non-mechanical waves  
B) Mechanical waves D) Matter waves
- Q.12 The waves which do not require a material medium for their propagation are:**  
A) Electromagnetic waves C) Mechanical waves  
B) Non-mechanical waves D) Both "A" and "B"
- Q.13 Mechanical waves can be:**  
A) Longitudinal only  
B) Transverse only  
C) Both longitudinal and transverse  
D) None of these
- Q.14 The relation between phase difference  $\phi$  and path difference  $x$  is:**  
A)  $\phi = \frac{2\pi x}{\lambda}$  C)  $\phi = \frac{2\pi}{x}$   
B)  $\phi = \frac{2\pi \lambda}{x}$  D)  $\phi = \frac{2\pi}{\lambda}$
- Q.15 If a wave is travelling at a speed of  $130 \text{ m s}^{-1}$  and has a wavelength of 5 m, then its frequency will be:**  
A) 650 Hz C) 26 Hz

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B)  $\frac{\lambda}{2}$

D)  $\lambda$

**Q.23** The relation for fundamental frequency of stationary waves in stretched string is:

A)  $f_1 = \frac{v}{2\ell}$

C)  $f_1 = \frac{v}{\ell}$

B)  $f_1 = \frac{v}{4\ell}$

D)  $f_1 = \frac{3v}{4\ell}$

**Q.24** The relation for fundamental wavelength of stationary waves generated in stretched string is:

A)  $\lambda_1 = 2\ell$

C)  $\lambda_1 = \frac{2\ell}{3}$

B)  $\lambda_1 = 4\ell$

D)  $\lambda_1 = \frac{4\ell}{3}$

**Q.25** As the frequency for stationary waves in stretched string increases the value of:

A) Wavelength decreases

B) Speed remains same

C) Both "A" and "B"

D) Both wavelength &amp; speed decreases

**Q.26** What is true for first overtone?

A)  $f_2 = 2f_1$

C)  $\lambda_2 = \frac{\lambda_1}{2}$

B)  $v = \text{constant}$ 

D) All of these

**Q.27** A metallic wire of 2 m length hooked between two points has tension of 10 N. If mass per unit length of wire is  $0.004 \text{ kg s}^{-1}$  then fundamental frequency emitted by wire on vibration is:

A) 12.5 Hz

C) 24 Hz

B) 48 Hz

D) 6.25 Hz

**Q.28** The minimum length of a tube, open at both ends, that resonates with a tuning fork of frequency 350 Hz is (where speed of sound is  $350 \text{ m s}^{-1}$ ):

A) 0.25 m

C) 0.5 m

B) 1 m

D) 2 m

**Q.29** The wavelength of fundamental mode of vibration of closed organ pipe is:

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- A)  $2\ell$  C)  $4\ell$   
B)  $\ell$  D)  $\frac{\ell}{2}$

**Q.30** If two waves are superimposed to form a stationary wave, what will be speed of wave having frequency 300 Hz while the distance between the two nodes is 1.5 m:

- A)  $100 \text{ m s}^{-1}$  C)  $200 \text{ m s}^{-1}$   
B)  $450 \text{ m s}^{-1}$  D)  $900 \text{ m s}^{-1}$

**Q.31** In Doppler effect change in frequency depends on:

- A) Distance between source and listener  
B) Speed of source and listener  
C) Density of air  
D) Frequency of source

**Q.32** A sound source of frequency 600 Hz is moving towards an observer with velocity  $20 \text{ m s}^{-1}$ . The speed of sound is  $340 \text{ m s}^{-1}$ . The frequency heard by observer will be:

- A) 565.5 Hz C) 725.5 Hz  
B) 637.5 Hz D) 520.5 Hz

**Q.33** If a sound source is moving toward a receiver at  $\frac{1}{3}$  the speed of sound, what would be the resulting wavelength?

- A) 6 times the emitted wavelength  
B)  $\frac{2}{3}$  times the emitted wavelength  
C)  $\frac{1}{3}$  times the emitted wavelength  
D) Can't be found

**Q.34** If the source of sound moves at the same speed or faster than the speed of wave then it results in:

- A) Doppler effect C) Shock waves  
B) Beats D) Refraction of sound

**Q.35** Stars moving away from earth give:

- A) Black shift C) Red shift  
B) Blue shift D) Green shift

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- Q.36** According to principle of superposition, two waves having same frequency and travelling in same direction super pose to given rise to:
- A) Beats  
B) Interference  
C) Stationary waves  
D) Progressive waves
- Q.37** In electromagnetic spectrum, which waves have longest wavelength and which waves have most energy among given options:
- A) Radio-waves,  $\gamma$ -rays  
B) Microwaves, X-rays  
C) Infrared, Visible  
D) Ultraviolet, X-rays

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**ANSWER KEY (Worksheet-16)**

1	C	11	B	21	A	31	B
2	B	12	D	22	B	32	B
3	D	13	C	23	A	33	B
4	A	14	A	24	A	34	C
5	B	15	C	25	C	35	C
6	B	16	B	26	D	36	B
7	B	17	C	27	A	37	A
8	C	18	C	28	C		
9	A	19	B	29	C		
10	A	20	B	30	D		

**SOLUTIONS****Unit – 4 (WS-16)****Q.1** Answer is “C”

**Solution:-** Doppler’s effect is applicable to all types of waves i.e Mechanical and Electromagnetic waves.

**Q.2** Answer is “B”

**Solution:-** When source of sound approaches the listener, apparent frequency is given as:

$$f_{\text{apparent}} = \left( \frac{v}{v - u_s} \right) f_{\text{actual}}$$

$$f_{\text{app}} > f_{\text{act}} \quad \text{Also}$$

$$\text{Pitch} \propto f_{\text{app}}$$

So both apparent frequency and pitch increase.

**Q.3** Answer is “D”

**Solution:-** When source of sound moves away from listener, apparent frequency and apparent wavelength are given as;

$$f_{\text{app}} = \left( \frac{v}{v + u_s} \right) f_{\text{act}}$$

$$f_{\text{app}} < f_{\text{act}}$$

**Also**

$$\lambda_{\text{app}} = \lambda_{\text{act}} + \Delta\lambda$$

$$\lambda_{\text{app}} > \lambda_{\text{act}}$$

**Q.4** Answer is “A”

**Solution:-** Doppler’s effect can be applied to estimate the velocity of star with respect to earth.

**Q.5** Answer is “B”

**Solution:-** Relation between phase difference and path difference is given as:

$$\frac{\text{Path Difference}}{\lambda} = \frac{\text{Phase Difference}}{2\pi}$$

**Q.6** Answer is “B”

**Solution:-** Amplitude does not depend on other three given parameters.

**Q.7** Answer is “B”

**Solution:-** Speed of sound in one medium remains same regardless of frequency, amplitude or wavelength of the sound waves.

**Q.8** Answer is “C”

**Solution:-** Wave is defined as

“A disturbance in a medium which carries momentum and energy without carrying the matter.”

**Q.9** Answer is “A”

**Solution:-** Stationary waves produced in stretched string are transverse stationary waves while stationary waves produced in air column are longitudinal stationary waves.

**Q.10** Answer is “A”

**Solution:-** Sound need medium but light does not.

**Q.11** Answer is “B”

**Solution:-** Waves which need medium for their propagation are called mechanical waves.

**Q.12** Answer is “D”

**Solution:-** Waves which do not require medium for their propagation (also these waves possess changing electric and magnetic fields) are called electromagnetic waves.

**Q.13** Answer is “C”**Solution:-** Mechanical waves can be both longitudinal as well as transverse.**Q.14** Answer is “A”**Solution:-** Relation between phase difference and path difference is given as:

$$\frac{\text{Path Difference}}{\lambda} = \frac{\text{Phase Difference}}{2\pi}$$

**Q.15** Answer is “C”**Solution:-** Use the relation;

$$v = f\lambda$$

$$f = \frac{v}{\lambda} = \frac{130}{5} = 26\text{Hz}$$

**Q.16** Answer is “B”**Solution:-** Basic conditions to produce stationary waves.**Q.17** Answer is “C”**Solution:-** Stationary waves can be produced both in stretched string as well as air column. In stretched string the stationary waves are transverse stationary waves while in air column the stationary waves are longitudinal stationary waves.**Q.18** Answer is “C”**Solution:-** Speed of stationary wave is given as:

$$v = \sqrt{\frac{F}{m}} \quad \text{Here}$$

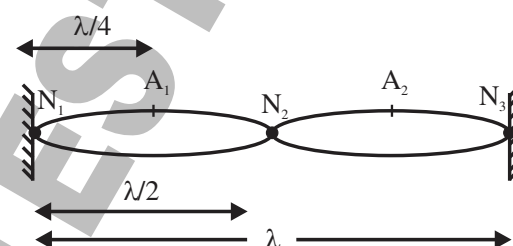
F = tension in the string

m = mass per unit length of string.

**Q.19** Answer is “B”**Solution:-** Speed of stationary wave is given as;

$$v = \sqrt{\frac{F}{m}} \Rightarrow v \propto \sqrt{F}$$

Making “F” four times will make “v” two times.

**Q.20** Answer is “B”**Solution:-** Distance of point (from near end) from where string is to be plucked tovibrate in “n” loops is  $= \frac{\ell}{2n}$ .**Q.21** Answer is “A”**Solution:-** On the ends of string particles of string can't move up & down, so nodes are formed on the ends always.**Q.22** Answer is “B”**Solution:-****Q.23** Answer is “A”**Solution:-** For a stretched string:

$$f_n = \frac{nv}{2\ell}$$

For n=1

$$f_1 = \frac{v}{2\ell}$$

**Q.24** Answer is “A”**Solution:-** For a stretched string;

$$\lambda_n = \frac{2\ell}{n}$$

For n=1

$$\lambda_1 = \frac{2\ell}{1}$$

**Q.25** Answer is “C”**Solution:-** If the frequency of stationary wave in a stretched string increases, its wavelength decreases by same proportion, so according to formula.

$$v = \uparrow f \lambda \downarrow = \text{constant}$$

Speed remains constant.

**Q.26** Answer is “D”**Solution:-** First overtone means 2<sup>nd</sup> harmonic i.e  $n=2$ , so

$$f_n = nf_1 \quad ; \lambda_n = \frac{\lambda_1}{n}$$

$$f_2 = 2f_1 \quad ; \lambda_2 = \frac{\lambda_1}{2}$$

And

$$v = f_n \lambda_n = \text{constant}$$

**Q.27** Answer is “A”**Solution:-** Given

$$m = 0.004 \text{ kg s}^{-1}; F = 10 \text{ N}, \ell = 2 \text{ m}$$

$$f_1 = \frac{1}{2\ell} \sqrt{\frac{F}{m}} = \frac{1}{2 \times 2} \sqrt{\frac{10}{0.004}}$$

$$f_1 = \frac{1}{4} \sqrt{\frac{10 \times 10^3}{4}} = \frac{1}{4} \times \frac{10^2}{2}$$

$$f_1 = 12.5 \text{ Hz}$$

**Q.28** Answer is “C”**Solution:-** Use relation  $f = \frac{v}{2\ell}$ **Q.29** Answer is “C”**Solution:-** For close ended pipe:

$$\lambda_n = \frac{4\ell}{n}$$

For fundamental mode

$$n = 1$$

$$\text{So, } \lambda_1 = 4\ell$$

**Q.30** Answer is “D”**Solution:-** Use relation;  $v = f\lambda$  first find “ $\lambda$ ” from distance between two nodeswhich is equal to  $\frac{\lambda}{2}$ .**Q.31** Answer is “B”**Solution:-** In Doppler's effect the apparent change in frequency only depends on relative motion between source & observer (except the motion of source on a circular path making observer as center)**Q.32** Answer is “B”**Solution:-** Apparent frequency when source moves towards observer is given as:

$$f_{app} = \left( \frac{v}{v - u_s} \right) f$$

$$f_{app} = \left( \frac{340}{340 - 320} \right) 600$$

$$f_{app} = \left( \frac{340}{320} \right) 600$$

$$f_{app} = 637.5 \text{ Hz}$$

**Q.33** Answer is “B”**Solution:-** When source moves towards observer, the apparent wavelength is given as:

$$\lambda_{app} = \lambda - \Delta\lambda$$

$$\lambda_{app} = \frac{v}{f} - \frac{u_s}{f}$$

$$\lambda_{app} = \frac{v}{f} - \frac{v}{3f}$$

$$\lambda_{app} = \frac{2}{3} \frac{v}{f} = \frac{2}{3} \lambda$$

**Q.34** Answer is “C”**Solution:-** If the sound source moves at or greater than the speed of sound wave then it results into shock waves.**Q.35** Answer is “C”**Solution:-** Stars moving away from earth give red shift while moving towards earth give blue shift.

Q.36 Answer is “B”

**Solution:-** Read three points of principle of superposition in topic 8.4

Q.37 Answer is “A”

**Solution:- Order of wavelength:**

Radio waves > Microwaves > Infrared >  
Visible > U.V > X-rays >  $\gamma$ -rays

**Order of Energy / Momentum /  
Frequency:**

Radio waves < Microwaves < Infrared <  
Visible < U.V < X-rays <  $\gamma$ -rays

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**Worksheet-17****Topics:- Interference of Light Waves, Young's Double Slit Experiment, Diffraction Grating**

- Q.1** The wave nature of light was proposed by:  
A) Thomas Young                      C) Newton  
B) Maxwell                              D) Huygens
- Q.2** Huygens principle states that:  
A) Light travels in straight line  
B) Light travels as electromagnetic waves  
C) Light has dual nature  
D) All points on primary wave front are sources of secondary wavelets
- Q.3** The distance between any two consecutive dark or bright fringes is called:  
A) Wavelength                      C) Amplitude  
B) Wavelet                              D) Fringe spacing
- Q.4** In Young's double slit experiment the condition for constructive interference (bright fringes) is:  
A)  $d\sin\theta = \left(m + \frac{1}{2}\right)\lambda$                       C)  $d\sin\theta = \left(m - \frac{1}{2}\right)\frac{\lambda}{2}$   
B)  $d\sin\theta = m\lambda$                       D)  $2d\sin\theta = m\lambda$
- Q.5** In Young's double slit experiment the condition for destructive interference is:  
A)  $d\sin\theta = m\lambda$                       C)  $d\sin\theta = \left(\frac{m}{2} - \frac{1}{2}\right)\lambda$   
B)  $d\sin\theta = \frac{m\lambda}{2}$                       D)  $d\sin\theta = \left(m + \frac{1}{2}\right)\lambda$
- Q.6** In Young's double slit experiment fringe spacing is equal to:  
A)  $\frac{d}{\lambda L}$                                       C)  $\frac{\lambda d}{L}$   
B)  $\frac{\lambda L}{d}$                                       D)  $\frac{2\lambda d}{L}$
- Q.7** The diffraction phenomena is found to be prominent if:  
A) Size of obstacle is smaller than wavelength of light  
B) Wavelength of light is greater than size of slit  
C) Size of slit is smaller than wavelength of light  
D) All of these
- Q.8** Diffraction is a special type of:

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- A) Polarization                      C) Reflection  
B) Interference                      D) Dispersion
- Q.9 The appearance of colours in thin film is due to:**  
A) Diffraction                      C) Interference  
B) Dispersion                      D) Polarization
- Q.10 Newton's rings are formed due to:**  
A) Diffraction of light              C) Polarization of light  
B) Interference of light              D) Reflection of light
- Q.11 When Newton's rings interference is seen from above by means of reflected light the central spot is?**  
A) Red                                  C) Bright  
B) Blue                                  D) Dark
- Q.12 Bending of light around the edges of an obstacle is called:**  
A) Refraction                      C) Polarization  
B) Interference                      D) Diffraction
- Q.13 In YDSE the process taking place was:**  
A) Interference                      C) Both "A" and "B"  
B) Diffraction                      D) Polarization
- Q.14 To observe interference of light interfering beams must:**  
A) Be monochromatic              C) Of same color  
B) Be coherent                      D) All of these
- Q.15 In "YDSE" the centre is:**  
A) Always bright                      C) May be bright or dark  
B) Always dark                      D) None of these
- Q.16 The centre of Newton's rings in case of transmitted light is:**  
A) Bright                              C) May be bright or dark  
B) Dark                                  D) None of these
- Q.17 The blue colour of sky is due to \_\_\_\_\_ of light:**  
A) Diffraction                      C) Interference  
B) Scattering                      D) None of these
- Q.18 A diffraction pattern is obtained using a beam of red light. If the red light is replaced by blue light, then:**  
A) The diffraction pattern remains unchanged  
B) Diffraction bands become narrower and crowded together  
C) Bands become broader and farther apart  
D) Bands disappear
- Q.19 Two coherent sources produce a dark fringe when the phase difference between interfering waves is:**

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- A)  $(2n-2)\pi$ ,  $n = 1, 2, 3 \dots$       C)  $2n\pi$ ,  $n = 1, 2, 3, 4, \dots$   
B)  $n\pi$ ,  $n = 1, 2, 3, \dots$       D)  $(2n - 1)\pi$ ,  $n = 1, 2, 3, 4$
- Q.20 In Young's double slit experiment the distance between the slits is gradually increased. The width of the fringes:**  
A) Increases  
B) Remains same  
C) Decreases  
D) First increases and then decreases
- Q.21 The image of the tip of a needle is never sharp because of:**  
A) Polarization of light      C) Diffraction of light  
B) Interference of light      D) Reflection of light
- Q.22 When interference of light takes place?**  
A) Energy is created at the position of maxima  
B) Energy is destroyed at the position of minima  
C) Energy is neither created nor destroyed but it is merely redistributed  
D) All of these
- Q.23 If the apparatus of Newton's rings is moved from air to water, the rings spacing:**  
A) Remains same      C) Decreases  
B) Increases      D) Becomes maximum
- Q.24 In YDSE the process under observation is:**  
A) Interference      C) Both "A" & "B"  
B) Diffraction      D) Polarization
- Q.25 A student bought two identical lamps with same colour of bulbs and allowed to fall light of both lamps after passing through two narrow openings at screen but found no interference pattern, this is due to the reason that:**  
A) Rays were not monochromatic  
B) Rays were coherent  
C) Rays were monochromatic  
D) Rays were not coherent
- Q.26 In YDSE the centre is always a maxima, it's order is:**  
A) 1<sup>st</sup> order      C) 0<sup>th</sup> order  
B) 2<sup>nd</sup> order      D) 3<sup>rd</sup> order
- Q.27 As we know that relation for distance of any minima**

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from centre is written as  $y_m = \left(m + \frac{1}{2}\right) \frac{\lambda L}{d}$ . To find the closest minima to centre we:

- A) Put  $m=0$ , Call it zero<sup>th</sup> order minima
- B) Put  $m=1$ , Call it 1<sup>st</sup> order minima
- C) Put  $m=0$ , Call it 1<sup>st</sup> order minima
- D) Put  $m=1$ , Call it 2<sup>nd</sup> order minima

**Q.28** If in YDSE four fringes are observed above the centre then total number of fringes present on screen will be:

- A) 4
- B) 9
- C) 5
- D) Can't be predicted

**Q.29** If instead of monochromatic light one uses white light in YDSE then:

- A) No interference pattern will be observed
- B) Centre will be white and coloured fringes will be observed on both sides
- C) Same results will be observed as with monochromatic light
- D) All of these




**Q.30** If we use white light in YDSE then the coloured fringe closer to the central maxima will be:

- A) Red
- B) Green
- C) Blue
- D) Yellow

**Q.31** A light wave has intensity  $I_0$  at 2 cm distance from source, what would be intensity at 4 cm?

- A) Increases by factor 2
- B) Decreases by factor  $\frac{1}{2}$
- C) Increases by factor 3
- D) Decreases by factor  $\frac{1}{4}$

**Q.32** The diffraction pattern of single slit is best represented as:

- A) 
- B) 
- C) 
- D) None of these



**ANSWER KEY (Worksheet-17)**

1	D	11	D	21	C	31	D		
2	D	12	D	22	C	32	B		
3	D	13	C	23	C	33			
4	B	14	D	24	A	34			
5	D	15	A	25	D	35			
6	B	16	A	26	C	36			
7	D	17	B	27	C	37			
8	B	18	B	28	B	38			
9	C	19	D	29	B	39			
10	B	20	C	30	C	40			

**SOLUTIONS****Unit – 5 (WS-17)****Q.1 Answer is “D”**

**Solution:-** The wave nature of light was proposed by Huygens in 1678 and it was experimentally proven by Thomas Young in 1801.

**Q.2 Answer is “D”**

**Solution:-** Huygen principle says all the points on a wavefront are the sources of secondary wavelets.

**Q.3 Answer is “D”**

**Solution:-** The distance between any two consecutive dark or bright fringes is called fringe spacing.

**Q.4 Answer is “B”**

**Solution:-** Conditions for constructive interference is;

Path difference =  $m\lambda$  where  
 $m = 0, \pm 1, \pm 2, \dots$

i.e Path difference =  $0, \pm\lambda, \pm 2\lambda, \dots$

also Phase difference =  $0, 2\pi, 4\pi, 6\pi, \dots$

**Q.5 Answer is “D”**

**Solution:-** For destructive interference

Path difference =  $\left(m + \frac{1}{2}\right)\lambda$

Where  $m = 0, \pm 1, \pm 2, \dots$

i.e Path difference =  $\pm \frac{1\lambda}{2}, \pm \frac{3\lambda}{2}, \pm \frac{5\lambda}{2}, \dots$

Also

Phase difference =  $\pm\pi, \pm 3\pi, \pm 5\pi, \dots$

**Q.6 Answer is “B”**

**Solution:-** Fringe spacing or the distance between adjacent bright or dark fringes is given as:

$$\Delta y = \frac{\lambda L}{d}$$

**Q.7 Answer is “D”**

**Solution:-** The diffraction phenomena is found to be prominent when; (size of obstacle/slit)  $\leq \lambda$

**Q.8 Answer is “B”**

**Solution:-** Diffraction is merely the bending of light around the edges of obstacle, after the bending the diffraction pattern is formed due to interference of light beams.

**Q.9 Answer is “C”**

**Solution:-** The beautiful colours in thin film are due to the interference of light.

**Q.10 Answer is “B”**

**Solution:-** Newton’s rings are formed due to interference of light.

**Q.11 Answer is “D”**

**Solution:-** For reflected light

$x = \frac{\lambda}{2}, \phi = 180^\circ$  so minima is formed.

**Q.12 Answer is “D”**

**Solution:-** “The bending of light around the edges of an obstacle and spreading of light into the geometrical shadow of obstacle is called diffraction.”

**Q.13 Answer is “C”**

**Solution:-** First bending then interference takes place.

**Q.14 Answer is “D”**

**Solution:-** Basic conditions for interference.

**Q.15 Answer is “A”**

**Solution:-** At the centre of screen the path difference of the superposing light waves is zero which is a condition of constructive interference.

**Q.16 Answer is “A”**

**Solution:-** For transmitted light maxima is formed.

**Q.17 Answer is “B”**

**Solution:-** Scattering  $\propto \frac{1}{\lambda}$

**Q.18 Answer is “B”**

**Solution:-** Fringe spacing  $\propto \lambda$

**Q.19 Answer is “D”**

**Solution:-** For destructive interference

$$\text{Path difference} = \left(m + \frac{1}{2}\right)\lambda$$

Where  $m = 0, \pm 1, \pm 2, \dots$

$$\text{i.e Path difference} = \pm \frac{1\lambda}{2}, \pm \frac{3\lambda}{2}, \pm \frac{5\lambda}{2}, \dots$$

Also

$$\text{Phase difference} = \pm\pi, \pm 3\pi, \pm 5\pi, \dots$$

This phase difference can be generalized as: phase difference  $= (2n-1)\pi$ ,  $n=1, 2, 3, \dots$

**Q.20 Answer is “C”**

$$\text{Solution:- } \Delta y \propto \frac{1}{d}$$

**Q.21 Answer is “C”**

**Solution:-** Due to prominent diffraction of light from needle tip its image is never sharp.

**Q.22 Answer is “C”**

**Solution:-** We can't go against law of conservation of energy.

**Q.23 Answer is “C”**

**Solution:-**  $\Delta y \propto \lambda$ ; as “ $\lambda$ ” decreases so fringe spacing also decreases.

**Q.24 Answer is “A”**

**Solution:-** Different lamps can't produce coherent beams.

**Q.25 Answer is “D”**

**Solution:-** When lamps changes the beams cannot be coherent

**Q.26 Answer is “C”**

**Solution:-** The central maxima is 0<sup>th</sup> order maxima, generally;

Order of maxima =  $m$

And

Order of minima =  $m+1$

**Q.27 Answer is “C”**

**Solution:-** The central maxima is 0<sup>th</sup> order maxima, generally;

Order of maxima =  $m$

And

Order of minima =  $m+1$

**Q.28 Answer is “B”**

**Solution:-** There are equal number of fringes above and below the central maxima on screen. So including the central fringe, four fringes above and four fringe below central fringe, total fringes are nine.

**Q.29 Answer is “B”**

**Solution:-** For white light in YDSE

- Central maxima will be white
- Moving away from central maxima, colored pattern is observed.
- That color is observed first whose wavelength is smaller.

**Q.30 Answer is “C”**

**Solution:-** Blue color is least diffracted or bended.

**Q.31 Answer is “D”**

**Solution:-**  $I \propto \frac{1}{x^2}$

**Q.32** Answer is “B”

**Solution:-** For diffraction Pattern

- i. Centre of screen is a maxima with maximum width and intensity.
- ii. Moving away from centre, width of maxima decreases and width of minima increases.



## Worksheet-18

**Topics:- KMT, Pressure of Gas, Interpretation of Temperature, Internal Energy, Specific Heat Capacity**

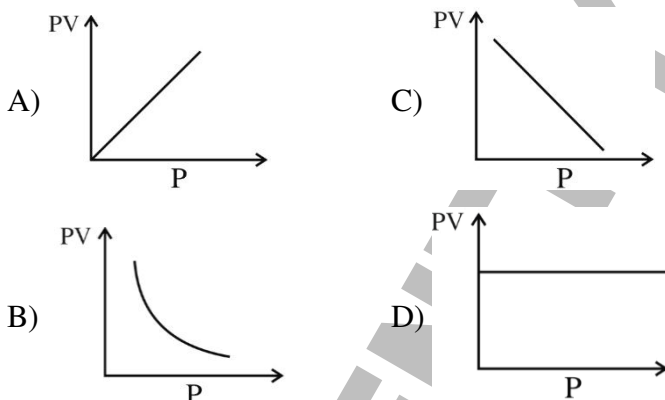
**Q.1**  $PV = RT$  Represent:

- A) Gas equation for  $n$  moles
- B) Gas equation for one mole
- C) Gas equation for 10 moles
- D) Gas constant for one molecule

**Q.2** The value of Boltzmann constant is:

- A)  $13.8 \times 10^{-23} \text{ J K}^{-1}$
- B)  $1.38 \times 10^{-23} \text{ J K}^{-1}$
- C)  $13.8 \times 10^{25} \text{ J K}^{-1}$
- D)  $1.38 \times 10^{-25} \text{ J K}^{-1}$

**Q.3** In an experiment to investigate the relationship between the volume  $V$  of a fixed mass of an ideal gas and its pressure  $P$ , a graph of  $PV$  against  $P$  is plotted. Which graph shows the correct relationship at constant temperature?



**Q.4** Which of the following parameters does not characterize the thermodynamic state of matter?

- A) Work
- B) Pressure
- C) Temperature
- D) Volume

**Q.5** Boyle's law is a relation between \_\_\_\_\_ thermodynamic parameters keeping temperature constant.

- A) 1
- B) 2
- C) 3
- D)  $\infty$

**Q.6** During an adiabatic expansion the increase in volume is

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associated with:

- A) Decrease in pressure and decrease in temperature
- B) Increase in pressure and decrease in temperature
- C) Increase in pressure and increase in temperature
- D) Decrease in pressure and increase in temperature

**Q.7** In the expressions below,  $R$  is the molar gas constant,  $P$  is pressure,  $T$  is thermodynamic temperature,  $N_A$  is the Avogadro's number,  $n$  is the number of moles,  $k$  is the Boltzmann constant, and  $m$  is the mass one molecule of gas. Which one of the expressions is correct for the molar volume  $V$  of an ideal gas?

- A)  $\frac{RT}{P}$
- B)  $\frac{N_A RT}{P}$
- C)  $\frac{nRT}{P}$
- D)  $\frac{nkT}{P}$

**Q.8** The internal energy of 1 mole of an ideal gas depends on:

- A) Only volume
- B) Only temperature
- C) Only pressure
- D) Temperature and pressure

**Q.9** The mass of  $O_2$  molecules is 16 times that of  $H_2$  molecules. The rms velocity of  $O_2$  molecules at room temperature is  $v_{rms}$ . The rms velocity of  $H_2$  molecules at the same temperature will be:

- A)  $16 v_{rms}$
- B)  $4 v_{rms}$
- C)  $\frac{v_{rms}}{4}$
- D)  $\frac{v_{rms}}{16}$

**Q.10** The internal energy of a monoatomic ideal gas is:

- A) Translational K.E
- B) Vibrational K.E
- C) Rotational K.E
- D) All of these

**Q.11** The rms velocity for monoatomic gas is:

- A)  $\sqrt{\frac{3kT}{m}}$
- B)  $\sqrt{\frac{8kT}{\pi m}}$
- C)  $\sqrt{\frac{2kT}{m}}$
- D) Zero

- Q.12** Internal energy is a unique function of state because change in internal energy.  
A) Does not depend upon path  
B) Depends upon path  
C) Corresponds to an adiabatic process  
D) Corresponds to an isothermal process
- Q.13** How will it effect the pressure “P” of a gas such that average velocity of gas molecules is doubled?  
A)  $P' = 4P$   
B)  $P' = 2P$   
C)  $P' = P$   
D) Not possible
- Q.14** When we provide heat to a system then it's temperature?  
A) May rise  
B) May fall  
C) May not change  
D) All of these
- Q.15** For which of the following process work done comes out to be maximum?  
A) Isothermal  
B) Isochoric  
C) Adiabatic  
D) Isobaric
- Q.16** When heat is neither given nor taken from a system then it's temperature?  
A) May remain same  
B) May rise  
C) May fall  
D) All of these
- Q.17** If temperature is increased from 200 K to 800 K then what would be the change in pressure at constant volume?  
A) Increases by factor 4  
B) Increases by factor 2  
C) Decrease by factor 4  
D) Decreases by factor 2
- Q.18** The average translational K.E of molecules in a gas at temperature 27 °C is:  
A)  $5.71 \times 10^{-21}$  J  
B)  $7.54 \times 10^{-21}$  J  
C)  $4.79 \times 10^{-21}$  J  
D)  $6.21 \times 10^{-21}$  J
- Q.19** The average speed of oxygen molecule in the air at STP is 461 m s<sup>-1</sup>. For calculation of this speed the temperature is taken:  
A) 298 K  
B) 273 K  
C) 327 K  
D) 25 °C
- Q.20** The direction of flow of heat between two bodies is determined by:

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- A) Internal energy                      C) Total energy  
B) Kinetic energy                      D) None of these
- Q.21 Universal gas constant of a gas is equal to:**  
A)  $C_p - C_v$                                   C)  $C_p \times C_v$   
B)  $C_p + C_v$                                   D) None of these
- Q.22 20 °C will be equal to:**  
A) 50 °F    C) 68 °F  
B) 98 °F    D) 100 °F
- Q.23 If a gas is heated against a pressure, keeping the volume constant, then workdone will be:**  
A) Positive                                      C) Zero  
B) Negative                                      D) Any of these
- Q.24 Which of the following is the property of a system?**  
A) Pressure and temperature  
B) Internal energy and entropy  
C) Volume and density  
D) All of these
- Q.25 Which of the following quantity is not the property of a system?**  
A) Pressure                                      C) Internal energy  
B) Temperature                                  D) Heat
- Q.26 Work done in a free expansion (expansion in vacuum) process is:**  
A) Positive                                      C) Zero  
B) Negative                                      D) Maximum
- Q.27 Kinetic theory of gases assumes that the collisions between the molecules are:**  
A) Perfectly inelastic                          C) Partially inelastic  
B) Partially elastic                              D) Perfectly elastic
- Q.28 Temperature of a gas is due to:**  
A) Its heating value  
B) Attraction of molecules  
C) Kinetic energy of molecules  
D) Potential energy of molecules
- Q.29 An ideal gas as compared to a real gas at very high**

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pressure occupies:

- A) More volume
- B) Less volume
- C) Same volume
- D) Unpredictable

**Q.30** Which of the following variable/variables control the physical properties of an ideal gas?

- A) Pressure
- B) Volume
- C) Temperature
- D) All of these

**Q.31** Heat and work are:

- A) State functions
- B) System properties
- C) Point functions
- D) Path functions

**Q.32** A perfect gas at  $30^{\circ}\text{C}$  is heated at constant pressure till its volume is double. The final temperature is:

- A)  $60^{\circ}\text{C}$
- B)  $333^{\circ}\text{C}$
- C)  $606^{\circ}\text{C}$
- D)  $120^{\circ}\text{C}$

**Q.33** A piston cylinder contains air at 600 kPa, 290 K and a volume of  $0.01\text{ m}^3$ . A constant pressure process gives 54 kJ of work out. The final volume of the air is:

- A)  $0.05\text{ m}^3$
- B)  $0.10\text{ m}^3$
- C)  $0.15\text{ m}^3$
- D)  $0.20\text{ m}^3$

**Q.34** A gas is enclosed in a container fitted with a piston of cross sectional area  $0.10\text{ m}^2$ . The pressure of the gas is maintained at  $8000\text{ Nm}^{-2}$ . When heat is slowly transferred, the piston is pushed up through a distance of 4.0 cm. If 42 J heat is transferred to the system during the expansion, the work done by the gas is:

- A) 52 J
- B) 38 J
- C) 48 J
- D) 32 J

**Q.35** Referring to previous question, the change in internal energy of the system is:

- A) 4 J
- B) 10 J
- C) 6 J
- D) 5 J

**Q.36** Evidence in favour of kinetic theory of gases is exhibited in:

- A) Diffusion of gases
- B) Brownian motion of smoke particles
- C) Both A & B
- D) Macroscopic approach of gases

**Q.37** Kinetic theory of gases is based on:

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- A) Microscopic approach      C) Molecular approach  
B) Macroscopic approach      D) Both A and C
- Q.38** “Molecules do not exert force on each other” this postulate implies:  
A) Gas molecules do not have K.E  
B) Gas molecules have P.E  
C) Gas molecules have very small mass  
D) Gas molecules do not have P.E
- Q.39** The momentum transferred to the walls of the container per second per unit area due to continuous collisions of molecules of the gas gives:  
A) Force per unit area      C) Pressure of gas  
B) K.E of gas      D) Both A and C
- Q.40** The collision frequency of gas molecules in a cubical container is:  
A)  $\frac{2\ell}{v}$       C)  $\frac{3v}{2\ell}$   
B)  $\frac{2\ell}{3v}$       D)  $\frac{v}{2\ell}$
- Q.41** If there are “N” no. of molecules each of mass “m” in a cubical container of volume “ $\ell^3$ ”, then density of gas is given by:  
A)  $\frac{m}{\ell^3}$       C)  $\frac{m}{N\ell^3}$   
B)  $\frac{M}{\ell^3}$       D)  $\frac{mN}{\ell^3}$
- Q.42** Referring to previous question, the no. of particles colliding with any face of cube are:  
A)  $\frac{N}{3}$       C)  $\frac{N}{6}$   
B)  $\frac{N}{2}$       D)  $\frac{N}{4}$
- Q.43** A gas in a cubical container contains three molecules each having speed of  $2 \text{ m s}^{-1}$ ,  $4 \text{ m s}^{-1}$  and  $4 \text{ m s}^{-1}$ . What is the root mean square speed?  
A)  $\frac{36}{3} \text{ m s}^{-1}$       C)  $6 \text{ m s}^{-1}$   
B)  $12 \text{ m s}^{-1}$       D)  $\sqrt{12} \text{ m s}^{-1}$
- Q.44** Two gases A and B having the same temperature T,

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till the pressure becomes double. The final mean square velocity is:

- A)  $v$  C)  $\sqrt{2}v$   
B)  $2v$  D)  $\frac{v}{2}$

**Q.52** The temperature of a gas is increased from  $27^\circ\text{C}$  to  $127^\circ\text{C}$ . The ratio of mean K.E at initial to final temperature is:

- A)  $\frac{10}{9}$  C)  $\frac{4}{3}$   
B)  $\frac{3}{4}$  D)  $\frac{9}{16}$

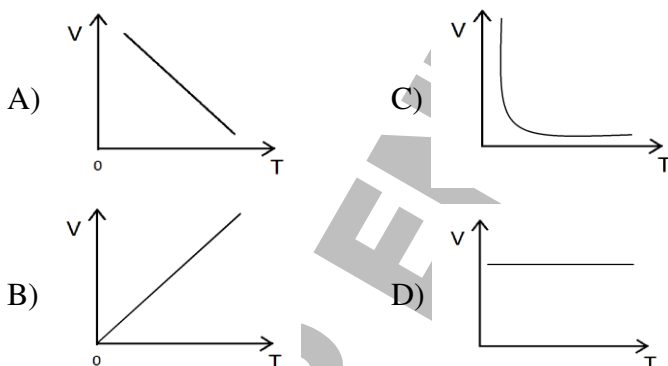
**Q.53** The mean kinetic energy of gas molecules at  $t^\circ\text{C}$  is directly proportional to:

- A)  $\sqrt{t}$  C)  $\sqrt{t+273}$   
B)  $(t+273)$  D)  $t$

**Q.54** The density of gas A is four times that of gas B. If the molar mass of gas A is  $M$ , then molar mass of gas B is:

- A)  $2M$  C)  $4M$   
B)  $\frac{M}{4}$  D)  $\frac{M}{2}$

**Q.55** Which one of the following represents correctly the variation of the volume ( $V$ ) of an ideal gas with temperature ( $T$ ) under constant pressure conditions?



**Q.56** Which one is correct relation between “ $^\circ\text{F}$ ” and “ $^\circ\text{C}$ ”?

- A)  $^\circ\text{F} = \frac{9}{5}^\circ\text{C} + 32$  C)  $^\circ\text{F} = \frac{9}{5}(^\circ\text{C} + 32)$   
B)  $^\circ\text{C} = \left(^\circ\text{F} - 32\right)\frac{5}{9}$  D) Both A and B

**Q.57** The temperature at which “ $^\circ\text{C}$ ” and “ $^\circ\text{F}$ ” have same

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values:

- A) +40°                      C) -40°  
B) 160°                      D) -160°

**Q.58** The temperature at which “ °F” and “kelvin” have same values:

- A) 460                      C) 340  
B) 574                      D) 525

**Q.59** At constant temperature if the pressure of gas is doubled then its volume becomes:

- A) Half                      C) Remains same  
B) Double                      D) Four times

**Q.60** In the general gas equation  $PV = nRT$ , how many state variable are there?

- A) 2                      C) 4  
B) 3                      D) 5

**Q.61** Which one of following is not true about the ratio “ $\frac{R}{N_A}$ ”?

- A) It is called Boltzmann constant  
B) It is called gas constant per mole  
C) It is called gas constant per molecule  
D) None of these

**Q.62** Which one of following is true about ideal gas?

- A) Mean K.E is directly proportional to absolute temperature  
B) Average speed of gas molecules is not zero  
C) Average velocity of gas molecules is zero  
D) All of these

**Q.63** The average speed of oxygen at STP is:

- A) 473 m s<sup>-1</sup>                      C) 437 m s<sup>-1</sup>  
B) 493 m s<sup>-1</sup>                      D) 461 m s<sup>-1</sup>

**Q.64** Which of following expression is not true?

- A)  $v_{rms} = \sqrt{\frac{3RT}{M}}$                       C)  $v_{rms} = \sqrt{\frac{3RT}{N_A m}}$   
B)  $v_{rms} = \sqrt{\frac{3kT}{m}}$                       D) None of these

**Q.65** Which one is true expression of mean K.E of a molecule

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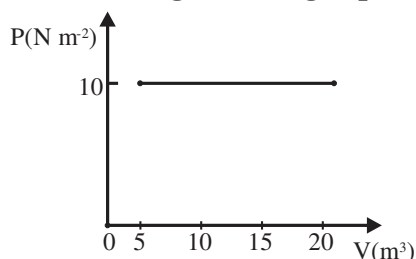
of ideal gas?

- A)  $\frac{3P}{2N_0}$  C)  $\frac{3kT}{2}$   
B)  $\frac{3PV}{2N}$  D) All of these

**Q.66** Which of following is correct about internal energy of ideal gas?

- A) It is measure of average translational K.E  
B) It is directly proportional to absolute temperature  
C) It is a state function  
D) All of these

**Q.67** The work done during following expansion of:



- A) 150 J C) 75 J  
B) 100 J D) 200 J

**Q.68** First law of thermodynamics is restatement of conservation of:

- A) Energy C) Charge  
B) Momentum D) Mass

**Q.69** Which is correct expression of 1<sup>st</sup> law of thermodynamics for bicycle pump?

- A)  $Q = \Delta U + W$  C)  $-W = +\Delta U$   
B)  $Q - \Delta U = W$  D)  $\Delta U = Q - W$

**Q.70** Which is correct expression of 1<sup>st</sup> law of thermodynamics for Human metabolism?

- A)  $\Delta U = Q - W$  C)  $+\Delta U = -W$   
B)  $-\Delta U = +W$  D) None of these

**Q.71** The process that occurs at constant temperature is:

- A) Isothermal process C) Isochoric process  
B) Adiabatic process D) Isobaric process

**Q.72** The PV-equation for isothermal process is:

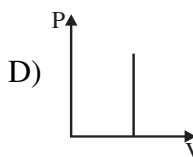
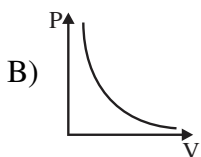
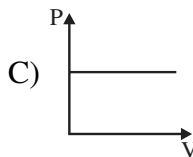
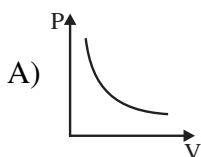
- A)  $P_1 V_1 = P_2 V_2$  C)  $P = \text{constant}$   
B)  $P_1 V_1^\gamma = P_2 V_2^\gamma$  D)  $V = \text{constant}$

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**Q.73** 1<sup>st</sup> law of thermodynamics in case of Adiabatic process is:

- A)  $W = -\Delta U$                       C)  $-Q = +W - \Delta U$   
B)  $Q = W - \Delta U$                       D)  $Q - \Delta U = W$

**Q.74** Which one represent Adiatat?



**Q.75** The ratio of slope of Adiatat to Isotherm is:

- A)  $\gamma$                       C)  $\frac{1}{\gamma}$   
B)  $\gamma^2$                       D)  $\frac{1}{\gamma^2}$

**Q.76** During which process work done is minimum?

- A) Isothermal                      C) Adiabatic  
B) Isochoric                      D) Isobaric

**Q.77** Which is correct expression?

- A)  $C_p - C_v = R, \frac{C_p}{C_v} = \gamma$                       C)  $C_v = \frac{R}{(\gamma-1)}$   
B)  $C_p = \frac{\gamma R}{(\gamma-1)}$                       D) All of these

**Q.78** 1st law of thermodynamics in case of Isobaric process is:

- A)  $C_p \Delta T = P \Delta V$                       C)  $C_p \Delta T = C_v \Delta T + P \Delta V$   
B)  $C_v \Delta T = C_p \Delta T + P \Delta V$                       D) None of these

**ANSWER KEY (Worksheet-18)**

1	B	21	A	41	D	61	B
2	B	22	C	42	C	62	D
3	D	23	C	43	D	63	D
4	A	24	D	44	C	64	D
5	B	25	D	45	B	65	D
6	A	26	C	46	A	66	D
7	A	27	D	47	C	67	A
8	B	28	C	48	D	68	A
9	B	29	A	49	B	69	C
10	A	30	D	50	C	70	A
11	A	31	D	51	B	71	A
12	A	32	B	52	B	72	A
13	D	33	B	53	B	73	A
14	D	34	D	54	B	74	B
15	D	35	B	55	B	75	A
16	D	36	C	56	D	76	B
17	A	37	D	57	C	77	D
18	D	38	D	58	B	78	C
19	B	39	D	59	A		
20	D	40	D	60	B		

**SOLUTIONS****Unit – 6 (WS-18)****Q.1** Answer is “B”**Solution:-** General gas equation for n moles is

$$PV = nRT$$

For one mole of a gas it can be written as:

$$PV = RT$$

**Q.2** Answer is “B”**Solution:-** Boltzman constant or gas constant per molecule is given as:

$$K = \frac{R}{N_A} = 1.38 \times 10^{-23} \text{ J K}^{-1}$$

**Q.3** Answer is “D”**Solution:-** At constant temperature,

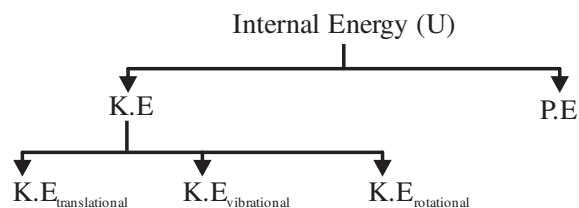
PV = constant, so graph will be a straight line parallel to P-axis.

**Q.4** Answer is “A”**Solution:-** Work is not a property of the system or surrounding. Work is a path variable. So work can not characterize the state of matter.**Q.5** Answer is “B”**Solution:-** Boyle’s law states:

“At constant temperature, the pressure of gas is inversely proportional to its volume.”

**Q.6** Answer is “A”**Solution:-** Expansion causes cooling, when temperature decreases, pressure also decreases.**Q.7** Answer is “A”**Solution:-** Put n=1 in general gas equation.**Q.8** Answer is “B”**Solution:-**  $U \propto T$ **Q.9** Answer is “B”

$$\text{Solution:- } \frac{V_{\text{rms}, \text{H}_2}}{V_{\text{rms}, \text{O}_2}} = \sqrt{\frac{\rho_{\text{O}_2}}{\rho_{\text{H}_2}}}$$

**Q.10** Answer is “A”**Solution:-** Internal energy of a gas can be described as:

- For ideal gases

$$P.E = K.E_{\text{vib}} = K.E_{\text{rot}} = 0$$

So,

$$U = K.E_{\text{trans}}$$



**Q.11 Answer is “A”****Solution:-** The rms velocity of a gas is:

$$v_{rms} = \sqrt{\frac{3KT}{m}}$$

or it can also be written as:

$$v_{rms} = \sqrt{\frac{3RT}{mN_A}} = \sqrt{\frac{3RT}{M}}$$

$$(\because M = mN_A)$$

**Q.12 Answer is “A”****Solution:-** Basic property of internal energy**Q.13 Answer is “D”****Solution:-** Average velocity = 0**Q.14 Answer is “D”****Solution:-** It may be a general process so temperature may rise but it may be an isothermal process as well in which  $T = \text{constant}$ **Q.15 Answer is “D”****Solution:-** Work done is calculated by area under PV graph which is maximum for isobaric process.**Q.16 Answer is “D”****Solution:-**

- If system is kept at same state temperature remains same.
- If system undergoes adiabatic process its temperature may rise or fall.

**Q.17 Answer is “A”****Solution:-**  $PV = nRT \Rightarrow P \propto T$ **Q.18 Answer is “D”****Solution:** The average translational K.E is given as:

$$\langle K.E \rangle = \frac{3kT}{2} = \frac{3 \times 1.38 \times 10^{-23} \times 300}{2}$$

$$\langle K.E \rangle = \frac{3 \times 1.38 \times 3 \times 10^{-21}}{2} \left( \because \frac{1.38}{2} \approx 0.7 \right)$$

$$\langle K.E \rangle = 9 \times 0.7 \times 10^{-21}$$

$$\langle K.E \rangle = 6.3 \times 10^{-21} \text{ J}$$

Just to simplify calculations we assumed

$$\frac{1.38}{2} = 0.7 \text{ so, now we'll choose the}$$

answer that is closest to  $6.3 \times 10^{-21}$  and smaller than this value. We'll use this technique to simplify calculations.**Q.19 Answer is “B”****Solution:-** Usually average speed of gas molecules is found at STP and for gases STP means;

$$T = 0^\circ\text{C} = 273.16 \text{ K and } P = 1 \text{ atm.}$$

**Q.20 Answer is “D”****Solution:-** It is determined by temperature**Q.21 Answer is “A”****Solution:-** Universal gas constant is related with specific heats as:

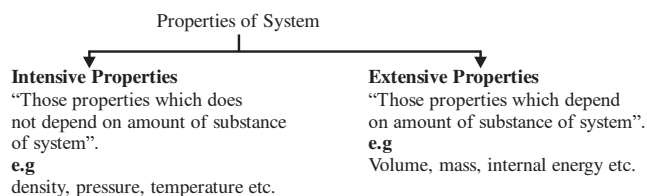
$$C_p - C_v = R$$

**Q.22 Answer is “C”****Solution:-** Use relation;  $T_F = \frac{9}{5}T_C + 32$ **Q.23 Answer is “C”****Solution:-** Since the volume of gas is kept constant, so;

$$\Delta V = 0$$

$$W = P\Delta V = 0$$

**Q.24 Answer is “D”**

**Solution:-**

Note:

Work and heat are neither intensive properties nor extensive properties of system.

**Q.25 Answer is “D”**

**Solution:-** Work and heat are not properties of a system. Work and heat are forms of energy in transit. They appear only when there occurs any change in the state of a system or surrounding. They don't exist before and after the change of the state, so they are not system properties.

**Q.26 Answer is “C”**

**Solution:-** When we talk about free expansion, it is understood that it is happening in vacuum, where the pressure on the system is zero, so,

$$W = P\Delta V = (0)\Delta V = 0$$

**Note:-**

Rapid expansion of air from a burst tyre (adiabatic expansion) happens in air, in this case pressure on the system is not zero, so work is done by system on surrounding on the cost of internal energy.

**Q.27 Answer is “D”**

**Solution:-** According to kinetic theory of gases, the collisions between the molecules of gas are PERFECTLY ELASTIC not partially elastic.

**Q.28 Answer is “C”**

**Solution:-** According to the relation

$$T = \frac{2}{3k} < K.E >$$

$$T \propto < K.E >$$

Temperature of a gas is directly proportional to average K.E.

**Q.29 Answer is “A”**

**Solution:-** At very high pressure the forces of attraction starts dominating in real gases and these forces tend to liquify the gas, so volume gets decreased, while in ideal gases no forces of attraction or repulsion are present so their volume at high pressure is more than real gases.

**Q.30 Answer is “D”**

**Solution:-** In the ideal gas equation;

$$PV = nRT$$

n=no.of moles, once selected they remain same

R=general gas constant.

P,V,T=describe physical state of gas.

**Q.31 Answer is “D”**

**Solution:-** Both heat and work are path variable as their value depends on the path which system follows.

**Q.32 Answer is “B”**

**Solution:-** As P=constant, Charles law can be applied which states;

$$V \propto T$$

Where T is in kelvin.

Also;

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \quad \left[ \begin{array}{l} \therefore T_1 = 30^\circ \text{C} = 303 \text{ K} \\ V_1 = V \\ T_2 = ? \\ V_2 = 2V \end{array} \right]$$
$$\frac{V}{303} = \frac{2V}{T_2}$$

$$T_2 = 606 \text{ K} = 333^\circ \text{C}$$

**Q.33 Answer is “B”**

**Solution:-** Data

$$P = 600 \times 10^3 \text{ Pa}, V_1 = 0.01 \text{ m}^3$$

$$W = 54 \times 10^3 \text{ J}, V_2 = ?$$

$$T = 290 \text{ K}$$

**Sol:-**

$$W = P\Delta V = P(V_2 - V_1)$$

$$54 \times 10^3 = 600 \times 10^3 (V_2 - 0.01)$$

$$\frac{54}{600} = V_2 - 0.01$$

$$\frac{54}{6} \times 10^{-2} = V_2 - 0.01$$

$$9 \times 10^{-2} = V_2 - 0.01$$

$$V_2 = 0.09 + 0.01 = 0.10 \text{ m}^3$$

**Q.34 Answer is “D”**

**Solution:-** Data:-

$$A = 0.1 \text{ m}^2, P = 8000 \text{ N m}^{-2}$$

$$\Delta y = 4 \text{ cm} = 4 \times 10^{-2} \text{ m}, Q = 42 \text{ J}$$

**Sol:-**

$$W = P\Delta V = P(A\Delta y)$$

$$W = 8000 \times 0.1 \times 4 \times 10^{-2}$$

$$W = 8 \times 10^3 \times 1 \times 10^{-1} \times 4 \times 10^{-2}$$

$$W = 32 \text{ J}$$

**Q.35 Answer is “B”**

**Solution:-** Data

$$A = 0.1 \text{ m}^2, P = 8000 \text{ N m}^{-2}$$

$$\Delta y = 4 \text{ cm} = 4 \times 10^{-2} \text{ m}, Q = 42 \text{ J}$$

**Sol:-**

$$W = P\Delta V = P(A\Delta y) = 32 \text{ J}$$

By 1<sup>st</sup>-law of thermodynamics

$$Q = W + \Delta U$$

$$\Delta U = Q - W = 42 - 32 = 10$$

$$\Delta U = 10 \text{ J}$$

**Q.36 Answer is “C”**

**Solution:-** Evidence in favour of kinetic theory of gases is exhibited in diffusion of gases and Brownian motion of smoke particles.

**Q.37 Answer is “D”**

**Solution:-** Kinetic theory of gases is based on microscopic approach in which the assumption is that gases are composed of molecules.

**Q.38 Answer is “D”**

**Solution:-** P.E is because of attractive or repulsive forces, so for ideal gas it is zero because of no attractive or repulsive force.

**Q.39 Answer is “D”**

**Solution:-** Pressure of gas is defined as;

$$P = \frac{F}{A} = \frac{\frac{\Delta P}{\Delta t}}{A} = \frac{\text{Momentum per second}}{\text{Area}}$$

**Q.40 Answer is “D”**

**Solution:-** See derivation of pressure of Gas

**Q.41 Answer is “D”**

**Solution:-**

$$\text{density} = \frac{\text{Total mass}}{\text{Total volume}} = \frac{mN}{\ell^3}$$

**Q.42** Answer is “C”**Solution:-** No. of particles colliding with total 6 faces of cube = N

$$\left( \frac{\text{No. of particles}}{\text{colliding with one face}} \right) = \frac{N}{6}$$

**Q.43** Answer is “D”

**Solution:-**  $v_{rms} = \sqrt{\frac{v_1^2 + v_2^2 + v_3^2}{3}}$

**Q.44** Answer is “C”**Solution:-** Dalton's law of partial pressure states  $P_{mixture} = P_1 + P_2 + \dots$ **Q.45** Answer is “B”

**Solution:-**  $P = \frac{2}{3} \frac{N}{V} \langle K.E \rangle$

Here

N &lt; K.E &gt; = average K.E of gas.

&lt; K.E &gt; = average K.E of one molecule of gas

**Q.46** Answer is “A”

**Solution:-**  $\frac{v_{rms,1}}{v_{rms,2}} = \sqrt{\frac{\rho_2}{\rho_1}} = \sqrt{\frac{M_2}{M_1}}$

Where  $\rho$  = density of gas

and M = molar mass of gas

**Q.47** Answer is “C”

**Solution:-**  $v_{rms} = \sqrt{\frac{3RT}{M}}$

**Q.48** Answer is “D”

**Solution:-**  $P = \frac{2}{3} \frac{N}{V} \langle \frac{1}{2} mv^2 \rangle$   
 $P \propto \langle v^2 \rangle$

**Q.49** Answer is “B”

**Solution:-**  $\frac{v_{rms,2}}{v_{rms,1}} = \sqrt{\frac{T_2}{T_1}}$  where  $T_2$  and

 $T_1$  are temperatures in kelvin

Alternative shortcut to solve this type of problem is:

$$T_2 = n^2 T_1$$

Where n = the number / factor to which speed at  $T_2$  is greater or smaller than at  $T_1$  for example in this question  $n=2$ .**Q.50** Answer is “C”**Solution:-** As the pressure of gas is given as:

$$P = \frac{2}{3} \frac{N}{V} \langle \frac{1}{2} mv^2 \rangle$$

$$P = \frac{2}{3} \frac{N}{V} \frac{1}{2} m \langle v^2 \rangle$$

$$P = \text{Constant} \langle v^2 \rangle$$

Taking square root on both sides

$$\sqrt{P} = \text{Constant} \sqrt{\langle v^2 \rangle}$$

$$\sqrt{P} = \text{Constant } v_{rms}$$

$$\sqrt{P} \propto v_{rms}$$

**Q.51** Answer is “B”**Solution:-** As the pressure of gas is given as:

$$P = \frac{2}{3} \frac{N}{V} \langle \frac{1}{2} mv^2 \rangle$$

$$P \propto \langle v^2 \rangle$$

$$\langle v^2 \rangle = \text{mean square velocity} = v_{ms}$$

$$P \propto v_{ms}$$

**Q.52** Answer is “B”

**Solution:-**  $\frac{\langle K.E \rangle_1}{\langle K.E \rangle_2} = \frac{T_1}{T_2}$

**Q.53** Answer is "B"

**Solution:-**  $T = \frac{2}{3k} < K.E >$

$$(t + 273) = \frac{2}{3k} < K.E >$$

**Q.54** Answer is "B"

**Solution:-**  $\frac{\rho_A}{\rho_B} = \frac{M_A}{M_B}$

**Q.55** Answer is "B"

**Solution:-**  $V \propto T$

**Q.56** Answer is "D"**Solution:-** Temperature conversion formulae**Q.57** Answer is "C"

**Solution:-**  $\frac{^{\circ}\text{C} - 0}{100} = \frac{^{\circ}\text{F} - 32}{180} = \frac{\text{K} - 273}{100}$

**Q.58** Answer is "B"

**Solution:-**  $\frac{^{\circ}\text{C} - 0}{100} = \frac{^{\circ}\text{F} - 32}{180} = \frac{\text{K} - 273}{100}$

**Q.59** Answer is "A"

**Solution:-**  $P \propto \frac{1}{V}$

**Q.60** Answer is "B"**Solution:-** P, V and T are state variable**Q.61** Answer is "B"**Solution:-** Boltzmann constant /gas constant per molecule is defined as;

$$K = \frac{R}{N_A} = 1.38 \times 10^{-23} \text{ J K}^{-1}$$

**Q.62** Answer is "D"**Solution:-** Average velocity of gas molecules is zero but average speed/rms velocity is not zero. Also,

$$T = \frac{2}{3k} < K.E >$$

$$T \propto < K.E >$$

**Q.63** Answer is "D"**Solution:-** Average speed of oxygen at STP is:

$$V = 461 \text{ m s}^{-1}$$

Average speed of nitrogen at STP is

$$V = 493 \text{ m s}^{-1}$$

**Q.64** Answer is "D"**Solution:-** Rms velocity of gas molecules is given as

$$v_{rms} = \sqrt{\frac{3kT}{m}} = \sqrt{\frac{3RT}{mN_A}} = \sqrt{\frac{3RT}{M}}$$

**Q.65** Answer is "D"

**Solution:-**  $P = \frac{2}{3} \frac{N}{V} < K.E >$

**Q.66** Answer is "D"**Solution:-** For ideal gas internal energy is equal to average K.E of gas molecules which is directly proportional to absolute temperature.**Q.67** Answer is "A"**Solution:-** Find area under graph i.e

$$W = \text{Area} = (10)(20 - 5)$$

$$W = (10)(15) = 150 \text{ J}$$

**Q.68** Answer is "A"**Solution:-** 1<sup>st</sup> Law of thermodynamics is another statement of law of conservation of energy.**Q.69** Answer is "C"**Solution:-** For a bicycle pump Q=0, so,

$$Q = W + \Delta U$$

$$0 = W + \Delta U$$

$$-W = +\Delta U$$

(-W)  $\Rightarrow$  Workdone on the system( $\Delta U$ )  $\Rightarrow$  Increase in internal energy

**Q.70** Answer is "A"**Solution:-** Rearrange 1<sup>st</sup> law of thermodynamics

i.e

$$Q = W + \Delta U$$

$$\Delta U = Q - W$$

 $(\Delta U) \Rightarrow$  Change in internal energy $(Q) \Rightarrow$  Energy gained from food $(-W) \Rightarrow$  Energy dissipated in different process by body**Q.71** Answer is "A"**Solution:-**

- Process at constant temperature is called isothermal process
- Process at constant volume is called isochoric/isometric process
- Process at constant pressure is called isobaric process
- Process in which  $Q=0$  is called adiabatic / isentropic process

**Q.72** Answer is "A"**Solution:-** For isothermal process: $T = \text{constant}$ 

So, Boyle's law is applicable i.e

$$P_1 V_1 = P_2 V_2$$

**Q.73** Answer is "A"**Solution:-** As  $Q = W + \Delta U$  putting  $Q=0$ 

$$0 = W + \Delta U$$

 $W = -\Delta U \Rightarrow$  Adiabatic Expansion $-W = \Delta U \Rightarrow$  Adiabatic Compression $-\Delta U \Rightarrow$  Adiabatic expansion $\Delta U \Rightarrow$  Adiabatic compression**Q.74** Answer is "B"**Solution:-** Among "A" and "B" the curve in option B is steeper, so it is adiabat.**Q.75** Answer is "A"**Solution:-**

$$(\text{Slope})_{\text{Isotherm}} = \frac{-P}{V}$$

$$(\text{Slope})_{\text{Adiabat}} = -\frac{\gamma P}{V}$$

Taking ratio:

$$\frac{(\text{Slope})_{\text{adiabat}}}{(\text{Slope})_{\text{isotherm}}} = \gamma$$

**Q.76** Answer is "B"**Solution:-** For isochoric process  $\Delta V = 0$  and  $W = P\Delta V = 0$ .**Q.77** Answer is "D"**Solution:-**  $C_p - C_v = R \longrightarrow (1)$ 

$$\gamma = \frac{C_p}{C_v}$$
$$\begin{array}{cc} \downarrow & \downarrow \\ C_p = \gamma C_v & C_v = \frac{C_p}{\gamma} \end{array}$$

Put these values after other in (1) and solve.

**Q.78** Answer is "C"**Solution:-** For isobaric process

$$Q_p = W + \Delta U$$

$$C_p \Delta T = P\Delta V + \Delta U$$

$$C_p \Delta T = P\Delta V + C_v \Delta T$$



# ENGLISH



WORKSHEETS 1-18



**STOP**

A PROJECT BY PUNJAB GROUP

**Worksheet-1**

**SUBJECT VERB  
AGREEMENT**

**DIRECTIONS:** Some segments of each sentence are underlined. Your task is to identify that underlined segment of the sentence which contains the mistake that needs to be corrected. Fill the circle corresponding to that letter under the segment in the MCQ Response form.

- Q.1** Everyone who plans to attend the senior  
A B C  
retreat need to pack appropriate camping  
D  
supplies.
- Q.2** A classic such as Cinderella, or other  
similar fairy tales, become distorted from  
A  
its original, and sometimes less than  
B C  
positive, story when Disney rewrites the  
D  
tale for public consumption.
- Q.3** Vast flows of information is carried on  
A B C D  
hair-thin fiber-optic cables.
- Q.4** Variations in melody, rhythm and tone of  
A B  
voice becomes a major feature of child  
C D  
speech toward the end of the first year.
- Q.5** Although the candidates accused each  
A  
other of encouraging voter fraud, most  
polls show that a majority of voters  
B  
believes the election was fair.  
C D

- Q.6** There is a number of solutions to the  
A  
problem of global warming that have not  
B  
been considered by this committee.  
C D
- Q.7** In a co-publication agreement, ownership  
of both the material and its means of  
A B  
distribution are equally shared by the  
C D  
parties.
- Q.8** More important than winning is developing  
A B  
the Ability to work with others and  
C  
developing leadership skills.  
D
- Q.9** At the foundation of the anti-insurgency  
program, strongly endorsed by the tribal  
A  
leaders, is plans to offer economic  
B  
redevelopment to the general population if  
they oppose the insurgents.  
C D
- Q.10** Light and shade, not color, is the principal  
A B C  
components of a drawing in the technique  
called chiaroscuro.  
D
- Q.11** Mueen claims that he wants to attend  
A B  
college after graduation, but his poor  
C  
attitude about studying during senior year  
do not indicate that he enjoys being a  
D  
student.

- Q.12** The paralegal believed that there were an  
overload of cases in the office, which was  
creating stress.  
A B C D
- Q.13** Ali is the only one of those children who  
wheedle you into giving her anything she  
wants.  
A B C D
- Q.14** The rate of unemployment among white-  
collar workers show much less regional  
variation than corresponding rates among  
blue-collar workers.  
A B C D
- Q.15** Imran said that \$2 million for the  
purchase of textbooks are a lot of money  
in the age of the computer.  
A B C D
- Q.16** Alena asked him whether the mayor or  
the city councilors are responsible for  
introducing the budget.  
A B C D
- Q.17** Here into the main ring of the circus  
comes the trained elephants along with  
their trainer.  
A B C D
- Q.18** Despite the residents' requests, the five  
members of the Homeowner's Association  
Executive Board hasn't issued a warning  
to those neighbors who have flouted the  
rules regarding lawn maintenance.  
A B C D

- Q.19** Some of the job applicants who have  
passed in written test is expected to pass  
the difficult screening test.  
A B C D
- Q.20** My favorite history professor, as well as  
some of their administrative staff, was  
asked to resign because fewer students  
were taking history courses than ever  
before.  
A B C D
- Q.21** A) Neither the men who are listed as  
administrators nor the woman who is  
also listed has been appointed to the  
board.  
B) Neither the men who are listed as  
administrators nor the woman who is  
also listed have been appointed to the  
board.  
C) Neither the men who are listed as  
administrators nor the women who is  
also listed has been appointed to the  
board.  
D) Neither the men who is listed as  
administrators nor has the woman  
who is also listed been appointed to  
the board.
- Q.22** A) The Prince and Pauper was my  
favorite book when I were a child.  
B) The Prince and The Pauper was my  
favorite books when I was a child.  
C) The Prince and The Pauper were my  
favorite book when I was a child.  
D) The Prince and The Pauper was my  
favorite book when I was a child.
- Q.23** A) Million of Americans watched the  
high-speed chase and most were  
mesmerized by the event.

- B) Millions of Americans watched the high-speed chase and most was mesmerized by the event.
- C) Millions of Americans watched the high-speed chase and most were mesmerized by the event.
- D) Millions of American watched the high-speed chase and most were mesmerized by the event.
- Q.24** A) Before the end of the semester, each of you needs to meet with your adviser or me to discuss your plans for next year.
- B) Before the end of the semester, each of you needs to meet with yours adviser or me to discuss your plans for next year.
- C) Before the end of the semester, each of you need to meet with your adviser or me to discuss your plans for next year.
- D) Before the end of the semester, each of you needs to meet with your adviser or I to discuss your plans for next year.
- Q.25** A) The city police have decided to take stern action against drivers which attempt to overtake on the left side in the city roads.
- B) The city police have decided to take stern action against drivers who attempt to overtake on the left side on the city roads.
- C) The city police has deciding to take stern action against drivers who attempt to overtake on the left side on the city roads.
- D) The city police have decided to taking stern action against drivers who

- attempt to overtake in the left side on the city roads.
- Q.26** A) Nine kilometers is not a long distance for a man who is an athlete.
- B) Nine kilometers is not a long distance for man who is an athlete.
- C) Nine kilometers is not a long distance for a man who are an athlete.
- D) Nine kilometers are not a long distance for a man who are a athlete.
- Q.27** A) A pair of gloves are lying in the bed.
- B) A pair of glove is lying on the bed.
- C) A pair of gloves is laying on the bed.
- D) A pair of gloves is lying on the bed.
- Q.28** A) Japan is the only one of those countries that consist of a group of islands called an archipelago; the biggest island is Honshu.
- B) Japan is one of those countries that consist of a group of islands called an archipelago; biggest island is Honshu.
- C) Japan is one of those countries that consist of a group of islands called an archipelago; the biggest island is Honshu.
- D) Japan is one of those countries that consists of a group of islands called an archipelago; the biggest island is Honshu.
- Q.29** A) I am worried as neither of my brothers has returned from the picnic.
- B) I am worried as neither of mine brothers has returned from the picnic.
- C) I am worried as neither of my brothers have returned from the picnic.

D) I am worried like neither of my brothers has returned from the picnic.

**Q.30** A) Because of it's remarkable speed and grace, cheetahs have captivated humans for thousands of years.

B) Because of its remarkable speed and grace, cheetahs have captivated humans for thousands of year.

C) Because of their remarkable speed and grace, cheetahs have captivated humans for thousands of years.

D) Because of their remarkable speed and grace, cheetahs have captivated humans for thousand of years.

**Q.31** A) The police has not made any arrests lately.

B) The police have not made any arrests lately.

C) The police have not made some arrests lately.

D) The police have not made any arrests late.

**Q.32** A) Most of the news and information in the media originates for public relations sources.

B) Most of the new and information in the media originates from public relations sources.

C) Most of the news and information in the media originate from public relation sources.

D) Most of the news and information in the media originates from public relation sources.

**Q.33** A) Despite the need for educated workers, the United State has a low high school graduation rate.

B) Despite the need for educated workers, the United States have a low high school graduation rate.

C) Despite the need for educated workers, the United States has a low high school graduation rate.

D) Despite the need for educated workers, the United States has a lower high school graduation rate.

**Q.34** A) A pairs of supportive shoes are important if you are experiencing lower back pain.

B) A pair of supportive shoe is important if you are experiencing lower back pain.

C) A pair of supportive shoes is important if you are experiencing lower back pain.

D) A pair of supportive shoes are important if you are experiencing lower back pain.

**Q.35** A) While the young analyst is bothered by the fact that his friend is not very skilled behind the wheel, each of his other redeeming qualities compensates for his driving ability.

B) While the young analyst is bothered by the fact that his friend is not very



skilled behind the wheel, each of his other redeeming qualities compensate for his driving ability.

C) While the young analyst is bothered by the fact that his friend is not very skilled behind the wheel, each of his other redeeming qualities compensate for their driving ability.

D) While the young analyst is bothered by the fact that his friend is not very skil behind the wheel, each of his other redeeming qualities compensate for his driving ability.

**Q.36** A) Carefully crafted plots and a brilliantly developed main character are what makes the book so compelling.

B) Carefully crafted plots and a brilliantly developed main character is what make the book so compelling.

C) Carefully crafted plots and a brilliantly developed main character is what makes the book such compelling.

D) Carefully crafted plots or a brilliantly developed main character are what makes the book so compelling.

**Q.37** A) The politician and opposition leader is opposed to the new reforms being enacted by the government.

B) The politician and opposition leader are opposed to the new reforms being enacted by the government.

C) The politician and opposition leader are opposed to the news reforms being enacted by the government.

D) The politician and the opposition leader is opposed to the new reforms being enacted by the government.

**Q.38** A) Forty percent of the student body are at favor of changing the policy.

B) Forty percent of the students body is in favor of changing the policy.

C) Forty percent of the student body are in favor of changing the policy.

D) Forty percent of the student body is in favor of changing the policy.

**Q.39** A) Studies have shown that the majority of heart-related problems listed in pharmacology is caused by a combination of poor dietary practices and lack of exercise.

B) Studies have shown that the majority of heart-related problems listed in pharmacology are caused by a combination of poor dietary practices and lack of exercise.

C) Studies have shown that a majority of heart-related problems listed in pharmacology are caused to a combination of poor dietary practices and lack of exercise.

D) Studies have shown that the majority of heart-related problems listed in pharmacology are caused by a combination for poor dietary practices and lack of exercise.

**Q.40** A) The looting was a reminder of how appallingly people can behave when law and order breaks down.

B) The looting was a reminder of how appallingly people can behave when law and order break down.



- C) The looting were a reminder of how appallingly people can behave when law and order breaks down.
- D) The looting was a reminder of how appallingly people can behaves when law and order breaks down.

STEP ENTRY TEST 2020

**ANSWER KEY (Worksheet-1)**

1	D	21	A
2	A	22	D
3	C	23	C
4	C	24	A
5	C	25	B
6	A	26	A
7	C	27	D
8	B	28	C
9	B	29	A
10	B	30	C
11	D	31	B
12	A	32	D
13	C	33	C
14	B	34	C
15	B	35	A
16	B	36	A
17	B	37	A
18	B	38	D
19	C	39	B
20	A	40	A

**ANSWERS EXPLAINED**

- Q.1 Correct Answer D: needs  
 Q.2 Correct Answer A: becomes  
 Q.3 Correct Answer C: are  
 Q.4 Correct Answer C: become  
 Q.5 Correct Answer C: believe  
 Q.6 Correct Answer A: are  
 Q.7 Correct Answer C: is  
 Q.8 Correct Answer B: are  
 Q.9 Correct Answer B: are  
 Q.10 Correct Answer B: are  
 Q.11 Correct Answer D: does  
 Q.12 Correct Answer A: was  
 Q.13 Correct Answer C: wheedles  
 Q.14 Correct Answer B: shows  
 Q.15 Correct Answer B: is

- Q.16 Correct Answer B: is  
 Q.17 Correct Answer B: come  
 Q.18 Correct Answer B: haven't  
 Q.19 Correct Answer C: are  
 Q.20 Correct Answer A: his  
 Q.21 Correct Answer A: When the subjects joined by or, nor, either ..... or, neither ..... nor are of different persons, the verb agrees with the nearer.  
 Q.22 Correct Answer D: The Prince and The Pauper is the title of a book; it is singular, thus requiring the singular form of verb, "was."  
 Q.23 Correct Answer C: *Million*, like the words *hundred, thousand* and *billion*, has two possible plural endings. Sometimes we say *million*, sometimes *millions*.  
 Without the plural ending -s  
 1. We **don't** add 's' when we give an exact number:  
 ▪ *two million pounds*  
 ▪ *two thousand years*  
 ▪ *three hundred*  
 ▪ *four billion*.  
 2. We **don't** add 's' when we use a quantifier like *several* or *a few*:  
 ▪ *several million years*  
 ▪ *a few thousand dollars*  
 ▪ *a few hundred*.  
 With the plural ending -s  
 Add 's' if you don't give an exact number:  
 ▪ *hundreds of people*  
 ▪ *thousands of years*  
 ▪ *millions of dollars*.  
 Q.24 Correct Answer A: Verb agreement with indefinite pronouns:  
 Indefinite pronouns are non-specific words like *someone, others, several* or *none*. Some of these pronouns are always singular or always plural. But some can change their number—they can be *either*

singular or plural, depending on the context.

It is important to know whether an indefinite pronoun subject is singular or plural so that we can make the verb agree.

#### a) Singular indefinite pronouns

Singular indefinite pronouns include the compounds of **-body, -one and -thing**, along with the words *one, another, each, either, neither* and *much*. A singular verb is used with these pronouns:

each	somebody	something	Someone
Every	everybody	everything	Everyone
neither	Any body	Anything	Anyone
either	Nobody	Nothing	No one
one			

- *Nobody likes* liver for supper.
- *Everyone sings* in the shower.
- *Something smells* funny.
- *One of the keys does* not fit the lock.
- *Each of the members has* the right to bring a guest.
- *Either is* fine with me.

**Q.25 Correct Answer B:** Police (plural noun) requires have. Drivers requires "who" instead of "which".

**Q.26 Correct Answer A:** Nine kilometers (a singular time unit) requires singular verb "is". Man (countable noun) requires article "a" and singular verb "is".

**Q.27 Correct Answer D:** Lying is suitable as intransitive verb instead of laying. "On the bed" is suitable as compare to "in the bed".

**Q.28 Correct Answer C:** (a) The only + One of the + PLURAL NOUN + THAT/WHO + SINGULAR VERB.

"He is one of the persons who bakes special cakes."

(b) One of the + PLURAL NOUN + that/who + PLURAL VERB  
"He is one of the persons who make money."

**Q.29 Correct Answer A:** Neither takes singular verb: Moreover "as" should be differentiated from "like".

**Q.30 Correct Answer C:** Cheetahs are plural verb and will take "their". Moreover, the correct structure is thousands of years.

**Q.31 Correct Answer B:** Police is plural that is why plural verb will be used.

**Q.32 Correct Answer D:** Indefinite pronouns (*all, any, some, most, none*.) may take a singular or plural verb: Example: - Singular: **Most** of the hospital remains open on weekends.

**Some** of this cake belongs to the nurses.

**Is any** of this medicine ready to be picked up?

**All** of the blood **is** donated by students.

-Plural: **Most** of the patients **complete** an information form.

**Some** of our doctors **work** the midnight shift.

**Any** of the diseases on this floor **are** contagious.

**All** of the rooms **are** clean.

**Q.33 Correct Answer C:** The United States is the name of country (singular subject) ..... singular verb .... Has

**Q.34 Correct Answer C:** A pair of (singular subject)..... is (singular verb)

**Q.35 Correct Answer A:** When words like "each" are the subject

When used as subjects, words such as

**each, either, neither another anyone, anybody, anything someone, somebody,**

something one, everyone everybody,  
everything no one, nobody, nothing  
take singular verbs.

Each takes her turn at rowing.

Neither likes the friends of the other.

**Q.36 Correct Answer A:** Subjects joined by "and" take plural verbs.

**Q.37 Correct Answer A:** When two or more singular subjects are joined by and, they take a singular verb if they represent a single person.

The politician and opposition leader..... single person

**Q.38 Correct Answer D:** With fractions, percentages and indefinite quantifiers, the verb agrees with the preceding noun

Forty percent of the student body (singular)..... is

**Q.39 Correct Answer B:** Majority can be either singular or plural depending on the noun after of. If the noun after of is singular, use a singular verb. If it is plural, use a plural verb.

majority of heart-related problems ..... are

**Q.40 Q. 20 Correct Answer A:** Some nouns linked by and have become so strongly connected that they form a composite subject (or double subject), expressing one idea rather than two. In such cases, we usually choose singular verbs and pronouns.

## Worksheet-2

## SENTENCE COMPLETION

**DIRECTIONS:** Each sentence below has a blank indicating that something has been omitted. Choose the word that best fits in with the meaning of the sentence as a whole.

**Q.1** Though the apprentice was a highly proficient IT professional, he had little or no \_\_\_\_\_ in designing educational software.

- A) Creativity                      C) Configuration  
B) Prospect                      D) Competition

**Q.2** They are a few of the extremely \_\_\_\_\_ educators that we ever had, with a/an \_\_\_\_\_ expertise of their subjects and a thoroughness in their coaching.

- A) Skilled ... imperfect  
B) Equivalent ... marvelous  
C) Energetic ... blithe  
D) Scholarly...profound

**Q.3** Since the people of Subcontinent were \_\_\_\_\_ under English régime, many headed toward the Japanese side during the second world war.

- A) Employed                      C) Edified  
B) Exiled                          D) Manipulated

**Q.4** The novelist told the publisher that the royalty imbursement indicated in the agreement was \_\_\_\_\_ on the grounds that the research expenditures, including traveling for writing the book, were far more than the royalties projected for a year.

- A) Logical                          C) Payable  
B) Precarious                      D) Insufficient

**Q.5** The individuals who were invited to Hanan's party had to come wearing \_\_\_\_\_ clothes, thus convincing all the visitors of his \_\_\_\_\_ tendency.

- A) Sonorous ... imaginative  
B) Gaudy ...humble  
C) Old-fashioned ... nostalgic  
D) Ragged ... frightening

**Q.6** The foreman's clemency, particularly in being candid, had its \_\_\_\_\_, one of which was \_\_\_\_\_workmanship.

- A) Damages ... intolerable  
B) Ambiguities ...superior  
C) Shortcomings ...shoddy  
D) Occurrences ...attractive

**Q.7** Even though the physical structure of the college's lunchroom appears dilapidated in many regards, it was extended and \_\_\_\_\_ quite lately.

- A) Stayed                          C) Conquered  
B) Inspected                      D) Renovated

**Q.8** Mani suffered one final ignominy after death when his tomb was \_\_\_\_\_.

- A) Consecrated                      C) Vitalized  
B) Secured                          D) Desecrated

**Q.9** The \_\_\_\_\_ in the Bible are equally erudite and educational.

- A) Syllables                          C) Achievements  
B) Helpfulness                      D) Parables

**Q.10** The provost was utterly \_\_\_\_\_ about having the students keep their books tidily in their lockers; yet her desk was very \_\_\_\_\_.

- A) Apathetic ...comfortable
- B) Bewildered ... bizarre
- C) Determined ...disorderly
- D) Considerate...modern

**Q.11** The \_\_\_\_\_ climate of the island made life uncomfortable for the locals; one minute it is raining, the next minute it would be sweltering.

- A) Congruous                      C) Immaculate
- B) Frigid                          D) Capricious

**Q.12** Azhar loves roses for the \_\_\_\_\_ appeal of their petals and leaves, while I am most \_\_\_\_\_ by their olfactory properties.

- A) Aesthetic ... Enthralled
- B) Acerbic ... Fascinated
- C) Pictorial ... Dissatisfied
- D) Implicit ... Disenchanted

**Q.13** Abid's \_\_\_\_\_ for learning history should prove to be practical during his studies to become a history teacher.

- A) Disregard                      C) Abhorrence
- B) Penchant                      D) Empathy

**Q.14** Because the committee issued its report that authenticated our actions, we felt \_\_\_\_\_.

- A) Indicted                      C) Vindicated
- B) Battered                      D) Destitute

**Q.15** The air in a room that contains several houseplants can be more \_\_\_\_\_ oxygen than a room that contains no plants.

- A) Complicated by              C) Obscured by
- B) Exhausted with              D) Saturated with

**Q.16** High rise apartments have been criticized in recent years as \_\_\_\_\_ for families with children because most of them lack recreational facilities.

- A) Inappropriate              C) Significant
- B) Humiliating                D) Inevitable

**Q.17** It is impossible for a serious scholar to condone this \_\_\_\_\_ dismissal of respected theories.

- A) Judicious                      C) Erudite
- B) Cavalier                      D) Laudable

**Q.18** Bullying the foe with artillery fire and dispersing them with fire ships, the English forced the Spanish to \_\_\_\_\_ their invasion attempt.

- A) Abandon                      C) Reassess
- B) Fortify                        D) Overlook

**Q.19** The golfer's \_\_\_\_\_ in concentration cost him first place in the tournament.

- A) Lapse                          C) Improvement
- B) Hole                          D) Increase

**Q.20** As the worker's intentions were found to be \_\_\_\_\_, no disciplinary action will be taken against him for the mistake.

- A) Bizarre                        C) Improvised
- B) Premeditated                D) Benign

**Q.21** Certain ailments, such as malaria, that have been nearly eradicated in the United Kingdom are still \_\_\_\_\_ in many places abroad.

- A) Wrecked                      B) Rampant
- C) Misstated                      D) Preserved



**Q.22** The Defense Minister had affirmed that Russia would \_\_\_\_\_ to its pronouncement to ban the United States jet fighters from Russian territory, in spite of the strong pressure from allies as a representative of our nation.

- A) Acquiesce                      C) Adhere  
B) Restore                        D) Surrender

**Q.23** The Timberland Administration cautioned that the spring forest fire season was in full swing and urged that \_\_\_\_\_ caution be practiced in lush zones.

- A) Conventional                C) Radical  
B) Dangerous                  D) Normal

**Q.24** He attempted his hardest to keep up his \_\_\_\_\_ even with the threatening crowd.

- A) Amalgamation               C) Equanimity  
B) Correspondence            D) Exasperation

**Q.25** Despite the fact that the demise of his puppy had disheartened him evidently, his computer designing aptitudes remained totally \_\_\_\_\_.

- A) Bitter                          C) Incapacitated  
B) Unaffected                  D) Demolished

**Q.26** The Chimpanzee were so \_\_\_\_\_ that the forest authorities needed to create different tactics to ensnare them.

- A) Outlying                      C) Extravagant  
B) Feral                          D) Elusive

**Q.27** The cook attempted to be \_\_\_\_\_; he would sometimes add garlic to the sauce, and other times he would add only basil.

- A) Inconsistent                C) Harmonious  
B) Quick                         D) Thoughtful

**Q.28** As a consequence of his \_\_\_\_\_ driving, the other wagon was forced to turn off the road or be hit.

- A) Observant                    C) Practical  
B) Slipshod                      D) Commendable

**Q.29** Until his demise, he remained \_\_\_\_\_ in the conviction that the world was conniving against him.

- A) Humiliating                C) Identical  
B) Taciturn                      D) Implacable

**Q.30** The proposal happened to be \_\_\_\_\_, for it would have necessitated more financial support than was available.

- A) Inflexible                    C) Irreparable  
B) Muddled                    D) Untenable

**Q.31** Before the inflation \_\_\_\_\_, one could have had an entire supper in an eatery for five dollars, though today, a coffee, and dessert would absolutely add up to two or three times.

- A) Spiral                        C) Uncoiled  
B) Lineal                        D) Plummeted

**Q.32** Britain's seizure of American ships and \_\_\_\_\_ of our sailors to serve in the British Naval force were two main reasons of the War of 1812.

- A) Coercing                    C) Bribing  
B) Recruiting                  D) Deriding

**Q.33** Even though he had not worked hard on his project, Akram was very \_\_\_\_\_ after discovering that he had won the contest.

- A) Exasperated                C) Euphoric  
B) Uninterested               D) Snubbed

**Q.34** Mueen was \_\_\_\_\_ about a rise in the worth of the stocks he had recently bought and was enthusiastic to make a change in his investment portfolio.

- A) Appalling                      C) Dubious  
B) Nonchalant                      D) Entertained

**Q.35** Because the theme was so technical, the trainer made every attempt to use \_\_\_\_\_ terms to illustrate it.

- A) Blunt                      C) Subtle  
B) Simplified                      D) Entangled

**Q.36** Regardless of Danish's marvelous knowledge, he was customarily \_\_\_\_\_ when faced with viable issue.

- A) Logical                      C) Thoughtful  
B) Baffled                      D) Moral0

**Q.37** The pictures of Uganda's famished kids exhibit the \_\_\_\_\_ of drought, poor land utilization, and overpopulation.

- A) Outcomes                      C) Disproportions  
B) Intolerances                      D) Mortalities

**Q.38** The investigators affirmed that an atomic war could \_\_\_\_\_ sufficient smoke and dust to rub out the sun and freeze the earth.

- A) Highlight                      C) Produce  
B) Terminate                      D) Clarify

**Q.39** Can public opinion be influenced so that it \_\_\_\_\_ rather than encourages the proliferation of the sale of firearms?

- A) Amplifies                      C) Advances  
B) Inverts                      D) Impedes

**Q.40** His matrimonial life was not \_\_\_\_\_ since it was filled with nasty unrest and rows.

- A) Abhorrent                      C) Obvious  
B) Tranquil                      D) Cogent

**ANSWER KEY (Worksheet-2)**

1	A	21	B
2	D	22	C
3	D	23	C
4	D	24	C
5	C	25	B
6	C	26	D
7	D	27	A
8	D	28	B
9	D	29	D
10	C	30	D
11	D	31	A
12	A	32	A
13	B	33	C
14	C	34	C
15	D	35	B
16	A	36	B
17	B	37	A
18	A	38	C
19	A	39	C
20	D	40	B

**ANSWERS EXPLAINED****Q.1 Correct Answer A:****Explanation:**

The first word, "Though," is an *opposition indicator*. The beginning of the sentence speaks positively about the IT professional. We must find a word that gives us a negative idea about him. Choice A, creativity, is the appropriate word though it is positive word but no or little makes it negative. The other choices are incorrect because their words are not appropriate to give us that opposite feeling.

**Q.2 Correct Answer D:****Explanation:**

Examine the first word of each choice. Choice B, equivalent (meaning tantamount) does not make sense because we do not

speak of tantamount professors. Now consider the other choices. Choice D, scholarly...profound, is the only choice which has a word pair that makes sense in the sentence.

**Q.3 Correct Answer D:****Explanation:**

The beginning word "Since" is a *result indicator*. We may expect, then, a reason in the first part of the sentence for the Indian people to escape from British rule and join the Japanese. The word "manipulated" (Choice D) provides the reason. The words in the other choices do not make sense in the sentence.

**Q.4 Correct Answer D:****Explanation:**

The author is obviously not satisfied with the royalty payment specified, as the sentence refers to the high research costs necessary for writing the book. The other choices do not fit this situation.

**Q.5 Correct Answer C:****Explanation:**

The first step is to examine the first word of each choice. We eliminate Choice because there are no such things as "sonorous clothes." Now we go to the remaining choices. Choice B, gaudy ...humble, and Choice D, ragged ... frightening, do *not* make sense in the sentence. Choice C, old-fashioned ... nostalgic, *does* make sense in the sentence

**Q.6 Correct Answer C:****Explanation:**

The first step is to examine the first word of each choice. We eliminate Choice B, ambiguities and Choice D, occurrences because the foreman's clemency did not have ambiguities or occurrences. Now we go to the remaining choices. Choice A, damages ... intolerable, does *not* make sense in the sentence. Choice C, shortcomings ... shoddy, makes the sentence meaningful.

**Q.7 Correct Answer D:****Explanation:**

The word "Even though" at the beginning of the sentence is an *opposition indicator*. As a contrast to the dilapidated condition of the school, the word "renovated" is the acceptable choice.

**Q.8 Correct Answer D:****Explanation:**

An "ignominy" is shame, disgrace, or humiliation, so because he suffered one final "ignominy" after death, we can infer that his tomb must have been "desecrated," which means defiled, disrespected, or dishonored. "Absolved" means forgiven or removed blame from; "vitalized" means gave strength and energy to; and "secured" means fixed so something can't be moved or assured the protection of.

**Q.9 Correct Answer D:****Explanation:**

Try each choice. Parables are *stories* or fables that illustrate a moral or ethical point while relating a simple incident.

**Q.10 Correct Answer C:****Explanation:**

The first step is to examine the first word of each choice. We eliminate Choice B, bewildered, and Choice D, considerate, because the first part of the sentence makes no sense with these choices. Now we go to the remaining choices. Choice A does not make sense in the sentence and is therefore incorrect. Choice C does make sense in the sentence.

**Q.11 Correct Answer : D****Explanation:**

After the semicolon, it is revealed that the climate is raining one minute, and very hot ("sweltering") the next minute. When something is very changeable, it is called "capricious." "Bleak" means desolate or offering little hope of success; "frigid" means extremely cold; "immaculate" means perfect or spotlessly clean; and "congruous" means consistent with something else.

**Q.12 Correct Answer : A****Explanation:**

Because the sentence indicates that Azhar "loves roses," the word that best fits in the first blank should have a positive connotation. The first word in answer choice B has a negative connotation, and the first words in answer choice has neutral connotation. "Aesthetic" refers to "the appreciation of beauty," which makes the most sense in this sentence. Likewise,

"enthralled," which means "captivated," works well in the second blank.

**Q.13 Correct Answer : B****Explanation:**

To have a "penchant" for something means to have a fondness for it. A fondness for history would be practical or helpful for future studies in the field. Answer choices A and C are incorrect because anyone having "disregard" or "Empathy" for history would certainly not study to become a history teacher.

**Q.14 Correct Answer : C****Explanation:**

The best answer is C. "Vindicated" means "cleared of suspicion or doubt" and "authenticated" means "proved to be genuine." The rest of the answer choices are contradictory in nature and do not fit the context of the sentence.

**Q.15 Correct Answer : D****Explanation:**

The word "saturated" most accurately indicates the density of the oxygen in the room. The other answer choices do not fit the context of the sentence.

**Q.16 Correct Answer : A****Explanation:**

The use of conjunction because shows that there is no contradiction within the sentence but, on the contrary, the second part of the sentence follows logically from the first part. If high rise buildings are **significant**, **'inevitable'** for families with children, they cannot be 'criticized' for that reason. So, (C), and (D) can be rejected straightway, and the choice is only between (A) and (B). The lack of recreational facilities in most high-rise buildings cannot lead to a conclusion that all high-rise buildings are '

**humiliating'** for families with children. The logical statement can be that such buildings are 'inappropriate' for families with children.

**Q.17 Correct Answer : B****Explanation:**

If the theories are respected ones, their dismissal by someone cannot be described as judicious (meaning very intelligent), or erudite (meaning learned), or laudable (meaning praiseworthy). It can only be described as cavalier (meaning arrogant or rash).

**Q.18 Correct Answer : A****Explanation:**

The sentence obviously describes a war between the British and the Spanish, which was started by an attempt of the Spanish to invade Britain. If, in that attempt, the Spanish were Bullying (meaning Harassing) by the British with artillery fire, what would be Spanish have been forced to do with their invasion attempt? 'Abandon' is the best among the given choices.

**Q.19 Correct Answer : A****Explanation:**

One would assume that a golfer would lose first place in a tournament if he messed up, so the correct answer must refer to a loss or stoppage in concentration. The correct answer is therefore "lapse," which means brief but unwanted pause in focus. You may have heard of the phrase "lapse in judgment" before—you can see now that it refers to a decision someone made when they were not judging the situation very well, or in other words, a bad decision in a situation where they were expected to make a good one and perhaps had before. If the golfer had had either an "improvement" or



an "increase" in concentration, it's unlikely that this would have led to his losing first place in the tournament, so neither of those answer choices can be correct.

**Q.20 Correct Answer : D****Explanation:**

The context of the sentence indicates that the employee will not be disciplined as a result of his mistake, which suggests that the error was not intentional, and that the employee meant no harm. The word "benign" means "harmless," so it is the best choice based on the context of the sentence.

**Q.21 Correct Answer B:****Explanation:**

The word rampant (meaning "prevalent") completes the sentence so that it makes good sense. The other choices don't work.

**Q.22 Correct Answer C:****Explanation:**

Note that the last part of the sentence contains an *opposition indicator* ("in spite of"). The word adhere in Choice C means "to stick" or "to cling." The Defense Minister's decision is in opposition to what the United States and its allies desire—that is, continuing to have United States jet fighters on Russian land. Choices A, B, and D are incorrect because they do not contain the 'opposite idea expressed in the sentence.

**Q.23 Correct Answer C:****Explanation:**

The word radical is the most appropriate among the four choices because the forest

fire season is in *full swing*. The other choices are not appropriate.

**Q.24 Correct Answer C:****Explanation:**

Try each choice. Bear in mind that even with the threatening crowd, you would probably try to keep (maintain) you calm, poise, or composure. Choices A, B, and D do not do that.

**Q.25 Correct Answer B:****Explanation:**

The first word, "Despite," is an *opposition indicator*. After the subordinate clause "Despite ...markedly," we can expect an opposing idea in the main clause that follows and completes the sentence. Choice B, **unaffected**, gives us the word that brings out the opposition thought that we expect in the sentence. Choices A, C, and D do not give us a sentence that makes sense.

**Q.26 Correct Answer D:****Explanation:**

The word "elusive" means "cleverly or skillfully; able to avoid being caught." Therefore, Choice D, elusive, is the only correct choice.

**Q.27 Correct Answer A:****Explanation:**

The cook's inconsistency in making sauce is obvious in the manner in which he adds spices—sometimes garlic and other times only basil. There are no clues in the



sentence that would lead to Choice B, C, or D.

**Q.28 Correct Answer B:****Explanation:**

Try each choice, being aware that “As a consequence of” is a *result indicator*. This happened because of his careless, *indifferent* driving.

**Q.29 Correct Answer D:****Explanation:**

Try each choice. The sentence implies that he retained the belief until his death; hence he was stubborn or unchanging. (*obstinate* or *obdurate*) in his belief.

**Q.30 Correct Answer D:****Explanation:**

The plan turned out to be impractical, unable to be logically supported. Note the root ten, “to hold,” so untenable means “not holding.” means “not possible to do easily.” Also note that the word “for” in the sentence is a result indicator.

**Q.31 Correct Answer A:****Explanation:**

Look at the contrasting clauses of the sentence—“five dollars” to “two or three times as much.” A *spiral* would get things out of control and up and up.

**Q.32 Correct Answer A:****Explanation:**

Try to complete the sentence *before* looking at the choices. Doing this, you might have come up with any of the following words that indicate an additional type of force or injury besides “seizure”: *forcing*, *pressuring*, *compelling*. These words all come close to the meaning of Choice A,

*coercing*. Therefore, Choices B, C, and D are incorrect.

**Q.33 Correct Answer C:****Explanation:**

We have an opposition indicator here—the student’s not working hard and his winning the contest. We, therefore, look for a definitely positive word as our choice to contrast with the negative thought embodied in his not working hard. Those positive words are euphoric (Choice C), which means “delighted beyond measure.” Accordingly, A, B, and D are incorrect.

**Q.34 Correct Answer C:****Explanation:**

The fact that the investor was eager to make an investment change points to his being “dubious” about his current investment—the stocks he had recently purchased.

**Q.35 Correct Answer B:****Explanation:**

Try to complete the sentence before looking at the four choices, you might have come up with any of the following words: **simple, ordinary, understandable, common, easy-to-understand**. These words all mean about the same as the correct Choice B, simplified. Therefore, Choices A, C, and D are incorrect.

**Q.36 Correct Answer B:****Explanation:**

The phrase “Regardless of” constitutes an opposite indicator. We can then expect an opposing idea to complete the sentence. The word baffled means “puzzled” or “unable to comprehend.” Choice B gives us the word that brings out the opposition thought we expect in the sentence. Choices

A, C, and D do not give us a sentence that makes sense.

**Q.37 Correct Answer A:**

***Explanation:***

Photographs of starving children must demonstrate something. Try to complete the sentence before looking at the four choices, you might have come up with words like “results” or “effects.” Therefore, Choice A is correct. The other choices are incorrect because they do not make sense in the sentence.

**Q.38 Correct Answer C:**

***Explanation:***

The word produce (meaning “to generate”) complete the sentence so that it makes good sense. The other choices don’t do that.

**Q.39 Correct Answer C:**

***Explanation:***

The clue here is rather than encourages. A verb whose object is proliferation and that means the opposite of encourages is needed. The best choice is impedes, which means obstructs or retards.

**Q.40 Correct Answer B:**

***Explanation:***

Try each choice, being aware that “since” is a *result indicator*. Their married life was not smooth and content.

**Worksheet-3**

**VOCABULARY LIST (1-40)**

**DIRECTIONS:** Select the most suitable synonym for the given words:

**Q.1 APPALLING**

- |             |                |
|-------------|----------------|
| A) Terrible | C) Appealing   |
| B) Waning   | D) Snowballing |

**Q.2 ASTOUNDED**

- |           |                  |
|-----------|------------------|
| A) Vying  | C) Enlighten     |
| B) Amazed | D) Collaborating |

**Q.3 ATTACHED TO**

- |            |               |
|------------|---------------|
| A) Distant | C) Vindictive |
| B) Devoted | D) pitiless   |

**Q.4 ALAS**

- |       |                |
|-------|----------------|
| A) Oh | C) Bravo       |
| B) Hi | D) Regrettably |

**Q.5 BOON**

- |                 |                |
|-----------------|----------------|
| A) Tribulation  | C) Benefit     |
| B) Disadvantage | D) Opportunity |

**Q.6 BEWILDERMENT**

- |                 |               |
|-----------------|---------------|
| A) Totalitarian | C) Clarity    |
| B) Democratic   | D) Puzzlement |

**Q.7 BAFFLING**

- |               |             |
|---------------|-------------|
| A) Apparent   | C) Unsolved |
| B) Dispersing | D) Teeming  |

**Q.8 BASHFUL**

- |                |                 |
|----------------|-----------------|
| A) Timid       | C) Bold         |
| B) Susceptible | D) Invulnerable |

**Q.9 BECKONED**

- |             |              |
|-------------|--------------|
| A) Repulse  | C) Surfeit   |
| B) Summoned | D) Dismissed |

**Q.10 CAPACIOUS**

- |             |            |
|-------------|------------|
| A) Ample    | C) Cramped |
| B) Stagnant | D) Dormant |

**Q.11 COLLIDED WITH**

- |           |              |
|-----------|--------------|
| A) Struck | C) Stop      |
| B) Rebuff | D) Harmonize |

**Q.12 CRUDELY**

- |                 |               |
|-----------------|---------------|
| A) Roughly      | C) Accurately |
| B) Sporadically | D) Regularly  |

**Q.13 CONFRONT**

- |            |            |
|------------|------------|
| A) Avoid   | C) Solace  |
| B) Provoke | D) Support |

**Q.14 COMPELLED**

- |           |               |
|-----------|---------------|
| A) Shrewd | C) Duty-Bound |
| B) Free   | D) Forced     |

**Q.15 CRUDELY**

- |                 |                 |
|-----------------|-----------------|
| A) Scrupulously | C) Accurately   |
| B) Carelessly   | D) Inaccurately |

**Q.16 COAXED**

- |              |                   |
|--------------|-------------------|
| A) Persuaded | C) Self-righteous |
| B) Forced    | D) Unpretentious  |

**Q.17 COMPREHENSION**

- |                     |                 |
|---------------------|-----------------|
| A) Misunderstanding | C) Refutation   |
| B) Grasp            | D) Confirmation |

**Q.18 DAINILY**

- |              |               |
|--------------|---------------|
| A) Clumsily  | C) Pleasantly |
| B) Peevishly | D) Elegantly  |

**Q.19 DISPENSING**

- |              |                |
|--------------|----------------|
| A) Penurious | C) Withholding |
| B) Provision | D) Well-off    |

**Q.20 DISPUTE**

- A) Agreement      C) Similarity  
B) Nuance      D) Argument

ANSWER KEY (SYNONYMS)				ANSWER KEY (ANTONYMS)			
1	A	11	A	1	C	11	C
2	B	12	A	2	C	12	C
3	B	13	B	3	A	13	A
4	D	14	D	4	C	14	B
5	C	15	D	5	B	15	C
6	D	16	A	6	C	16	B
7	C	17	B	7	A	17	A
8	A	18	D	8	C	18	A
9	B	19	B	9	D	19	C
10	A	20	D	10	C	20	A

**Worksheet-4**  
**PREPOSITION**

**DIRECTIONS:** Some segments of each sentence are underlined. Your task is to identify that underlined segment of the sentence which contains the mistake that needs to be corrected. Fill the circle corresponding to that letter under the segment in the MCQ Response form.

- Q.1 The package was lying by the front door-  
A B  
a cube-shaped carton sealed by tape.  
C D
- Q.2 Norma picked it down, unlocked the door  
A B  
and went into the apartment.  
C D
- Q.3 She turned the unit over and saw a folded  
A B  
piece of paper scotch-taped to the bottom  
C D  
of the box.
- Q.4 She turned unit over and saw a folded  
A B  
piece about paper scotch-taped to the  
C D  
bottom of the box.
- Q.5 She turned unit over and saw a folded  
A B  
piece of paper scotch-taped on the bottom  
C D  
of the box.
- Q.6 During Arthur had returned to his book,  
A B C  
Norma went back to the kitchen and  
D  
finished washing the dishes.
- Q.7 Norma slid below the covers. "Well, I  
A B  
think it's intriguing," she said.  
C D

- Q.8 Later lunch, she took the card halves from  
A B C  
her purse again and scotch-taped the  
D  
edges together.
- Q.9 After lunch, she took the card halves out  
A B C  
her purse again and scotch-taped the  
D  
edges together.
- Q.10 I am sick with all quarrelling among  
A B  
politician who should be concentrating on  
C D  
vial issues. button unit?"
- Q.11 The firm is working on a new product in  
A B C  
combination to several overseas partners.  
D
- Q.12 Scotland's onslaught over Wales in the  
A B  
second half of the match earned them a 4-1  
C D  
victory.
- Q.13 Some of the dialogue has been changed to  
A B  
make it more palatable for an American  
C D  
audience.
- Q.14 Since Mani refused to complete his  
A B  
assignments and failed to pay obeisance  
C  
for his boss, she was fired.  
D
- Q.15 In this society there is a taboo about any  
A B  
sort of public display of affection.  
C D

- Q.16 As a result of the gang leader's vendetta on police, on duty officers are required to ride in pairs.  
A B C D
- Q.17 She managed to hide her corrupt dealings under a veneer for respectability.  
A B C D
- Q.18 During his twelve years in Congress he has tussled in the chemical, drug and power companies on behalf of the ordinary person.  
A B C D
- Q.19 Only by identifying the real cause of the house fire can we exonerate you for the arson charge.  
A B C D
- Q.20 After the wind storm, many pieces of wood embedded themselves on the siding on my house.  
A B C D
- Q.21 Abruptly, she began to smash it over the sink edge, pounding it harder and harder, until the wood split.  
A B C D
- Q.22 "This is the way, Jess," said my father, pointing from his cane across the deep valley below us.  
A B C D

- Q.23 "I want to show you something you've not seen since many years!"  
A B C D
- Q.24 I wiped the streams of sweat from my face to keep them through stinging my eyes.  
A B C D
- Q.25 But my father walked home five miles across the mountain and told Mom what the doctor had said.  
A B C D
- Q.26 I wiped more sweat away my face as I followed him down the little path between the pasture and the meadow.  
A B C D
- Q.27 Suddenly he stopped at the edge of the meadow, took his pocket knife through his pocket, and cut a wisp of alfalfa.  
A B C D
- Q.28 Remember when we sat below these hickories and the squirrels threw green hickory shells down at us?  
A B C D
- Q.29 The pines onto top of the mountain above us looked as if the fingers of their long boughs were fondling the substance of a white cloud.  
A B C D



Q.30 He whiffed and whiffed the smell of this  
A B C  
wild dirt in his nostrils.  
D

Q.31 These were blessed breaks in routine, but  
A  
not, of course, comparable to the holidays  
B C  
we got on Christmas.  
D

Q.32 A row of neat hurdles was arranged on  
A  
the polished floor; like the ones on which  
B C  
Gorgios had won his race when at school.  
D

Q.33 She opened up for an instant but before I  
A B  
could see anything she came down again  
C  
and gripped the wooden blade among her  
D  
molars.

Q.34 Few people were about, and here and  
A  
there rang out the steps of solitary  
B  
travelers in the way home across the  
C D  
bridge to Battersea.

Q.35 I was very angry with myself in making  
A B C  
such a stupid mistake.  
D

Q.36 One evening at January a well-groomed  
A  
young man having walked up Davis Road  
B  
to the Mall turned to Charing Cross.  
C D

Q.37 It was a frequent picture in his mind, that  
A  
summer day with the sunlight filtering  
B

across the dust in Wetherby's study.  
C D

Q.38 In other words, in those days about seven  
A  
out of eight babies died before reaching at  
B C D  
their first birthday.

Q.39 She blurted out and immediately took out  
A B  
the key which hung in a thread through  
C D  
her neck.

Q.40 For eight years, he sought to find  
A B  
a means to aid the leucocytes in their fight  
C  
with invading bacteria.  
D

**ANSWER KEY (Worksheet-4)**

1	C	21	B
2	A	22	B
3	A	23	D
4	C	24	D
5	D	25	A
6	A	26	B
7	A	27	D
8	A	28	C
9	C	29	A
10	A	30	D
11	D	31	D
12	A	32	C
13	C	33	D
14	D	34	C
15	B	35	B
16	A	36	A
17	D	37	C
18	B	38	D
19	D	39	D
20	C	40	D

**ANSWERS EXPLAINED**

- Q.1 Correct Answer C: (with)  
 Q.2 Correct Answer A: (up)  
 Q.3 Correct Answer A: (over)  
 Q.4 Correct Answer C: (of)  
 Q.5 Correct Answer D: (to)  
 Q.6 Correct Answer A: (after)  
 Q.7 Correct Answer A: (beneath)  
 Q.8 Correct Answer A: (after)  
 Q.9 Correct Answer C: (from)  
 Q.10 Correct Answer A: (of)  
 Q.11 Correct Answer D: (with)  
 Q.12 Correct Answer A: (on)  
 Q.13 Correct Answer C: (to)

- Q.14 Correct Answer D: (to)  
 Q.15 Correct Answer B: (on/against)  
 Q.16 Correct Answer A: (against)  
 Q.17 Correct Answer D: (of)  
 Q.18 Correct Answer B: (with)  
 Q.19 Correct Answer D: (from)  
 Q.20 Correct Answer C: (in)  
 Q.21 Correct Answer B: (on)  
 Q.22 Correct Answer B: (with)  
 Q.23 Correct Answer D: (across)  
 Q.24 Correct Answer D: (below)  
 Q.25 Correct Answer A: (for)  
 Q.26 Correct Answer B: (through)  
 Q.27 Correct Answer D: (from)  
 Q.28 Correct Answer C: (from)  
 Q.29 Correct Answer A: (beneath)  
 Q.30 Correct Answer D: (on)  
 Q.31 Correct Answer D: (at)  
 Q.32 Correct Answer C: (over)  
 Q.33 Correct Answer D: (between)  
 Q.34 Correct Answer C: (on the way)  
 Q.35 Correct Answer B: (for)  
 Q.36 Correct Answer A: (in)  
 Q.37 Correct Answer C: (through)  
 Q.38 Correct Answer D: (reaching at)  
 Q.39 Correct Answer D: (around)  
 Q.40 Correct Answer D: (against)

**Worksheet-5**

**VOCABULARY LIST (41-80)**

**DIRECTIONS:** Select the most suitable synonym for the given words:

**Q.1 DISTRACT**

- |           |               |
|-----------|---------------|
| A) Divert | C) Lose       |
| B) Reap   | D) Straighten |

**Q.2 DILAPIDATED**

- |            |             |
|------------|-------------|
| A) Raucous | C) Pristine |
| B) Subdued | D) Rundown  |

**Q.3 DISCONSOLATELY**

- |                |              |
|----------------|--------------|
| A) Contentedly | C) Unhappily |
| B) Resentment  | D) Support   |

**Q.4 DELICATELY**

- |              |              |
|--------------|--------------|
| A) Precisely | C) Clumsily  |
| B) Rampant   | D) Contained |

**Q.5 DILAPIDATED**

- |                |             |
|----------------|-------------|
| A) Punctilious | C) Decrepit |
| B) Pristine    | D) Sloppy   |

**Q.6 DISGUISE**

- |                |            |
|----------------|------------|
| A) Costume     | C) Reveal  |
| B) Proliferate | D) Dwindle |

**Q.7 ENCOURAGED**

- |               |                  |
|---------------|------------------|
| A) Precarious | C) Drained       |
| B) Nontoxic   | D) Reinvigorated |

**Q.8 ECCENTRIC**

- |                   |                 |
|-------------------|-----------------|
| A) Repugnant      | C) Conventional |
| B) Unconventional | D) Obscene      |

**Q.9 ELABORATE**

- |             |             |
|-------------|-------------|
| A) Renounce | C) Ornate   |
| B) Simplify | D) Abdicate |

**Q.10 FLAWLESSLY**

- |              |                |
|--------------|----------------|
| A) Penurious | C) Generous    |
| B) Perfectly | D) Imperfectly |

**Q.11 FRICTION**

- |             |               |
|-------------|---------------|
| A) Rubbing  | C) Smoothness |
| B) Paradigm | D) Antithesis |

**Q.12 GINGERLY**

- |               |               |
|---------------|---------------|
| A) Carefully  | C) Boldly     |
| B) Ostensibly | D) Accurately |

**Q.13 GLISTENING**

- |            |            |
|------------|------------|
| A) Dull    | C) Noxious |
| B) Shining | D) Anodyne |

**Q.14 HAGGARD**

- |             |             |
|-------------|-------------|
| A) Fatigued | C) Unbroken |
| B) Motley   | D) Fresh    |

**Q.15 HAPHAZARDLY**

- |                   |               |
|-------------------|---------------|
| A) Chaotically    | C) Stingily   |
| B) Systematically | D) Charitably |

**Q.16 HARMONY**

- |                |            |
|----------------|------------|
| A) Melancholy  | C) Accord  |
| B) Discordance | D) Discord |

**Q.17 HAVOC**

- |                |             |
|----------------|-------------|
| A) Chaos       | C) Order    |
| B) Magnanimity | D) Altruism |

**Q.18 HEARSAY**

- |           |              |
|-----------|--------------|
| A) Fact   | C) Rigidity  |
| B) Gossip | D) Stiffness |

**Q.19 INTENDED**

- |               |               |
|---------------|---------------|
| A) Accidental | C) Peripheral |
| B) Future     | D) Central    |

**Q.20 ILLUMINATION**

- A) Lighting                      C) Nimbleness  
B) Listlessness                D) Confusion

ANSWER KEY (SYNONYMS)				ANSWER KEY (ANTONYMS)			
1	A	11	A	1	D	11	C
2	D	12	A	2	C	12	C
3	C	13	B	3	A	13	A
4	A	14	A	4	C	14	D
5	C	15	A	5	B	15	B
6	A	16	C	6	C	16	D
7	D	17	A	7	C	17	C
8	B	18	B	8	C	18	A
9	C	19	B	9	B	19	A
10	B	20	A	10	D	20	D

**Worksheet-6**

**PREPOSITION**

**DIRECTIONS:** In each of the following questions, four alternative sentences are given. Choose the **CORRECT** one and fill the Circle corresponding to that letter in the MCQ Response Form.

- Q.1** A) The pollution in the city had a bad effect about me.  
B) The pollution in the city had a bad effect for me.  
C) The pollution in the city had a bad effect in me.  
D) The pollution in the city had a bad effect on me.
- Q.2** A) She wheedled me to lending her my new coat.  
B) She wheedled me in lending her my new coat.  
C) She wheedled me out lending her my new coat.  
D) She wheedled me into lending her my new coat.
- Q.3** A) Norma tried to lift it off, but it is locked to place.  
B) Norma tried to lift it off, but they were locked to place.  
C) Norma tried to lift it off, but it was locked in place.  
D) Norma tried to lift it off, but it was locked for place.
- Q.4** A) Norma had put the button unit besides her on the couch.  
B) Norma put an button unit besides her on the couch.  
C) Norma put the button unit besides hers on the couch.  
D) Norma put the button unit beside her on the couch.
- Q.5** A) They go in the living room and Mr. Steward sat in Norma's chair.  
B) They went into the living room and Mr. Steward sat in Norma's chair.

- C) They went in the living room and Mr. Steward sit in Norma's chair.  
D) They went into the living room but Mr. Steward sat in Normas' chair.
- Q.6** A) The children, small seeds, might on any instant be sown to all the Martian climes.  
B) The children, small seeds, might about any instant be sown to all the Martian climes.  
C) The children, small seeds, might at any instant be sown to all the Martian climes.  
D) The children, small seeds, might for any instant be sown to all the Martian climes.
- Q.7** A) In the morning, as she left the apartment, Norma saw the card halves on the table.  
B) At the morning, as she left the apartment, Norma saw the card halves on the table.  
C) At a morning, as well she left the apartment, Norma saw the card halves on the table.  
D) On the morning, as she left the apartment, Norma saw the card halves on the table.
- Q.8** A) Norma remain at the table, staring for her coffee.  
B) Norma remained at the table, staring of her coffee.  
C) Norma remaining at the table, staring on her coffee.  
D) Norma remained at the table, staring into her coffee.
- Q.9** A) When he had gone, Arthur tore it in half and tossed the pieces in the table.  
B) When he was gone, Arthur tore it in half and tossed the pieces into the table.  
C) When he was gone, Arthur tore it in half and tossed the pieces onto the table.  
D) While he was gone, Arthur tore it in half and tossed the pieces into the table.

- Q.10** A) They both looked at each other, startled by all they had just finished saying.  
B) They both looked through each other, startled by all they had just finished saying.  
C) They both looked from each other, startled by all they had just finished saying.  
D) They both looked about each other, startled by all they had just finished saying.
- Q.11** A) He was avid in more information.  
B) He was avid for more information.  
C) He was avid about more information.  
D) He was avid to more information.
- Q.12** A) He chastised the team from their lack of commitment.  
B) He chastised the team to their lack of commitment.  
C) He chastised the team of their lack of commitment.  
D) He chastised the team for their lack of commitment.
- Q.13** A) She commiserated with the losers on their defeat.  
B) She commiserated for the losers on their defeat.  
C) She commiserated to the losers on their defeat.  
D) She commiserated with the losers in their defeat.
- Q.14** A) As more snow fell, the bottom layer was compressed to ice.  
B) As more snow fell, the bottom layer was compressed in ice.  
C) As more snow fell, the bottom layer was compressed into ice.  
D) As more snow fell, the bottom layer was compressed for ice.

- Q.15** A) The bruising was not contiguous for the wound.  
B) The bruising was not contiguous to the wound.  
C) The bruising were not contiguous with the wound.  
D) The bruising was not contiguous of the wound.
- Q.16** A) The committee is reportedly unhappy about the discrepancy on numbers.  
B) The committee is reportedly unhappy about the discrepancy about numbers.  
C) The committee is reportedly unhappy about the discrepancy in numbers.  
D) The committee is reportedly unhappy about the discrepancy for numbers.
- Q.17** A) Her tears elicited great sympathy from her audience.  
B) Her tears elicited great sympathy for her audience.  
C) Her tears elicited great sympathy over her audience.  
D) Her tears elicited great sympathy in her audience.
- Q.18** A) The convention called for a two-year moratorium over commercial whaling.  
B) The convention called for a two-year moratorium in commercial whaling.  
C) The convention called for a two-year moratorium on commercial whaling.  
D) The convention called for a two-year moratorium for commercial whaling.
- Q.19** A) Inside the cartoon were a push-button unit fastened to a small wooden box.  
B) Inside the carton was a push-button unit fastened to a small wooden box.  
C) Insides the cartoon was a push-button unit fastened to a small wooden box.  
D) Insides the carton were a push-button unit fastening to a small wooden box.
- Q.20** A) The package was lying by the front door.  
B) The package was laying to the front door.  
C) The package was laid to the front door.  
D) The package was lying to a front door.



- Q.21** A) After the meal had concluded the Chief of the police appeared on the scene.  
B) After the meal had concluded the Chief of the police appeared over the scene.  
C) After the meal has concluded the Chief of the police appeared above the scene.  
D) While the meal had concluded the Chief of the police appeared above the scene.
- Q.22** A) He consumed his heart above this and wasted away before the very eyes of the people.  
B) He consumed his heart over this and wasted away before the very eyes of the people.  
C) He consumed his heart above this and waste away before the very eyes of the people.  
D) He consumed his heart above this and wasted away before the very eyes of the peoples.
- Q.23** A) The child was fully dressed and sitting through her father's lap near the kitchen table.  
B) The child was fully dressed and sitting across her father's lap near the kitchen table.  
C) The child was fully dressed and sitting in her father's lap near the kitchen table.  
D) The child was fully dressed and sitting through her father's lap near the kitchen table.
- Q.24** A) So we thought you'd better look her in and tell us what the matter is.  
B) So we thought you'd better look her out and tell us what the matter is.  
C) So we thought you'd better look her into and tell us what the matter is.

- D) So we thought you'd better look her over and tell us what the matter is.
- Q.25** A) Will you open it now through yourself or shall we have to open it for you?  
B) Will you open it now by yourself or shall we have to open it for you?  
C) Will you open it now from yourself or shall we have to open it for you?  
D) Will you open it now among yourself or shall we have to open it for you?
- Q.26** A) After sometime the boat was hit by a storm and started tossing.  
B) About sometime the boat was hit by a storm and started tossing.  
C) Out of sometime the boat was hit by a storm and started tossing.  
D) Away sometime the boat was hit by a storm and started tossing.
- Q.27** A) After sometime the boat were hit with a storm and started tossing.  
B) Ago sometimes the boat was hit with a storm and started tossing.  
C) After sometime the boat was hit through a storm and started tossing.  
D) After sometime the boat was hit by a storm and started tossing.
- Q.28** A) A man does not realize the worth of safety about the misfortune until he has tasted it.  
B) A man does not realize the worth of safety since the misfortune until he has tasted it.  
C) A man does not realize the worth of safety from the misfortune until he has tasted it.

- D) A man does not realize the worth of safety for the misfortune until he has tasted it.
- Q.29** A) Orders were issued to search for an individual of this kind.
- B) Orders were issued to search through an individual of this kind.
- C) Orders were issued to search among an individual of this kind.
- D) Orders were issued to search from a individual of this kind.
- Q.30** A) A son of a farmer was discovered to possess the qualities mentioned through the doctors.
- B) A son of a farmer was discovered to possess the qualities mentioned by the doctors.
- C) A son of a farmer was discovered to possess the qualities mentioned from the doctors.
- D) A son of a farmer was discovered to possess the qualities mentioned to the doctors.
- Q.31** A) Chips saw them off at the railway station at the evening.
- B) Chips saw them to on the railway station in the evening.
- C) Chips saw them of at the railway station in the evening.
- D) Chips saw them off at the railway station in the evening.
- Q.32** A) You can't really extrapolate a trend for such a small sample.
- B) You can't really extrapolate a trend by such a small sample.

- C) You can't really extrapolate a trend from such a small sample.
- D) You can't really extrapolate a trend in such a small sample.
- Q.33** A) He lived at the style befitting a gentleman.
- B) He lived through the style befitting a gentleman.
- C) He lived by the style befitting a gentleman.
- D) He lived in the style befitting a gentleman.
- Q.34** A) He never allowed his work to impinge for his private life.
- B) He never allowed his work to impinge on his private life.
- C) He never allowed his work impinge up his private life.
- D) He never allowed his work to impinge about his private life.
- Q.35** A) The horse reared off on its hind legs.
- B) The horse reared of on its hind legs.
- C) The horse reared up on its hind legs.
- D) The horse reared down on its hind legs.
- Q.36** A) Heat the olive oil into a heavy pan.
- B) Heat the olive oil in a heavy pan.
- C) Heat the olive oil with a heavy pan.
- D) Heat the olive oil on a heavy pan.
- Q.37** A) She breaks off and glances at the door again.
- B) She breaks of and glances at the door again.

- C) She breaks away and glances at the door again.
- D) She breaks out and glances on the door again.
- Q.38** A) Chips had put to Brookfield after a year in Melbury.
- B) Chips had put in for Brookfield behind a year at Melbury.
- C) Chips had put in for Brookfield after a year at Melbury.
- D) Chips had put after Brookfield after a year at Melbury.
- Q.39** A) That's a very smart uniform but I prefer the ones made of metal, the ones you used to wear.
- B) That's a very smart uniform but I prefer the ones made from metal, the ones you used to wear.
- C) That's a very smart uniform but I prefer the ones made up metal, the ones you used to wear.
- D) That's a very smart uniform but I prefer the ones made to metal, the ones you used to wear.
- Q.40** A) He stroked it and it leapt up onto the bench.
- B) He stroked it and it leapt up to the bench.
- C) He stroked it and it leapt upto onto the bench.
- D) He stroked it and it leapt upon onto the bench.

ANSWER KEY (Worksheet-6)			
1	D	21	A
2	D	22	B
3	C	23	C
4	D	24	D
5	B	25	B
6	C	26	A
7	A	27	D
8	D	28	C
9	C	29	A
10	A	30	B
11	B	31	D
12	D	32	C
13	A	33	D
14	C	34	B
15	B	35	C
16	C	36	B
17	A	37	A
18	C	38	C
19	B	39	A
20	A	40	A

**ANSWERS EXPLAINED**

**Q.1 Correct Answer D:**

**Effect (on somebody/something) :** a change that somebody/something causes in somebody/something else; a result.

**Q.2 Correct Answer D:**

**Wheedle somebody into doing something:** to persuade somebody to give you something or do something by saying nice things that you do not mean.

**Q.3 Correct Answer C:**

Locked in place

**Q.4 Correct Answer D:**

Beside her

**Q.5 Correct Answer B:**

Went into \_\_\_ sat

**Q.6 Correct Answer C:**

At any instant

**Q.7 Correct Answer A:**

In the morning

**Q.8 Correct Answer D:**

Remained \_\_\_ staring into

**Q.9 Correct Answer C:**

Was gone, onto

**Q.10 Correct Answer A:**

Looked at each other

**Q.11 Correct Answer B:**

**Avid for something :** wanting to get something very much.

**Q.12 Correct Answer D:**

**Chastise somebody (for something/for doing something)** to criticize somebody for doing something wrong.

**Q.13 Correct Answer A:**

**Commiserate (with somebody) (on/about/for/over something) | + speech** to show somebody sympathy when they are upset or disappointed about something.

**Q.14 Correct Answer C:**

**Compress something (into something):** to press or squeeze something together or into a smaller space; to be pressed or squeezed in this way.

**Q.15 Correct Answer B:**

**Contiguous with/to something :** touching or next to something.

**Q.16 Correct Answer C:**

**Discrepancy (in something):** a difference between two or more things that should be the same.

**Q.17 Correct Answer A:**

**Elicit something (from somebody) :** to get information or a reaction from somebody, often with difficulty.

**Q.18 Correct Answer C:**

**Moratorium (on something) :** a temporary stopping of an activity, especially by official agreement.

**Q.19 Correct Answer B:**

Was a push button unit \_\_\_\_ fastened to

**Q.20 Correct Answer A:**

Lying by

**Q.21 Correct Answer A:**

On the scene.

**Q.22 Correct Answer B:**

Over this.

**Q.23 Correct Answer C:**

In her father's lap.

**Q.24 Correct Answer D:**

Look her over.

**Q.25 Correct Answer B:**

By yourself.

**Q.26 Correct Answer A:**

After some time.

**Q.27 Correct Answer D:**

Was hit by a storm.

**Q.28 Correct Answer C:**

From the misfortune.

**Q.29 Correct Answer A:**

Search for an individual.

**Q.30 Correct Answer B:**

Mentioned by the doctors.

**Q.31 Correct Answer D:**

**See somebody off:** to go to a station, an airport, etc. to say goodbye to somebody who is starting a journey.

**Q.32 Correct Answer C:**

**Extrapolate (from/to something):** to estimate something or form an opinion about something, using the facts that you have now and that are valid for one situation and supposing that they will be valid for the new one.

**Q.33 Correct Answer D:**

**In the style:** a particular kind, sort, or type, as with reference to form, appearance, or character.

**Q.34 Correct Answer B:**

**Impinge (on/upon something/somebody) :** to have a noticeable effect on something/somebody, especially a bad one.

**Q.35 Correct Answer C:**

Rear up: To rise on the hind legs, as of a horse.

**Q.36 Correct Answer B:**

In a pan.

**Q.37 Correct Answer A:**

**Breaks off :** Stop abruptly,

**Q.38 Correct Answer C:**

**At**

Used to indicate a place:

- There were hundreds of people at the park.
- We saw a baseball game at the stadium.

**Q.39 Correct Answer A:**

**Made from**

We often use made from when we talk about how something is manufactured:

Plastic is **made from** oil.

**Made of**

We use made of when we talk about the basic material or qualities of something. It has a meaning similar to 'composed of':

She wore a beautiful necklace **made of** silver.

**Q.40** **Correct Answer A:**  
**Leap up: to jump upwards.**

STEP ENTRY TEST 2020



**Worksheet-7****VOCABULARY LIST (81-120)**

**DIRECTIONS:** Select the most suitable synonym for the given words:

**Q.1 INVARIABLY**

- A) Erratically C) Indolent  
B) Always D) Energetic

**Q.2 INSINUATED**

- A) Declared C) Exonerated  
B) Incriminated D) Suggested

**Q.3 INTENTLY**

- A) Imperiously C) Closely  
B) Abstractedly D) Feebly

**Q.4 INDUSTRY**

- A) Business C) Hasten  
B) Sloth D) Idiosyncratic

**Q.5 IMPERCEPTIBLY**

- A) Obviously C) Furtively  
B) Gradually D) Openly

**Q.6 JUDICIAL**

- A) Legal C) Stupid  
B) Fortuitous D) Planned

**Q.7 JUVENILE**

- A) Youthful C) Mature  
B) Foolhardy D) Impulsive

**Q.8 JUBILANT**

- A) Disappointed C) Thrilled  
B) Jaded D) Exhausted

**Q.9 KINDRED**

- A) Intrepid C) Dissimilar  
B) Associated D) Cowardly

**Q.10 LUDICROUS**

- A) Mythical C) Absurd  
B) Sensible D) Correct

**Q.11 LIMP**

- A) Floppy C) Profound  
B) Facile D) Stiff

**Q.12 MENACED**

- A) Reassured C) Endangered  
B) Extricated D) Engaged

**Q.13 MEAN**

- A) Kind C) Exhibitionistic  
B) Nasty D) Expedient

**Q.14 MINIMUM**

- A) Maximum C) Smallest  
B) Exacting D) Onerous

**Q.15 MUMBLED**

- A) Epitomize C) Exemplified  
B) Muttered D) Clear

**Q.16 MENACING**

- A) Encroaching C) Alarming  
B) Reassuring D) Respecting

**Q.17 NAÏVE**

- A) Immature C) Sophisticated  
B) Flummox D) Obvious

**Q.18 NATIVE**

- A) Flagrant C) Natural  
B) Learnt D) Brazen

**Q.19 NAUSEOUS**

- A) Nauseated C) Easygoing  
B) Fastidious D) Well

**Q.20 NEGATE**

- A) Embroil                      C) Refute  
B) Affirm                      D) Catch

ANSWER KEY (SYNONYMS)				ANSWER KEY (ANTONYMS)			
1	B	11	A	1	A	11	D
2	D	12	C	2	A	12	A
3	C	13	B	3	B	13	A
4	A	14	C	4	B	14	A
5	B	15	B	5	A	15	D
6	A	16	C	6	C	16	B
7	A	17	A	7	C	17	C
8	C	18	C	8	A	18	B
9	B	19	A	9	C	19	D
10	C	20	C	10	B	20	B

## Worksheet-8

**CAUSATIVE, SUBJUNCTIVE, INFINITIVE,  
BARE INFINITIVE, INFINITIVE VS GERUND,  
INVERSION CONJUGATION OF VERB  
(TRANSITIVE VS INTRANSITIVE,  
WEAK VS STRONG)**

**DIRECTIONS:** Some segments of each sentence are underlined. Your task is to identify that underlined segment of the sentence which contains the mistake that needs to be corrected. Fill the circle corresponding to that letter under the segment in the MCQ Response form.

- Q.1 Instead of buying a new bicycle, why  
A B  
don't you have your old one fix?  
C D
- Q.2 He really wanted a dog, but his parents  
A B  
wouldn't let him has a pet.  
C D
- Q.3 She made me to take off my shoes before  
A B  
I went into her house. She said she  
C  
wanted to keep the carpet clean.  
D
- Q.4 It's important that she remembers to take  
A B C  
her medicine twice a day.  
D
- Q.5 Mrs. Rashid demanded that the heater  
A B  
should be repaired immediately.  
C D
- Q.6 The nutritionist recommended that Ruby  
A B  
reduces her daily fat intake.  
C D

- Q.7 I think to defend yourself is the right  
A B C  
thing to do if you have a good reason.  
D
- Q.8 The high amount of carbohydrates in fast  
A  
food and sugary drinks is blamed for  
B C  
destabilize the body's regulation of appetite.  
D
- Q.9 No sooner had the meeting started, then  
A B C  
fighting broke out in the audience.  
D
- Q.10 No for one moment did Henry suspect his  
A B C  
brother of complicity in the crime.  
D
- Q.11 He told them how the glory of their  
A B  
country and of its ancient throne  
C  
would have been increased if the post of  
D  
court acrobat were created.
- Q.12 So we thought you had better to look her  
A  
over and tell us what the matter is.  
B C D
- Q.13 The students requested that the instructor  
postpones the test, but he decided against  
A B C  
the postponement.  
D

Q.14 To say the truth," I went on, as if I had  
A B  
been prompted to lie about it, "I am not a  
C D

detective at all.

Q.15 You plan to have Wozzeck pretends he  
A B  
has found a pearl in the oyster  
C  
when he opens it.  
D

Q.16 Everyone was certain that the East End  
A  
lads would be hooligans, or else that they  
B  
would be made to feel uncomfortably.  
C D

Q.17 If my father hadn't an important meeting  
A B  
at the office, he would have been at home  
C D  
last night.

Q.18 He went off the day after I had gotten my  
A B C  
last haircut about a month ago.  
D

Q.19 The government has announced plans  
A  
creating one million new training places.  
B C D

Q.20 When I would have willingly displayed  
A  
my knowledge, they sought to expose my  
B C D  
ignorance.

**DIRECTIONS:** In each of the following questions, four alternative sentences are given. Choose the CORRECT one and fill the Circle corresponding to that letter in the MCQ Response Form.

Q.21 A) I suggests you put on sunblock immediately before you get a sunburn.

B) I suggested you put on sunblock immediate before you get a sunburn.

C) I suggest you put on sunblock immediately before you get a sunburn.

D) I suggest you should put on sunblock immediately before you get a sunburn.

Q.22 A) I cant imagine jumping out of a flying jet.

B) I can't imagine jumping out of a flying jet.

C) I can't imagines jumping out of a flying jet.

D) I can't imagine to jump out of a flying jet.

Q.23 A) To go on a cruise and climbing Mt. Rushmore were Rachel's summer vacation plans.

B) Going on a cruise and climbing Mt. Rushmore was Rachel's summer vacation plans.

C) Going on a cruise and climbing Mt. Rushmore were Rachel's summer vacation plans.

D) Gone on a cruise and climbing Mt. Rushmore were Rachel's summer vacation plans.

Q.24 A) Why does you pretend eating my hamburger?

B) Why did you pretended eating my hamburger?

C) Why did you pretend eating my hamburger?

D) Why did you pretend to eat my hamburger?

- Q.25** A) The doctor advised to me to exercise regularly.  
B) The doctor advised me to take exercise regularly.  
C) The doctor advise me to exercise regularly.  
D) The doctor advised me to doing exercise regular.
- Q.26** A) The massage felt relaxed, so I booked another session with the same masseur.  
B) The massage feeling relaxing, so I booked another session with a same masseur.  
C) The massage felt relaxing, so I booked another session with the same masseur.  
D) I felt relaxing, so I booked another session with the same masseur.
- Q.27** A) The Director will ever gived in to public pressure.  
B) Never will the director given up in to public pressure.  
C) The Director will never give in to public pressure.  
D) The Director will never gives in to public pressure.
- Q.28** A) Only then he was certain of his results, did he announce his discovery to the world.  
B) Only when he was certainly of his results, did he announce his discovery to the world.

- C) Only when he was certain of his results, did he announce his discovery to the world.  
D) Only when he was certain of his results, he did announce his discovery to the world.
- Q.29** A) Would you require any furthers information, don't hesitate to contact me.  
B) Should you require any further information, don't hesitate to contact me.  
C) Should your require any further informations, don't hesitate to contact me.  
D) Should you require some further informations, don't hesitate to contact me.
- Q.30** A) Were the government to raze interest rates, they would lose the election.  
B) Were the government to raise interest rates, them would loose the election.  
C) Were the government to rise interest rates, they would lose the election.  
D) Were the government to raise interest rates, they would lose the election.
- Q.31** A) We might have buy a larger house if we had more money.  
B) We might buy a larger house if we had had more money.  
C) We might buy larger house if we had more money.

- D) We might buy a larger house if we had more money.
- Q.32** A) He looked as if he was fourteen or fifteen, frail and willow-wild, in tennis shoes and blue jean.
- B) He looked as if he were fourteen or fifteen, frail and willow-wild, in tennis shoes and blue jeans.
- C) He looked as if he were the fourteen or the fifteen, frail and willow-wild, in tennis shoes and blue jeans.
- D) He looked as if he were fourteen or fifteen, frail and willow-wild, on tennis shoes and blue jeans.
- Q.33** A) I can't help noticing that you are not wearing your's wedding ring.
- B) I can't help notice that you are not wearing your wedding ring.
- C) I can't help but noticing that you are not wearing your wedding ring.
- D) I can't help but notice that you are not wearing your wedding ring.
- Q.34** A) Inflation in the United States has not and, we hope, never will reach a rate of 20 percent a year.
- B) Inflation on United States has not reached and, we hope, never will reach a rate of 20 percent a year.
- C) Inflation in the United States has not reached and, we hope, never will a rate of 20 percent a year.
- D) Inflation in the United States has not reached and, we hope, never will reach a rate of 20 percent a year.
- Q.35** A) I am afraid I'll never used to living in this place because I simple don't like it and never will.
- B) I am afraid I'll never used to living in this place because I simply don't like it and never will.

- C) I am afraid I'll never get used to live in this place because I simply don't like it and never will.
- D) I am afraid I'll never get used to living in this place because I simply don't like it and never will.
- Q.36** A) If the food tastes good, children eat it.
- B) If the food tastes well, children will eat it.
- C) If the food tastes good, children will eat it.
- D) If the foods tastes good, children will eat it.
- Q.37** A) I wish I'll take a closer look to that ship when I had the chance.
- B) I wish I'd taken a closer look at that ship when I had had the chance.
- C) I wish I'd taken a closer look at that ship when I had the chance.
- D) I wish I'd taken a closer look after that ship when I have had the chance.
- Q.38** A) I'd rather he opens this oyster.
- B) I'd rather he opened these oyster.
- C) I'd rather he opened this oyster.
- D) I'd rather he open this oyster.
- Q.39** A) He have decided to grow a beard and a moustache.
- B) He has decided to grow a beard and a moustache.
- C) He has been decided to growing a beard and a moustache.
- D) He have been decided to growing a beard and a moustache.



- Q.40** A) Instead of buying a new car, why don't you have your old one fixed
- B) Instead of buying a new car, why don't you have your old one fix.
- C) Instead of buying a new car, why don't you have your old one to fix.
- D) Instead buying a new car, why don't you have your old one fixed.

STEP ENTRY TEST 2020

ANSWER KEY (Worksheet-8)			
1	D	21	C
2	D	22	B
3	A	23	C
4	B	24	D
5	C	25	B
6	C	26	C
7	B	27	C
8	D	28	C
9	C	29	B
10	A	30	D
11	D	31	D
12	A	32	B
13	A	33	D
14	A	34	D
15	B	35	D
16	D	36	C
17	A	37	C
18	C	38	C
19	B	39	B
20	C	40	A

### ANSWERS EXPLAINED

- Q.1 Correct Answer D: (fixed)  
 Q.2 Correct Answer D: (have)  
 Q.3 Correct Answer A: (take off)  
 Q.4 Correct Answer B: (remembered)  
 Q.5 Correct Answer C: (be)  
 Q.6 Correct Answer C: (reduce)  
 Q.7 Correct Answer B: (defending)  
 Q.8 Correct Answer D: (destabilizing)  
 Q.9 Correct Answer C: (than)  
 Q.10 Correct Answer A: (not)  
 Q.11 Correct Answer D: (would be)  
 Q.12 Correct Answer A: (look)  
 Q.13 Correct Answer A: (postpone)

- Q.14 Correct Answer A: (tell)  
 Q.15 Correct Answer B: (pretend)  
 Q.16 Correct Answer D: (uncomfortable)  
 Q.17 Correct Answer A: (hadn't had)  
 Q.18 Correct Answer C: (got)  
 Q.19 Correct Answer B: (to create)  
 Q.20 Correct Answer C: (sought)  
 Q.21 Correct Answer C: "Should" is not to be used after "suggest". Moreover, immediately is required here as an adverb.  
 Q.22 Correct Answer B: "Can't", without an apostrophe is wrong. Moreover "imagine" will take "gerund" and not infinitive.  
 Q.23 Correct Answer C: "Going" and "Climbing" should be parallel structure. Moreover, there should be plural verb in the sentence.  
 Q.24 Correct Answer D: "Did" will take first form of verb. Moreover pretend will take an infinitive.  
 Q.25 Correct Answer B: The correct collocations is "to take exercise". The adverb "regularly" should be used.  
 Q.26 Correct Answer C: Relaxing is correct instead of relaxed. "The same" is correct instead of "a same".  
 Q.27 Correct Answer C: Give up is contextually correct.  
 Q.28 Correct Answer C: "When" is correct instead of "then". Certain is correct instead of certainly. Moreover, after only when, inversion is required.  
 Q.29 Correct Answer B: "Further" is the correct expression instead of furthers. "Should" is correct as compared to

"would". Moreover information is never pluralized.

**Q.30 Correct Answer D:** "Raise" is correct instead of raze or rise. They is correct use of pronoun here.

**Q.31 Correct Answer D: if + Simple Past, + would + base verb**

In conditional type 2, in the if clause "were" instead of "was" "is" usually used, even if the pronoun is I, he, she or it. "were" here is a subjunctive form.

**Q.32 Correct Answer B:** WHERE is instead of WAS because the sentence is in the SUBJUNCTIVE mood which is used for hypothetical situations. This is a condition which is contrary to fact or reality.

**In the subjunctive mood we use IF + I / HE / SHE / IT + WERE for the verb To Be.**

- If I were not in debt, I would quit my job. (But the contrary is true, I AM in debt, so I cannot quit my job)
- If he were taller, he'd be accepted into the team.
- She would be still be correcting my grammar if she were still alive.

**Q.33 Correct Answer D:** can't help + verb + ing  
can't help but + verb base form

**Q.34 Correct Answer D:** Has reached and never will reach.

**Q.35 Correct Answer D:** Be /Get Used To + -ing Verb / Noun

Used To + base Verb

**Q.36 Correct Answer C: Conditional Sentence Type 1**

Often called the "real" conditional because it is used for real or possible situations. These situations take place if a certain condition is met. It is possible and also very likely that the condition will be fulfilled.

**If + Simple Present, + Simple Future**

Conditional Sentences Type 1 refer to the future. An action in the future will only happen if a certain condition is fulfilled by that time. We don't know for sure whether the condition actually will be fulfilled or not, but the conditions seems rather realistic – so we think it is likely to happen.

**Q.37 Correct Answer C:** We use past tense forms to talk about wishes:

We use past tense modals *would* and *could* to talk about wishes for the future:

I don't like my work. I wish I would get a better job.

We use past tense forms to talk about wishes for the present:

I wish it wasn't so cold.

We use the past perfect to talk about wishes for the past:

I wish I had worked harder when I was at school.

**Q.38 Correct Answer C:** Would rather or 'd rather is used to talk about preferring one thing to another.

Would rather has two different constructions.

**same subject (+ base form)**

**different subject (+ past simple clause)**

**Q.39 Correct Answer B:** Some verbs are followed by the to-infinitive:

**decide to grow**

**Q.40 Correct Answer A: CAUSATIVE VERBS HAVE:** give someone else the responsibility to do something

- HAVE + PERSON + VERB (base form)
- HAVE + THING + PAST PARTICIPLE OF VERB

**Worksheet-9****VOCABULARY LIST (121-160)**

**DIRECTIONS:** Select the most suitable synonym for the given words:

**Q.1 NEUTRAL**

- A) Biased C) Unbiased  
B) Effervesce D) Elusive

**Q.2 OCCASIONALLY**

- A) Amenably C) Frequently  
B) Dogmatically D) Rarely

**Q.3 OPERATION**

- A) Cooperation C) Effusion  
B) Inaction D) Process

**Q.4 PURCHASE**

- A) Disillusionment C) Sale  
B) Acquisition D) Research

**Q.5 PENSIVELY**

- A) Diffusely C) Unthinkingly  
B) Musingly D) Concisely

**Q.6 PRIME**

- A) Inferior C) Deleterious  
B) Beneficial D) Major

**Q.7 PLACIDLY**

- A) Calmly C) Dauntlessly  
B) Blameworthy D) Harshly

**Q.8 PEERED**

- A) Dearth C) Looked  
B) Glanced D) Glut

**Q.9 PASSION**

- A) Corroboration C) Indifference  
B) Desire D) Sense

**Q.10 PROMPTLY**

- A) Late C) Prompt  
B) Copiously D) Liberally

**Q.11 PRECISION**

- A) Accuracy C) Confluence  
B) Vagueness D) Divergence

**Q.12 PIZZAZZ**

- A) Dullness C) Bread  
B) Conflagration D) Style

**Q.13 POTENTIAL**

- A) Unlikely C) Possible  
B) Compendious D) Succinct

**Q.14 PRECAUTIONS**

- A) Injury C) Significances  
B) Protections D) Corollaries

**Q.15 QUALM**

- A) Concurrence C) Misgiving  
B) Conflict D) Hunch

**Q.16 QUANTITATIVE**

- A) Coalesce C) Unquantifiable  
B) Measureable D) Amalgamating

**Q.17 QUARREL**

- A) Agreement C) Squabble  
B) Charlatan D) Clandestine

**Q.18 QUENCH**

- A) Cajole C) Stimulate  
B) Compel D) Slake

**Q.19 QUERY**

- A) Inquiry C) Bipartisanship  
B) Answer D) Boorishness

Q.20 QUIVER

- A) Palpation                      C) Quiet  
B) Facsimile                      D) Tremor

ANSWER KEY (SYNONYMS)				ANSWER KEY (ANTONYMS)			
1	C	11	A	1	A	11	B
2	D	12	D	2	C	12	A
3	D	13	C	3	B	13	A
4	B	14	B	4	C	14	A
5	B	15	C	5	C	15	D
6	D	16	B	6	A	16	C
7	A	17	C	7	D	17	A
8	C	18	D	8	B	18	C
9	B	19	A	9	C	19	B
10	C	20	D	10	A	20	C



Worksheet-10

TENSES

**DIRECTIONS:** Some segments of each sentence are underlined. Your task is to identify that underlined segment of the sentence which contains the mistake that needs to be corrected. Fill the circle corresponding to that letter under the segment in the MCQ Response form.

- Q.1 When zara goes to the coffee shop and places her order, it took her about five minutes to detail all of her specifications.  
A B C D
- Q.2 Anytime fozia hears a new equation, she was able to remember it even months later.  
A B C D
- Q.3 By the time Ron got the brilliant orange goldfish home from the carnival and put it in a fishbowl, it died.  
A B C D
- Q.4 Reporters speculated wildly about what the prisoners had saw while they were in captivity, a time that spanned almost ten months.  
A B C D
- Q.5 Beverly Hills was a significant part of Los Angeles because its inhabitants include important professionals who have been very influential in the historical development of the entertainment industry.  
A B C D

- Q.6 Justin, who had never tried celery before, was amazed by how crisp and refreshing it tastes.  
A B C D
- Q.7 The general was a man of great dignity and courage who sees the potential in men rather than simply their current ability, and he commanded in battle with clear eyes and a level head.  
A B C D
- Q.8 As I left my house to go to the store, I having my keys in hand and my makeup carefully applied; I had no idea that neither of those states would last.  
A B C D
- Q.9 Since the argument about cheese curds, Hassan and I are not speaking to each other more than is absolutely necessary.  
A B C D
- Q.10 Although sohail does not usually have an appetite, he has ate more tonight than anyone else at the dinner.  
A B C D
- Q.11 Marketers are finding greater success making sales when they phoned people in the morning rather than late in the afternoon.  
A B C D

**Q.12** The undercover agents chose not to  
A  
apprehend the suspect in the mall that  
B  
afternoon, but instead apprehended him at  
C  
the harbor before he is boarding a ship to  
D

Morocco.

**Q.13** Despite a strict ban and severe  
A  
punishments, the circulation of illegal  
jokes remains a thriving part of that  
B C  
country's underground culture.  
D

**Q.14** Many people theorized that the darkness  
A  
was caused by smoke  
from a volcanic eruption, but a few  
B C  
know that the real cause was an alien  
D  
invasion.

**Q.15** One alien invader, who misunderstood the  
A  
orders he has been given, landed in the  
B C  
Great Barrier Reef instead of Great  
D  
Britain.

**Q.16** Feeling uninspired, the writer stared out  
A  
at the gloomy landscape and thought of  
the days when he had rode along the old  
B C  
county roads in his father's truck.  
D

**Q.17** He decided it would being a good idea to  
A  
tell his friends that his birthday  
was ally the following day, but he  
B  
was nt sure how to say it tactfully.  
C D

**Q.18** Thankfully, they brang their pirate  
A  
diorama to school show-and-tell  
that day; they would have failed if  
B C  
they had forgotten.  
D

**Q.19** Until recently, scientists think that genes  
A  
alone determine the longevity of new  
crops; however, new  
B  
research suggests that environment, in  
C  
addition to genetic factors, plays a crucial  
D  
role in regulating a plant's ability to  
resist pests and disease.

**Q.20** As soon as I bought an expensive patio  
A B  
umbrella I am finding them on  
C  
clearance everywhere.  
D

**DIRECTIONS:** In each of the following questions, four alternative sentences are given. Choose the CORRECT one and fill the Circle corresponding to that letter in the MCQ Response Form.

Q.21

- A) In a prolonged effort to curb abuses, the governments reduce the amount in bonuses for arrests.
- B) In a prolonged effort to curb abuses, the governments reduction the amount in bonuses for arrests.
- C) In a prolonged effort to curb abuses, the governments reduced the amount in bonuses for arrests.
- D) In a prolonged effort to curb abuses, the governments reduces the amount in bonuses for arrests.

Q.22

- A) Celebrations began the school after it was announced they had won the championship.
- B) Celebrations begin the school after it was announced they had won the championship.
- C) Celebrations begun in the school after it was announced they had won the championship.
- D) Celebrations begun by the school after it was announced they had won the championship.

Q.23

- A) Something strange occurred every night of the trip, which spooked the entire family.
- B) Something strange occurring every night of the trip, which spooked the entire family.
- C) Something strange occurs every night of the trip, which spooked the entire family.
- D) Something strange occurs every nights of the trip, which spooked the entire family.

Q.24

- A) Politics has gains such a nasty tone in recent years that it has turned off many voters.
- B) Politics has gains a nasty tone in recent years that it has turned off many voters.
- C) Politics has gains such nasty tone in recent years that it has turned off many voters.

- D) Politics has gained such a nasty tone in recent years that it has turned off many voters.

Q.25

- A) All of the people know the costs of do business with the corrupt shopkeeper.
- B) All of the people know the costs of does business with the corrupt shopkeeper.
- C) All of the people know the costs of business doing with the corrupt shopkeeper.
- D) All of the people know the costs of doing business with the corrupt shopkeeper.

Q.26

- A) The four touchdowns were scored by the opposing team
- B) The opposing team had scored four touchdowns
- C) The scoring of four touchdowns by the opposing team happened
- D) The opposing team scored four touchdowns  
The opposing team were scoring four touchdowns

Q.27

- A) Less than five people attending the event that took place six months ago.
- B) Less than five people attendance the event that took place six months ago.
- C) Less than five people attend the event that took place six months ago.
- D) Less than five people attended the event that took place six months ago.

Q.28

- A) Musicians frequently discuss the ability to play without thinking, lets music flow right out of them.
- B) Musicians frequently discuss the ability to play without thinking, let the music flow right out of them.
- C) Musicians frequently discuss the ability to play without thinking, letting so that music flows right out of them.
- D) Musicians frequently discuss the ability to play without thinking, letting the music flow right out of them.

Q.29

- A) Unbeknownst to her colleagues, she had been suffered from a serious illness.
- B) Unbeknownst to her colleagues, she was suffered from a serious illness.
- C) Unbeknownst to her colleagues, she suffering from a serious illness.
- D) Unbeknownst to her colleagues, she was suffering from a serious illness.

Q.30

- A) The old path worn around to the point that no vegetation would grow on it.
- B) The old path was worn out to the point that no vegetation would grow on it.
- C) The old path worn through to the point that no vegetation would grow on it.
- D) The old path worn out to the point that no vegetation would grow on it.

Q.31

- A) The arrangements preventing the groups from developing until they were changed three years ago.
- B) The arrangements prevent the groups from developing until they were changed three years ago.
- C) The arrangements prevented the groups from developing until they were changed three years ago.
- D) The arrangements prevents the groups from developing until they were changed three years ago.

Q.32

- A) We have always sang anthems that celebrate our nation.
- B) We have always sing anthems that celebrate our nation.
- C) We have always sung anthems that celebrate our nation.
- D) We have sing always anthems that celebrate our nation.

Q.33

- A) In the nineteenth century, the Transcendentalists seeking to find solace in the wonders of nature.
- B) In the nineteenth century, the Transcendentalists sought to found solace in the wonders of nature.

- C) In the nineteenth century, the Transcendentalists are seeking to find solace in the wonders of nature.
- D) In the nineteenth century, the Transcendentalists sought to find solace in the wonders of nature.

Q.34

- A) The spokesperson noted that over the past year, a new wave of technological advances had increased the company's profitability.
- B) The spokesperson noted that over the past year, a new wave of technological advances will have increased the company's profitability.
- C) The spokesperson noted that over the past year, a new wave of technological advances have increased the company's profitability.
- D) The spokesperson noted that over the past year, a new wave of technological advances has increased the company's profitability.

Q.35

- A) Previously, the candidates refused to run any negative ads against their opponents.
- B) Previously, the candidates refusal to run any negative ads against their opponents.
- C) Previously, the candidates refuse to run any negative ads against their opponents.
- D) Previously, the candidates refuse to be running any negative ads against their opponents.

Q.36

- A) After Majeed were to have left the store, he had gone to the gas station.
- B) After Majeed left the store, he had gone to the gas station.
- C) After Majeed was leaving the store, he had gone to the gas station.
- D) After Majeed left the store, he went to the gas station.

**Q.37**

- A) If I would have used the coupon, forty dollars could have been saved by me.
- B) If I would have used the coupon, I could have saved forty dollars.
- C) If I will have used the coupon, I could have saved forty dollars.
- D) If I had used the coupon, I could have saved forty dollars.

**Q.38**

- A) Many parents mistakenly thinking babies should be on low-fat diets; on the other hand, fat is crucial to infants' brain and nerve development.
- B) Many parents mistake and think babies should be on low-fat diets; however, fat is crucial to infants' brain and nerve development.
- C) Many parents mistakenly think babies should be on low-fat diets; however, fat is crucial to infants' brain and nerve development.
- D) Many parents mistakenly had thought babies should be on low-fat diets; however, fat is crucial to infants' brain and nerve development.

**Q.39**

- A) When I discovered that my mom hid chocolate bars in her top drawer, I took and ate them all.
- B) When I made the discovery that my mom hid chocolate bars in her top drawer, I was taking them all and ate them.
- C) When I discovered that my mom hid chocolate bars in her top drawer, I had taken them all and eaten them.
- D) When I was discovering that my mom hid in her top drawer chocolate bars, I took them all and ate them all.

**Q.40**

- A) The new recruit made enough mistakes in basic training that the sergeant believed he would never become a good soldier.
- B) The new recruit made enough mistakes in basic training that the sergeant believing he would never become a good soldier.

- C) The new recruit made enough mistakes in basic training that that sergeant believes he would never become a good soldier.
- D) The new recruit made enough mistakes in basic training that the sergeant believes he would never become a good soldier.



**ANSWER KEY (Worksheet-10)**

1	C	21	C
2	B	22	C
3	D	23	A
4	B	24	D
5	A	25	D
6	D	26	B
7	C	27	C
8	B	28	D
9	B	29	D
10	C	30	B
11	C	31	C
12	D	32	C
13	B	33	D
14	D	34	D
15	B	35	A
16	C	36	D
17	A	37	D
18	A	38	C
19	A	39	A
20	C	40	A

**ANSWERS EXPLAINED****Q.1 Correct Answer C:**

This sentence has a problem with verb tense. Since the first half of the sentence is in the present, the second half has to be too. The corrected sentence reads, "When zara goes to the coffee shop and places her order, it takes her about five minutes to detail all of her specifications."

**Q.2 Correct Answer B:**

Context clues in the sentence, such as "Anytime Clara hears" and "even months later" indicate that the speaker is not referring to fozia ability in the past tense. Therefore, "was" should be changed to "is" or "will be."

**Q.3 Correct Answer D:**

Give the form of this sentence, the verb "to die" should be in the present perfect and not the simple past tense. We know this, because the sentence follows the general form "by the time X

happened, Y had happened." So the sentence should read "it had died," not "it died."

**Q.4 Correct Answer B:**

In this sentence, the correct verb tense of "to see" is the present perfect, which is "had seen," not "had saw."

**Q.5 Correct Answer A:**

This sentence is written in the present tense, as we can tell from its verb "include." However, the verb "was" is in the past tense. It should be in the present tense as well. To correct the sentence's error, "was" should be changed to "is."

**Q.6 Correct Answer D:**

The sentence is in past tense, as indicated by "was" and "had never tried." For this reason, the verb "taste" should also be in past tense. "Tasted" would be the correct version, not "tastes."

**Q.7 Correct Answer C:**

Although the rest of the sentence clearly refers to the past ("was a man," "commanded in battle"), "sees" is written in the present tense. It should be changed to its third-person past tense form, "saw," to agree with the other verbs in the sentence.

**Q.8 Correct Answer B:**

"Having" is the present progressive form of the verb "to have," and the rest of the sentence is written entirely in the past tense. "Having" should be changed to "had" to agree with "left," "applied," and "had no idea."

**Q.9 Correct Answer B:**

The timeline of the verb tenses in this sentence is slightly off. The corrected sentence reads: *Since the argument about cheese curds, Hassan and I have not been speaking to each other more than is absolutely necessary.*

**Q.10 Correct Answer C:**

The phrase "has ate" should be "has eaten." "Eaten" is the proper participle for the present perfect form.

**Q.11 Correct Answer C:**

The sentence is present tense, so use "phone" instead of "phoned."



**Q.12 Correct Answer D:**

"Is boarding" should be "boarded" because it matches the tense of other verbs in the sentence.

**Q.13 Correct Answer B:**

For the timeline of the sentence to make sense, "remain" should be changed to past tense, because it occurred before the Soviet Union collapsed. A simple correction would be "remained."

**Q.14 Correct Answer D:**

This sentence has an error in verb tense. Since the first half is in past tense, the second half should be too. The corrected sentence reads, "Many people theorized that the darkness was caused by smoke from a volcanic eruption, but a few knew that the real cause was an alien invasion."

**Q.15 Correct Answer B:**

This sentence has a problem with verb tense. The main clause is in the past tense, and the modifying phrase should reflect that. The corrected sentence reads, "One alien invader, who misunderstood the orders he had been given, landed in the Great Barrier Reef instead of Great Britain."

**Q.16 Correct Answer C:**

This sentence uses an ill-formed verb. The corrected sentence reads: *Feeling uninspired, the writer stared out at the gloomy landscape and thought of the days when he had ridden along the old county roads in his father's pick-up.*

**Q.17 Correct Answer A:**

This sentence uses "being" when "be" is appropriate. The corrected sentence reads, "He decided it would be a good idea to tell his friends that his birthday was actually the following day, but he was not sure how to say it tactfully."

**Q.18 Correct Answer A:**

To correct this sentence's error, "brang" needs to be changed to "brought," which is the correct but irregular past tense form of "bring."

**Q.19 Correct Answer A:**

When we encounter a phrase such as "until recently," we know it must describe an event that took place in the past, but the verb "think" is in the present tense. This sentence therefore contains a tense error in the verb "think." Changing "think" to "thought" corrects the sentence's error.

**Q.20 Correct Answer C:**

This sentence has a problem with the timeline of verb tenses. Since the first half of the sentence is in the past, the second half has to be too. The corrected sentence reads, "As soon as I bought an expensive patio umbrella I found them on clearance everywhere."

**Q.21 Correct Answer C:**

The opening clause of the sentence notes a "prolonged effort," which indicates the government action has taken place over a long time period. The proper verb will either be in the past tense or show a long amount of time. "The governments reduced" is the best choice among the answers.

**Q.22 Correct Answer C:**

The underlined section of the sentence contains both a verb and a preposition, but the only issue lies in the present tense verb. The use of time in the sentence, "after they found out," indicates the celebrations took place in the past. "Began in the school," is the correct answer choice.

**Q.23 Correct Answer A:**

The sentence contains two complete thoughts, separated by the conjunction "which." This means the two verbs in each phrase need to have the same tense. As "spooked" is in the past tense, "Something strange occurred every night of the trip," is the correct answer.

**Q.24 Correct Answer D:**

The underlined phrase needs to be parallel to the later verb usage of "has turned off" later in the sentence. The underlined phrase then needs to similarly be in the past perfect tense. "Has gained such a nasty tone" is the correct answer.

**Q.25 Correct Answer D:**

The underlined phrase does not appropriately parallel the earlier verb use of "know" in the sentence. Thus, the correct answer choice needs to make the verb form into a present tense verb. "Doing business" is the best choice among the answers.

**Q.26 Correct Answer B:**

This sentence contains two different past tense verbs: *sat* and *scored*. One verb was completed before the other (*scored* before *sat*); therefore, *scored* needs to be put in the past perfect tense: *had scored*.

**Q.27 Correct Answer C:**

The underlined word in the sentence is in the incorrect tense for the sentence, best indicated by the fact the event "took place six months ago;" therefore, the sentence needs a past tense verb, so "attended" is the correct answer choice.

**Q.28 Correct Answer D:**

The underlined portion of the sentence is a dependent clause, a complete thought that cannot stand alone, but is reliant on the other part of the sentence. A dependent clause cannot have an active verb form, as it has no connection to the previous portion of the sentence. "Letting the music flow right out of them" is the answer choice that best solves this issue.

**Q.29 Correct Answer D:**

The use of the past tense verb "suffered" is incorrect in this construction. Being paired with "was," the verb needs to become a gerund, a verb form that can function as a noun. "She was suffering from" is the only answer choice that correctly uses the gerund form.

**Q.30 Correct Answer B:**

The use of the verb phrase "worn out" is incorrect, as the past tense verb "worn" coupled with the preposition "out" is actually used as an adverb to describe the path. The sentence can be made correct by adding a form of the verb "to

be," and "was worn out" is the only answer choice that does this.

**Q.31 Correct Answer C:**

The phrase "until they were changed" contains a past tense verb and indicates that the use of the present tense verb "prevent" is incorrect. "Prevent" needs to be changed to the past-tense "prevented" to make the sentence grammatically correct. "The arrangements prevented the groups from developing" is the only answer choice that uses the correct verb tense.

**Q.32 Correct Answer C:**

The use of "have," a past-tense helping (auxiliary) verb, makes the verb in the sentence past-tense and perfect. However, "sing," a present-tense verb, completes the signaled past perfect form incorrectly and introduces confusion about the sentence's tense. While we could change the verbs in the sentence in many ways to correct the error, only "always sing" is underlined. This means that we can't alter "have," so we need to change "sing" to "sung" to create a correct past perfect verb ("have . . . sung"). The answer choices "always sing" and "sing always" don't correct the sentence's error. "Always sang" may look potentially correct, but "to sing" is an irregular verb in which "sang" is the past tense and "sung" is used in the perfect tense (Example: "She sang the song yesterday, after she had sung the duet."). "Always sang" can't be the correct answer, then, because it incorrectly constructs the past perfect tense. While "always sung" and "sung always" may each look like a potentially correct answer, "sung always" introduces an awkward word order that "always sung" avoids, so "always sung" is the correct answer, making the corrected sentence, "We have always sung anthems that celebrate our nation."

**Q.33 Correct Answer D:**

The sentence describes what Transcendentalists did "In the nineteenth century." This indicates the underlined portion of the sentence needs to make use of the past tense, because that part of the sentence is describing the actions that took place "In the nineteenth century." Only "seeking" needs

to be changed, as the form "to find" is an infinitive, and does not change regardless of the tense of the verb that precedes it. "Sought to find" is the correct answer choice.

**Q.34 Correct Answer D:**

We know that the proper tense to describe an event that happened "over the course of past year" is the present perfect, which narrows down potentially correct answer choices to either "have increased the company's profitability" or "has increased the company's profitability."

Since the subject of the increasing event is "wave," not "advances," we should go with the answer choice that uses the singular verb—"has increased the company's profitability."

**Q.35 Correct Answer A:**

The underlined portion describes what happened "Previously," which indicates the verb has to be in a tense showing what happened before. The correct answer must be in the past tense, and only "refused to run" has the correct tense among the answers.

**Q.36 Correct Answer D:**

The original sentence uses the pluperfect verb form ("had gone to the gas station") erroneously because the event of going to the gas station happened after Majeed left the store.

**Q.37 Correct Answer D:**

One can never say "If I would have done". One can only say "If I had done", which is called the past perfect verb form.

**Q.38 Correct Answer C:**

Correct answer:

Many parents mistakenly think babies should be on low-fat diets; however, fat is crucial to infants' brain and nerve development.

**Q.39 Correct Answer A:**

The original statement uses the wrong verb tense for the verb "take"; it should be "took". The correct answer is also more concise than the original.

**Q.40 Correct Answer A:**

The use of the present tense verb "believes" in the underlined portion of the sentence is at odds with the main verb of the sentence, "made," which is in the past tense. "Believes" needs to be changed to the past tense form, making "that the sergeant believed he would never" the correct answer choice.

**Worksheet-11****VOCABULARY LIST (161-212)**

**DIRECTIONS:** Select the most suitable synonym for the given words:

**Q.1 REINFORCE**

- A) Weaken C) Support  
B) Avarice D) Belie

**Q.2 REPRIMANDED**

- A) Praised C) Aspired  
B) Lectured D) Attenuated

**Q.3 RELUCTANTLY**

- A) Affected C) Unwillingly  
B) Willingly D) Aptly

**Q.4 RARELY**

- A) Seldom C) Often  
B) Never D) Ever

**Q.5 RESONANT**

- A) Bead C) Booming  
B) Minimum D) Tinny

**Q.6 SWATHE**

- A) Strip C) Expose  
B) Limping D) Mean

**Q.7 STERNLY**

- A) Leniently C) Severely  
B) Fluttered D) Natively

**Q.8 SOLEMNLY**

- A) Somberly C) Cheerfully  
B) Flawlessly D) Fatality

**Q.9 SAUNTERED**

- A) Flicked C) Strolled  
B) Hurried D) Elaborated

**Q.10 STABLE**

- A) Erratic C) Constant  
B) Bashful D) Ludicrous

**Q.11 TENTATIVELY**

- A) Crudely C) Neutrally  
B) Boldly D) Hesitantly

**Q.12 TUMULTUOUS**

- A) Causal C) Unbridled  
B) Abrupt D) Peaceful

**Q.13 TANGLED**

- A) Twisted C) Yearned  
B) Relived D) Untangled

**Q.14 URGE**

- A) Help C) Impulse  
B) Oppose D) Laugh

**Q.15 UNBURDENED**

- A) Relieved C) Kindled  
B) Hoped D) Harbored

**Q.16 UNPROVOKED**

- A) Provoked C) Upgraded  
B) Wanton D) Innovated

**Q.17 VULNERABLE**

- A) Helpless C) conceivable  
B) valuable D) Invincible

**Q.18 ZEALOUS**

- A) Apathetic C) Smooth  
B) Keen D) Jagged

**Q.19 ZENITH**

- A) Nadir C) Drift  
B) Dune D) Summit

Q.20 ZEST

- A) Pardon                      C) Apathy  
B) Keenness                  D) Jubilation

ANSWER KEY (SYNONYMS)				ANSWER KEY (ANTONYMS)			
1	C	11	D	1	A	11	B
2	B	12	C	2	A	12	D
3	C	13	A	3	B	13	D
4	A	14	C	4	C	14	B
5	C	15	A	5	D	15	D
6	A	16	B	6	C	16	A
7	C	17	A	7	A	17	D
8	A	18	B	8	C	18	A
9	C	19	D	9	B	19	A
10	C	20	B	10	A	20	C

Worksheet-12

SEQUENCE OF TENSES +  
CONDITIONLS

**DIRECTIONS:** Some segments of each sentence are underlined. Your task is to identify that underlined segment of the sentence which contains the mistake that needs to be corrected. Fill the circle corresponding to that letter under the segment in the MCQ Response form.

- Q.1 She had just turned over the supper steaks  
A B  
when the telephone had rung.  
C D
- Q.2 Komal will continue to learn English  
A B  
when she will get to the States.  
C D
- Q.3 The pickpocket confessed that he picked  
A B C  
my pocket.  
D
- Q.4 Euclid proved that the three angles of a  
A  
triangle were equal to two right angles.  
B C D
- Q.5 In my perplexity I requested my guide to  
A  
tell me what I have to do.  
B C D
- Q.6 The great throne-room had been turned  
A  
into a kind of a gymnasium, with the  
B C  
members of the Royal House seated  
along a raised platform.  
D
- Q.7 If I were a co-operative store and family  
A B  
hotel combined, I might have been able  
C  
to oblige you.  
D

- Q.8 If you push the button, " Mr. Steward  
told him, "somewhere in the world  
A B C  
someone you don't know dies.  
D
- Q.9 If they get a chance to lie their eggs, we  
A B  
are going to have everything eaten flat  
C D  
with hoppers later on.
- Q.10 If I were rich, I would buy an apartment  
A B  
in Manhattan and an house in Hawaii.  
C D
- Q.11 If people were smart, they  
A  
wouldn't have been out on a night like  
B C D  
this.
- Q.12 If the college is alive to its work of  
A B  
advise, such cases are caught before the  
C D  
failure is complete.
- Q.13 If the duties of this officer isn't reduced,  
A  
there will not be enough time to finish the  
B C D  
project.
- Q.14 If I was a co-operative store and family  
A B  
hotel combined, I might be able to oblige  
C D  
you.
- Q.15 If you had worked hard, you will have  
A B  
had no trouble passing the exam.  
C D



**DIRECTIONS:** In each of the following questions, four alternative sentences are given. Choose the **CORRECT** one and fill the Circle corresponding to that letter in the MCQ Response Form.

**Q.16**

- A) Even the early doctors knew that the washing of hands prevent infection.
- B) Even the early doctors knew that the washing of hands prevents infection.
- C) Even the early doctors knew that the washing of hands prevented infection.
- D) Even the early doctors knew that the washing of hands preventing infection

**Q.17**

- A) He valued his friendship more than he values mine.
- B) He valued his friendship more from he values mine.
- C) He valued his friendship more than he values my.
- D) He valued his friendship more than he values mine's.

**Q.18**

- A) You had better to mend your ways; otherwise, you will land in serious trouble.
- B) You had better mend your ways; otherwise, you will land in serious trouble.
- C) You had better mend your ways, otherwise, you will land in serious trouble.
- D) You had better mend your ways otherwise you will land in serious trouble.

**Q.19**

- A) Newton discovered that the force of gravity pulls all bodies to the Earth.
- B) Newton discovered that the force of gravity pulled all bodies to the Earth.
- C) Newton discovered that the force of gravity pulls all bodies to Earth.

- D) Newton discovered that the force of gravity pulls all bodies on the Earth.

**Q.20**

- A) No one could explain how the prisoner have escaped from the prison.
- B) No one could explain how the prisoner escaped from the prison.
- C) No one can explain how the prisoner had escaped from the prison.
- D) No one could explain how the prisoner had escaped from the prison.

**ANSWER KEY (Worksheet-12)**

1	D	11	B
2	C	12	C
3	C	13	A
4	B	14	A
5	C	15	B
6	B	16	B
7	C	17	A
8	D	18	B
9	B	19	A
10	D	20	D

**ANSWERS EXPLAINED**

Q.1 Correct Answer D: (rang)

Q.2 Correct Answer C: (gets)

Q.3 Correct Answer C: (had picked)

Q.4 Correct Answer B: (are)

Q.5 Correct Answer C: (had)

Q.6 Correct Answer B: (kind of)

Q.7 Correct Answer C: (might be)

Q.8 Correct Answer D: (will die)

Q.9 Correct Answer B: (lay)

Q.10 Correct Answer D: (a)

Q.11 Correct Answer B: (wouldn't be)

Q.12 Correct Answer C: (advice)

Q.13 Correct Answer A: (aren't)

Q.14 Correct Answer A: (were)

Q.15 Correct Answer B: (will would)

Q.16 Correct Answer B:

Q.17 Correct Answer A:

Q.18 Correct Answer B:

Q.19 Correct Answer A:

Q.20 Correct Answer D:

**Worksheet-13**

**ARTICLES + NOUN**

**DIRECTIONS:** Some segments of each sentence are underlined. Your task is to identify that underlined segment of the sentence which contains the mistake that needs to be corrected. Fill the circle corresponding to that letter under the segment in the MCQ Response form.

- Q.1** Of course, he made speeches, and fine one's, on many other subjects; but all the while he stuck to his one idea.  
A B C D
- Q.2** When I arrived, I was met by the mother, a big startled looking women, very clean and apologetic.  
A B C D
- Q.3** As it happens we had been having a number of cases of diphtheria in the school to which this children went during that month.  
A B C D
- Q.4** Two peoples threw him in the sea and when he was about to be drowned they pulled him back to the boat.  
A B C D
- Q.5** This appeared strange to the king, who could not comprehend the wiseness in the action taken by the sergeant, and he asked for it.  
A B C D

- Q.6** Before he had experiencing the danger of being drowned, he knew not about the safety of the boat.  
A B C D
- Q.7** Before he had experienced the danger of being drowned, he knew not about the safeness of the boat.  
A B C D
- Q.8** For five eggs, which the king allows to be taken by force, the peoples belonging to his army will put a thousand fowls on the spit."  
A B C D
- Q.9** The king summoned the father and mother of a the boy, whose consent he got by giving them huge number of wealth.  
A B C D
- Q.10** It happened that one of the animal entered a melon-field, and that a melon stuck in its throat.  
A B C D
- Q.11** Trees minimize depletion in an ozone layer by absorbing carbon dioxide and other harmful gases.  
A B C D
- Q.12** It takes decade to teach children to be good.  
A B C D

Q.13 The student was with an university fellow  
A B  
when he suffered heart attack.  
C D

Q.14 An European delegate has recently come  
A B  
up with a project.  
C D

Q.15 A guest had been waiting for him for an  
A B C  
hour when a umbrella-holding man  
D  
arrived.

Q.16 The English is a very important language  
A B  
in a post graduate student's life.  
C D

Q.17 My Christian friends attend prayer service  
A B  
at the church every Sunday.  
C D

Q.18 If you have a faith in the Almighty,  
A B  
everything will turn out to be all right.  
C D

Q.19 According to the Quran it is upright who  
A B C  
shall inherit the earth.  
D

Q.20 I am not a rich, so I cannot afford to buy a  
A B C D  
four wheeler.

**DIRECTIONS:** In each of the following questions, four alternative sentences are given. Choose the CORRECT one and fill the Circle corresponding to that letter in the MCQ Response Form.

Q.21 A) The packages was lying by the front door.

B) The package was lying by the front door.

C) The package was laying by the front door.

D) A packages was lying by the front door.

Q.22 A) Your thought I was going to say, but I didn't snatch peoples pocketbooks.

B) You thought I was going to say, but I didn't snatched peoples pocketbooks.

C) You thought I was going to say, but I didn't snatch people's pocketbooks.

D) You thought I were going to say, but I didn't snatch peoples' pocketbooks.

Q.23 A) Ones a king and a Persian slave was sailing in the same boat.

B) Once a kings and a Persian slave were sailing in the same boat.

C) Once a king and a Persian slavery were sailing in the same boat.

D) Once a king and a Persian slave were sailing in the same boat.

Q.24 A) Anothers tried to pacify him by kindness and affection but he didn't hear anybody.

B) The others tried to pacify him by kindness and affection but he didn't hear anybody.

C) One anothers tried to pacify his by kindness and affection but he didn't hear anybody.

D) One another tried to pacify him by kindness and affectionate but he didn't hear anybody.

**Q.25** A) A man do not realizes the worthy of safety from the misfortune until he has tasted it.

B) A man does no realize the worthy of safety from the misfortune until he has tasted it.

C) A man does not realize the worth of safety from the misfortune until he has tasted it.

D) A man does not realize the worthy of safety from the misfortune until he has tasted it.

**Q.26** A) "The foundation of oppression was small in the world", said the king.

B) "The foundation of oppressive was small in the world", said the king.

C) "The foundation of oppresses was small in the world", said the king.

D) "The foundation of oppress was small in the world", said the king.

**Q.27** A) Whoever enlarged it, so that it reached its present magnify, is at fault.

B) Whomever enlarged it, so that it reach its present magnify, is at fault.

C) Whoever enlarged it, so that it reached its present magnificence, is at fault.

D) Whoever enlarged it, so that it reached its present magnitude, is at fault.

**Q.28** A) Orders were issued to search for an individual of this kind.

B) Orderings were issued to search for an individual of this kind.

C) Orders was issued to search for an individual of this kind.

D) Orders were issued to search for a individual of this kind.

**Q.29** A) The Qazi issued a decree to shed the blood of a person for the healthy of the king.

B) The Qazi issued a decree to shed the blood of a person for the health of the king.

C) The Qazi issue a decree to shed the blood of a person for the healthy of the king.

D) The Qazi issued a decree to shedding the blood of a person for the healthy of the king.

**Q.30** A) When conscience return, this bewildered victim inquired: "Why, sir, this cruel usage?"

B) When conscience returned, this bewildered victim inquire: "Why, sir, this cruel usage?"

C) When consciousness returned, this bewildered victim inquired: "Why, sir, this cruel usage?"

D) When conscience returned, this bewildered victim inquired: "Why, sir, this cruel usage?"

Q.31

- A) This appeared strange to the king, who could not comprehend the wisdom in the action taken by the sergeant.
- B) This appeared strange to the king, who could not comprehend wisdom in the action taken from the sergeant.
- C) This appeared strange to the king, who could not comprehend a wisdom in the action taken through the sergeant.
- D) This appeared strange to the king, whom could not comprehend an wisdom in the action taken with the sergeant.

Q.32

- A) He was in the Germany, visiting his home, when war broke out.
- B) He was in Germany, visiting his home, when war broke out.
- C) He was in Germany, visiting his home, when war broke into.
- D) He was in Germany, visiting his home, when war broke about.

Q.33

- A) But famines in Europe have been much less serious than in other parts of the world.
- B) But famines in Europe have been much less serious than in other parts of world.
- C) But famines in Europe have been much less serious then in other parts of a world.
- D) But famines in Europe has been very less serious than in other parts of the world.

Q.34

- A) We were whole taught to speak English.
- B) We were all taught to speak English.
- C) We were all taught to speak the English.
- D) We were all taught to speaking the English.

Q.35

- A) Everyone have their own ideas about the bestest way to bring up children.
- B) Everyone has their own ideas about the best way to bring up children.
- C) Everyone has his/her own ideas about the best way to bring up children.
- D) Everyone has their own ideas about best way to bring up children.

Q.36

- A) The Switzerland is a European country that is known for its landlocked mountains.
- B) Switzerland is an European country that is known for its landlocked mountains.
- C) Switzerland is a European country that is known for its landlocked mountains.
- D) Switzerland is a European country that is known for its landlocked the mountains.



Q.37

- A) More people or things there are, the better a situation will be.
- B) The more people or things there are, the good a situation will be.
- C) The more people or things there are, the better a situation will be.
- D) The more people or things there are, the best a situation will be.

Q.38

- A) Happy is the man that has few cares.
- B) Happy is man that has few cares.
- C) Happy is man who has few cares.
- D) Happy is the man that has fewer cares.

Q.39

- A) For more than a century, Times has been a integral and important part of the political structure of Great Britain.
- B) For more than a century, The Time has been an integral and important part of the political structure of Great Britain.
- C) For more than a century, The Times has been an integral and important part of the political structure of Great Britain.
- D) For more than a century, The Times have been an integral and important part of the political structure of Great Britain.

Q.40

- A) The Parkers along with their neighbors is coming for dinner tonight.
- B) The Parkers along with its neighbors are coming for dinner tonight.
- C) The Parkers along with their neighbors are coming for dinner tonight.
- D) Parkers along with their neighbors are coming for dinner tonight.

**ANSWER KEY (Worksheet-13)**

1	B	21	B
2	D	22	C
3	D	23	D
4	A	24	B
5	D	25	C
6	B	26	A
7	D	27	D
8	C	28	A
9	D	29	B
10	B	30	C
11	B	31	A
12	C	32	B
13	B	33	A
14	A	34	B
15	D	35	C
16	A	36	C
17	C	37	C
18	A	38	A
19	B	39	C
20	B	40	C

**ANSWERS EXPLAINED**

- Q.1 Correct Answer B: (ones)  
 Q.2 Correct Answer D: (woman)  
 Q.3 Correct Answer D: (child)  
 Q.4 Correct Answer A: (persons)  
 Q.5 Correct Answer D: (wisdom)  
 Q.6 Correct Answer B: (experiment)  
 Q.7 Correct Answer D: (safety)  
 Q.8 Correct Answer C: (people)  
 Q.9 Correct Answer D: (amount)  
 Q.10 Correct Answer B: (animals)  
 Q.11 Correct Answer B: (in the ozone)  
 Q.12 Correct Answer C:  
 (a children-no article)  
 Q.13 Correct Answer B: (a university)

- Q.14 Correct Answer A: (a European )  
 Q.15 Correct Answer D: (an hour)  
 Q.16 Correct Answer A: (English)  
 Q.17 Correct Answer C: (church)  
 Q.18 Correct Answer A: (church)  
 Q.19 Correct Answer B: (the upright)  
 Q.20 Correct Answer B: (rich)  
 Q.21 Correct Answer B:  
 The package was lying  
 Q.22 Correct Answer C:  
 You (sub case) thought I was  
 Q.23 Correct Answer D:  
 A king and a Persian slave + were  
 (plural verb)  
 Q.24 Correct Answer B:  
 The others \_\_\_\_ affection  
 Q.25 Correct Answer C:  
 Does not \_\_\_\_ worth  
 Q.26 Correct Answer A:  
 Oppression  
 Q.27 Correct Answer D:  
 Whoever \_\_\_\_ it reached \_\_\_\_  
 magnitude  
 Q.28 Correct Answer A:  
 Orders were issued \_\_\_\_  
 Q.29 Correct Answer B:  
 Issued \_\_\_\_ to shed  
 Q.30 Correct Answer C:  
 Consciousness returned  
 Q.31 Correct Answer A:  
 The wisdom  
 uncountable nouns take the  
 article **the** when used in a  
 particular sense.  
 Q.32 Correct Answer B:  
 No article is included when referring to a  
 country (1) with a single name (except  
 The Gambia) or with merged single-  
 named states Bosnia and Herzegovina.  
 Note that most countries have an official  
 title that includes the kind of state, for

example, the republic, the kingdom, the principality, the commonwealth, the union, the confederation, and so on.

Include the before countries (1) with plural names (the Philippines, the Maldives and the Netherlands); (2) with names containing a noun stating the kind of state (the Republic, the Democratic, the State(s), the Union, the Confederation, the Kingdom, the Commonwealth, the Principality). Capitalize the when it is included in the official name (The Bahamas).

**Q.33 Correct Answer A:**  
**the world.**

**Q.34 Correct Answer B:**  
English ..... Language  
The English..... People

**Q.35 Correct Answer C:**  
**THE is used** in superlative expressions, where noun is, by definition, unique

**Q.36 Correct Answer C:**  
a + consonant sound ..... a European  
an + vowel sound ..... a game of golf

**Q.37 Correct Answer C:**  
The...the... with comparative adjectives  
Comparison and contrast are expressed by the use of **the...the...**with comparative adjectives in parallel clauses  
Structure: the + comparative adjective + clause + the + comparative adjective + clause

**Q.38 Correct Answer A:**  
Use the in sentences or clauses where you define or identify a particular person or object.

**Q.39 Correct Answer C:**  
Before the names of newspapers

**Q.40 Correct Answer C:**  
**THE** is used before plural **family names** (to indicate the family as a group).

Worksheet-14

CONJUNCTION +  
FAULTY COORDINATION

**DIRECTIONS:** Some segments of each sentence are underlined. Your task is to identify that underlined segment of the sentence which contains the mistake that needs to be corrected. Fill the circle corresponding to that letter under the segment in the MCQ Response form.

- Q.1 My library normally only allows  
A  
patrons to check out three books at a  
time, and when I explained that I needed  
B C  
to check out more than that because I was  
working on a term paper,  
they allowed me to do so.  
D
- Q.2 I would bake more cookies, and  
A B  
every time I do, my oven burns them.  
C D
- Q.3 Jonathan was a devoted fan of music  
A  
of almost any kind, and he just  
B C  
could not tolerate reggae.  
D
- Q.4 Only six students attended the football  
A  
game on Saturday, and many students  
B C  
went instead to the school dance.  
D
- Q.5 Jack was the one who got us into  
A  
this dangerous situation, but he has  
B C  
absolutely no right to complain.  
D
- Q.6 As his friends cut the triple layer  
A  
chocolate cake, the author felt cheerful  
B  
but newly energized.  
C D

- Q.7 Unlike his mentor, acheiving the title of  
A B  
"partner" by the time he was thirty years  
old, Jon does not think that  
he will acheive this position until he is  
C  
at least forty years old.  
D
- Q.8 Vincent van Gogh sold only a  
A  
few paintings during his lifetime,  
but yet he is considered one of  
B  
the greatest painters of all time.  
C D
- Q.9 Once I learned how to swim,  
A B  
I would never go in the water  
C  
for fear of drowning.  
D
- Q.10 Whether or nor they were in love, John  
A B  
decided he needed to break up with his  
C  
long-distance girlfriend; the time apart  
D  
was just too difficult.
- Q.11 Anna is an amazing lawyer,  
but however she has many personal issues  
A B  
that often get in the way of her  
C D  
professional work.
- Q.12 Until my friends went ice skating,  
A  
I would always stay at home  
B  
for fear of falling down on the ice.  
C D

**Q.13** Whether and not the citizens agreed  
A  
with the final decisions, the politicians  
B  
felt that it was their responsibility to set  
C  
laws that were fair for everyone.  
D

**Q.14** Bob, an insurance agent, wishes he had  
A  
the kind of job that allowed him  
B  
to travel, whenever he wanted.  
C D

**Q.15** Provided by she was paid overtime, Kara  
A B  
agreed to clean the golf course before she  
C D  
left for the day.

**Q.16** When whenever we had enough to eat  
A  
when I was younger, my whole family  
B C  
was completely overjoyed.  
D

**Q.17** There's an old saying,  
"great men are rarely good men."  
A  
but yet many of my favorite heroes from  
B C  
history were exceedingly kind.  
D

**Q.18** The choice between relationships  
A  
or space travel can be excruciating  
B C  
to make.  
D

**Q.19** The neighborhood's changing cultural  
landscape  
A  
is evident in everything from the people  
B  
walking down the sidewalks and the  
C  
products carried in the corner markets.  
D

**Q.20** Neither the teachers or the students were  
A  
told that  
the famous actor and actress would be  
visiting  
B  
the school until the day before the visit; it  
was hard to tell  
C  
which group was the more excited one  
D  
when everyone found out.

**Q.21** The distinction between "all  
natural" or "organic" is something  
A B  
consumers often fail to recognize.  
C D

**Q.22** Neither the aliens who were  
A  
invading or the people who  
B  
were being invaded really  
C  
understood what was happening.  
D

**Q.23** Neither the dog or the cat could climb the  
A  
trees outside the house, for the trees  
B  
were too tall.  
C D

**Q.24** Choosing between the carrot cake with  
A  
cream cheese frosting or the marble cake  
B  
with chocolate ganache was  
C  
an agonizing decision.  
D

**Q.25** Because it is not a holiday, neither the  
A B  
church or the bank is closed early.  
C D

**ANSWER KEY (Worksheet-14)**

1	B	14	C
2	B	15	A
3	C	16	A
4	C	17	B
5	C	18	B
6	C	19	C
7	B	20	A
8	B	21	A
9	A	22	B
10	A	23	A
11	A	24	B
12	A	25	C
13	A	-	

**ANSWERS EXPLAINED****Q.1 Correct Answer B:**

This sentence's error is one that has to do with the logic of conjunctions. The conjunction "and" is used to join two sentences that do not contradict each other. This is not the case with these two sentences: based on the first sentence, you would think that the speaker would only be allowed to check out three books, but this is not the case. So, "and" is not the correct conjunction to use; changing "and" to "but" would correct the sentence's error.

**Q.2 Correct Answer B:**

This sentence begins with "I would bake more cookies" but then the speaker gives a reason why he or she does not bake more cookies, "every time [he or she] tries to bake cookies, [his or her] oven burns them." So, "and" is not the correct conjunction to use in this sentence. A conjunction like "but" is needed to contrast the two parts of the sentence and convey why the speaker does not bake more cookies even though he or she "would."

**Q.3 Correct Answer C:**

This sentence is not coordinated correctly. Logically, the second half contradicts the message of the first, so the conjunction "but"

would be more appropriate. The corrected sentence reads: *Jonathan was a devoted fan of music of almost any kind, but he just could not tolerate reggae.*

**Q.4 Correct Answer C:**

This sentence contains an error in the logical expression of ideas. The original text uses the conjunction "and," which fails to capture the cause and effect relationship between low attendance at the football game and students going to the dance instead. A better conjunction to express the cause and effect relationship would be "because."

**Q.5 Correct Answer C:**

This sentence isn't coordinated correctly. The conjunction "but" does not describe the logical connection between the two parts of the sentence. A better alternative would be, "John was the one who got us into this dangerous situation, so he has absolutely no right to complain."

**Q.6 Correct Answer C:**

This sentence uses the wrong coordinating conjunction. Since "cheerful" and "newly energized" are similar, the conjunction "and" should be used. The corrected sentence reads, "As his friends cut the triple layer chocolate cake, the author felt cheerful and newly energized."

**Q.7 Correct Answer B:**

The error exists in the underlined portion of the sentence, "achieving." In order to explain the background of who the mentor is, it is not sufficient to place a comma after "mentor" without a transition, such as "who achieved." Simply using the word "achieving" is not sufficient. Therefore, "achieving" is the correct answer.

**Q.8 Correct Answer B:**

This sentence contains a redundancy error. The conjunctions "but" and "yet" are synonyms; they mean the same thing, so only one or the other is necessary to convey the intended meaning of the sentence.

The answer choice "sold" is correct because it contains the simple past tense, which is correct



for events that happened in the past and don't continue into the present.

The answer choice "greatest" is correct because it uses the superlative form (the "-est" form) of the adjective great, which is appropriate for comparisons involving more than two items.

The answer choice "of all time" is a perfectly correct use of an idiomatic expression.

**Q.9 Correct Answer A:**

"Once" is the incorrect subordinate conjunction; it should be replaced by "until," which is the only logical conjunction for the sentence.

**Q.10 Correct Answer A:**

The proper form of the subordinating conjunction is "whether or not," not "whether or nor."

**Q.11 Correct Answer A:**

The sentence features a redundancy error—since "but" comes first in the sentence, there is no need to include the synonym "however."

**Q.12 Correct Answer A:****Explanation:**

The sentences uses the incorrect subordinate conjunction "Until"—"When" or "Whenever" would be better choices for the correct subordinate conjunction.

**Q.13 Correct Answer A:**

The form of the subordinating conjunction used here is incorrect—it should be "Whether or not" instead of "Whether and not."

**Q.14 Correct Answer C:**

Since "whenever" is a subordinating conjunction linking a dependent and independent clause, no comma is needed before it. Commas are required before coordinating conjunctions, but not subordinating conjunctions.

**Q.15 Correct Answer A:**

This question is checking for understanding of the subordinate conjunction "provided that." If it helps, "provided that" can be thought of as equivalent to "on the condition that." The only error in the sentence is that "provided by" is used instead of "provided that." "Provided by" has a

different use (as a regular verb) and is not a subordinate conjunction.

An example of "provided by" used correctly: "Her cell phone service was provided by her local cell phone company."

An example of "provided that" used correctly: "Provided that she was paid overtime, Kara agreed to clean the golf course before she left for the day."

**Q.16 Correct Answer A:**

In the sentence above, the words "when" and "whenever" are being used to cause the second portion of the sentence to be a subordinate clause: they are subordinate conjunctions. They also mean roughly the same thing, so using both is redundant. One of the conjunctions should remain in the sentence, and the other should be deleted. The best way to correct the sentence above is:

"When we had enough to eat when I was younger, my whole family was completely overjoyed."

OR

"Whenever we had enough to eat when I was younger, my whole family was completely overjoyed."

**Q.17 Correct Answer B:**

In the sentence above, the words "but" and "yet" are being as subordinate conjunctions. They also mean roughly the same thing. Only one of them is necessary, and the other should be deleted. The best way to correct the sentence above is:

There's an old saying, "great men are rarely good men," yet many of my favorite heroes from history were exceedingly kind.

OR

There's an old saying, "great men are rarely good men," but many of my favorite heroes from history were exceedingly kind.

**Q.18 Correct Answer B:**

This sentence uses the wrong conjunction between "relationships" and "space travel." If you use "between," you also need to use the conjunction "and." The corrected sentence reads,

"The choice between relationships and space travel can be excruciating to make."

**Q.19 Correct Answer C:**

This sentence has a problem with coordination. When "from" is used, it should trigger "to" as the coordinator between examples. That is, the phrasing should be "from (noun) to (other noun)" instead of "from (noun) and (other noun)." The corrected sentence reads, "The neighborhood's changing cultural landscape is evident in everything from the people walking down the sidewalks to the products carried in the corner markets."

**Q.20 Correct Answer A:**

When using the word "neither" to introduce one of two things in a negative fashion, one needs to introduce the other thing using the word "nor," not "or." So, the correct answer is, "Neither the teachers nor the students were told that the famous actor and actress would be visiting the school until the day before the visit; it was hard to tell which group was the more excited one when everyone found out."

**Q.21 Correct Answer A:**

The word "between" always triggers the conjunction "and." Here, "or" is used instead. The corrected sentence reads, "The distinction between "all-natural" and "organic" is something consumers often fail to recognize."

**Q.22 Correct Answer B:**

This sentence has a problem with coordinators. If "neither" is used, it triggers the use of "nor." The corrected sentence reads: *Neither the aliens who were invading nor the people who were being invaded really understood what was happening.*

**Q.23 Correct Answer A:**

The proper conjunction here would be "nor," as it agrees with "neither."

**Q.24 Correct Answer B:**

This sentence does not follow conventions regarding the use of phrase "between X and Y." The conjunction "and," not "or," should always be used when setting up a sentence using "between" to describe a choice or a

comparison. The corrected sentence reads, "Choosing between the carrot cake with cream cheese frosting and the marble cake with chocolate ganache was an agonizing decision."

**Q.25 Correct Answer C:**

"Neither" always takes "nor," never "or." It may be tempting to choose "is." Neither may use plural or singular verbs, depending on the plural or singular quality of the subjects it refers to.

Worksheet-15

MODIFIERS + PERNOUN

**DIRECTIONS:** Some segments of each sentence are underlined. Your task is to identify that underlined segment of the sentence which contains the mistake that needs to be corrected. Fill the circle corresponding to that letter under the segment in the MCQ Response form.

- Q.1 'Anything,' jorkens replied, 'so long as he sticks to it, and sticks to it enough hard and long enough. Anything whatever.'
- Q.2 As often, in so cases, they weren't telling me more than they had to, it was up to me to tell them; that's why they were spending three dollars on me.
- Q.3 One evening, as the sun was setting, any travelers stayed to rest under a clump of trees, and, loosening their camels, set them to graze.
- Q.4 One of them, however, said: "She was a much old woman, who must have died shortly in any case.
- Q.5 One of them, however, said: "She was a very old woman, who must have died shortly in none case.

- Q.6 Sudden he stopped at the edge of the and meadow, took his pocket knife from his pocket, cut a wisp of alfalfa.
- Q.7 "When I bought this a little farm, everybody around here said I'd end up with my family at the country poor farm if I tried to make a living here," he bragged again.
- Q.8 I had seen the beauty of much wild flowers, a few rock cliffs, and many species of hard and soft-wood trees.
- Q.9 I followed at his heels. Just a little steps in front of him a fox squirrel crossed the path and ran up a hickory tree.
- Q.10 The others passengers whirled away across the Martian meadow, leaving the man alone among his family.
- Q.11 Of the two cars that you have, the new Suzuki is without any question the cheapest to run.
- Q.12 Since the boy was absorbing much too poison to permit proper application to his college work, we had to ask him to go home.

Q.13 You can get Clay around to the truth  
A B  
enough easy just as soon as he gets his  
C D  
father home.

Q.14 And suddenly, in a torrent of thoughts  
A  
very pressing to be put into words, Chips  
B C  
made answer to himself.  
D

Q.15 He is so tight-fisted that he spends  
A  
nothing on himself and lives miserly.  
B C D

Q.16 There were marks on the snow but their  
A B C  
were unrecognizable.  
D

Q.17 The dog wagged it's tail when it saw me.  
A B C D

Q.18 To who did you pass the message I gave  
A B C D  
you?

Q.19 We have to do it ourself as there are not  
A B  
enough workers to finish it on time.  
C D

Q.20 The boy which was chosen as Head Boy  
A B C  
is my Friend.  
D

**DIRECTIONS:** In each of the following questions, four alternative sentences are given. Choose the CORRECT one and fill the Circle corresponding to that letter in the MCQ Response Form.

Q.21

- A) Based on ours prior knowledge of the impartial judge, we knew that the winner would be whomever does best.
- B) Based on our prior knowledge of the impartial judge, us knew that the winner would be whomever does best.
- C) Based on our prior knowledge of the impartial judge, we knew that the winner would be whoever does best.
- D) Based on our prior knowledge of the impartial judge, we knew that the winner would be whomever does best.

Q.22

- A) Him and I had planned to spend vacation in hilly areas, but we couldn't arrange finances.
- B) He and I had planned to spend vacation in hilly areas, but we couldn't arrange finances.
- C) Him and me had planned to spend vacation in hilly areas, but we couldn't arrange finances.
- D) Him and I had planned to spend vacation in hilly areas, but us couldn't arrange finances.

Q.23

- A) I admit that it were my fault to rely on he.
- B) I admit that it was mine fault to rely on him.
- C) We admit that it was mine fault to rely on him.

- D) I admit that it was my fault to rely on him.

**Q.24**

- A) I can't give my comments until I have seen the film myself.  
B) I can't give my comments until I have seen the film myself.  
C) I can't give mine comments until me have seen the film myself.  
D) I can't give my comments until I have seen the film myself.

**Q.25**

- A) She make a handsome gift to him.  
B) She made him a handsome gift.  
C) She made a handsomely gift to himself.  
D) She making a handsome gift to him.

**Q.26**

- A) The girl fell asleep as soon as them arrived.  
B) The girl felled asleep as soon as them arrived.  
C) The girl fell asleep as soon as they arrived.  
D) The girl fall asleep as soon as themselves arrived.

**Q.27**

- A) Their did it themselves.  
B) They did it themself.  
C) Them did it themselves.  
D) They did it themselves.

**Q.28**

- A) Businesses need subsidies each year to prevent them from loss.  
B) Businesses need subsidies each year to prevent themselves from loss.  
C) Businesses need subsidies each year to prevent them self from loss.  
D) Businesses each year need to prevent subsidies from loss.

**Q.29**

- A) Their plans to close several of there projects.  
B) They are planning to close several of their projects.  
C) They are planning to close several of them projects.  
D) Are they planning to close several of theirs projects.

**Q.30**

- A) Them should act to prevent further economic damages  
B) Theirs should act to prevent further economic damages  
C) They should act to prevent further economic damages  
D) Themselves should act to prevent further economic damages

**Q.31**

- A) Whom could they choose but the man who had worked for it all those years?  
B) Who could they choose but the man whom had worked for it all those years?  
C) Whom could them chose but the man who had worked for it all those years?  
D) Whom could they choose but man who had worked for it all those years.



Q.32

- A) Students should learn a lesson from what they read in the story because one's may be in the same situation someday.
- B) Students should learn a lesson from what they read in the story because they may be in the same situation someday.
- C) Students should learn a lesson from what they read in the story because one may be in the same situation someday.
- D) Students should learn a lesson from what they read in the story because ones may be in the same situation someday.

Q.33

- A) You, I and she have been commended for the success of the project.
- B) You, she and I have been commended from the success of the project.
- C) You, she and I have been commended for the success of the project.
- D) I, she and you have been commended for the success of the project.

Q.34

- A) The batting team in cricket has eleven players, of whom two will be at the crease at any moment.
- B) The batting team in cricket has eleven players, of who two will be at the crease at any moment.
- C) The batting team in cricket has eleven players, of which two will be at the crease at any moment.

- D) The batting team in cricket have eleven players, of whom two will be at the crease at any moment.

Q.35

- A) The student whom aims to get the first rank must invest a significant amount of his time and energy in hard work.
- B) The student whose aims to get the first rank must invest a significant amount of their time and energy in hard work.
- C) The student who aims to get the first rank must invest a significant amount of theirs time and energy in hard work.
- D) The student who aims to get the first rank must invest a significant amount of his time and energy in hard work.

Q.36

- A) The smell of his new saddle and bridle-leather was sweet than mine.
- B) The smell of his new saddle and bridle-leather was sweeter than me.
- C) The smell of his new saddle and bridle-leather was sweeter than my.
- D) The smell of his new saddle and bridle-leather was sweeter than mine.

Q.37

- A) After you play in the sand at the beach, its very easy to get a lot of sand stuck in your shoes.
- B) After you play in the sand at the beach, it's very easy to get a lot of sand stuck in your shoes.



- C) After yours play in the sand at the beach, it's very easy to get a lot of sand stuck in your shoes.
- D) After you play in the sand at the beach, it's very easy to get a lot of sand stuck in yours shoes.

**Q.38**

- A) In general election, the competition was very fierce, but It was ours who won the election.
- B) In general election, the competition was very fierce, but It was our who won the election.
- C) In general election, the competition was very fierce, but It was us who won the election.
- D) In general election, the competition was very fierce, but It was we who won the election.

**Q.39**

- A) On the TV show I saw last night said that unemployment is rising.
- B) On the TV show I saw last night it said that unemployment is rising.
- C) The TV show I saw last night it said that unemployment is rising.
- D) The TV show I saw last night said that unemployment is rising.

**Q.40**

- A) The police usually ask for every detail that help identify the missing person.
- B) The police usually ask about every detail that helps to identify the missing person.
- C) The police usually ask for every detail that helps identify the missing person.
- D) The police usually ask for every detail which helps identify the missing person.

**ANSWER KEY (Worksheet-15)**

1	C	21	C
2	A	22	B
3	B	23	D
4	B	24	B
5	D	25	B
6	A	26	C
7	B	27	D
8	A	28	B
9	B	29	B
10	A	30	C
11	C	31	A
12	A	32	B
13	C	33	C
14	B	34	A
15	D	35	D
16	C	36	D
17	B	37	B
18	A	38	D
19	A	39	D
20	B	40	C

**ANSWERS EXPLAINED**

- Q.1 Correct Answer C: (hard enough)  
 Q.2 Correct Answer A: (such)  
 Q.3 Correct Answer B: (some)  
 Q.4 Correct Answer B: (very old)  
 Q.5 Correct Answer D: (any)  
 Q.6 Correct Answer A: (suddenly)  
 Q.7 Correct Answer B: (little)  
 Q.8 Correct Answer A: (many)  
 Q.9 Correct Answer B: (a few)  
 Q.10 Correct Answer A: (the other)  
 Q.11 Correct Answer C: (The cheaper)  
 Q.12 Correct Answer A: (too much)

- Q.13 Correct Answer C: (easy enough)  
 Q.14 Correct Answer B: (too)  
 Q.15 Correct Answer D: (in a miserly way)  
 Q.16 Correct Answer C: (they)  
 Q.17 Correct Answer B: (its)  
 Q.18 Correct Answer A: (whom)  
 Q.19 Correct Answer A: (ourselves)  
 Q.20 Correct Answer B: (who)  
 Q.21 Correct Answer C:  
 Our instead of ours.  
 Q.22 Correct Answer B:  
 He and I.  
 Q.23 Correct Answer D:  
 My fault.  
 Q.24 Correct Answer B:  
 My comments until I have seen.  
 Q.25 Correct Answer B:  
 Made him a handsome gift \_\_\_\_ direct  
 object pronoun.  
 Q.26 Correct Answer C:  
 They arrived.  
 Q.27 Correct Answer D:  
 They (sub) did it themselves (emphatic).  
 Q.28 Correct Answer B:  
 Prevent themselves (reflexive).  
 Q.29 Correct Answer B:  
 Their (possessive).  
 Q.30 Correct Answer C:  
 They (subject).  
 Q.31 Correct Answer A:  
 Use this he/him method to decide  
 whether who or whom is correct.  
 he = who  
 him = whom  
**Examples:**  
 Who/Whom wrote the letter?  
 He wrote the letter. Therefore, who is  
 correct.  
 Who/Whom should I vote for?

Should I vote for him? Therefore,  
whom is correct.

**Q.32 Correct Answer B:**

A pronoun usually refers to something  
earlier in the text (its antecedent) and  
must agree in number — singular/plural  
— with the thing to which it refers.

Students ..... they

One.....one

**Q.33 Correct Answer C:**

When some pleasant news is to be  
announced, follow the following order:

**II person, III person and I person (231)**

and when some unpleasant news is to be  
announced, follow the following order:

**I person, II person and III person (132)**

**Q.34 Correct Answer A:**

After a preposition, use whom not who.

Who refer to people and which refer to  
things.

**Q.35 Correct Answer D:**

**Who ..... subject**

**Whose .....possession**

**Whom ..... object**

**Q.36 Correct Answer D:**

To decide whether to use the subject  
possessive, or object pronoun after the  
words than or as, mentally complete the  
sentence.

**Q.37 Correct Answer B:**

The only time it's has an apostrophe is  
when it is a contraction for it is or it has.

**Q.38 Correct Answer D:**

Use a subjective case of pronoun after be  
forms of verb.

**Q.39 Correct Answer D:**

Double subject is wrong. The TV show  
and IT both act as subjects.

**Q.40 Correct Answer C:**

After EVERY that is used instead of  
which.

Worksheet-16

PUNCTUATION

**DIRECTIONS:** Some segments of each sentence are underlined. Your task is to identify that underlined segment of the sentence which contains the mistake that needs to be corrected. Fill the circle corresponding to that letter under the segment in the MCQ Response form.

- Q.1 Knitting may appear  
A  
complex, but even its most complicated  
B  
patterns can be created from a  
C  
combination of just two stitches; knit  
D  
stitches and purl stitches.
- Q.2 Everyone on the team agreed that the best option was to forfeit the  
A  
game; without their best player; the team  
B C  
didn't have a chance of winning.  
D
- Q.3 That book over there belongs  
A B  
to Eileen; so we should return it to her  
C  
before she needs to study for the massive  
D  
English test next week.
- Q.4 During Roman times, Julius Caesar was well known not only for his  
A B  
superior strategy on the  
battlefield; but also for his oratorical  
C D  
abilities.
- Q.5 James's grocery list included  
A  
the following items; broccoli, frozen  
B C  
yogurt, bread, pork chops, and eggs.  
D

- Q.6 I was going to go for a  
A  
run today, however, the stormy weather  
B C  
caused me to postpone my workout.  
D
- Q.7 The martial art of karate is based around  
A B  
two ain techniques; kicks and punches. \_  
C D
- Q.8 Jamie and Geanna could not agree  
on what day would be best to go to the  
A B  
music festival; Jamie wanted to go see a  
C  
great DJ on Saturday; while Geanna  
D  
wanted to see her favorite band on  
Sunday.
- Q.9 Nathan has never been known as a  
A  
shy person; and he proved that again  
B  
tonight by jumping on stage  
C  
and singing with the band.  
D
- Q.10 The guests will have  
several desserts to choose from; chocolate  
A B C  
cake, lemon sorbet, peach pie, and flan.  
D

**DIRECTIONS:** Each sentence below has a blank indicating that something has been omitted. Choose the word that best fits in with the meaning of the sentence as a whole.

- Q.11
- A) I am asking if you would like to rollerblade together tomorrow?  
B) I am asking "if you would like to rollerblade together tomorrow?"  
C) I am asking if you would like to rollerblade together tomorrow.

D) I am asking "if you would like to rollerblade together tomorrow."

**Q.12**

- A) Yes, Jean, you were right about that answer.
- B) Yes Jean, you were right about that answer.
- C) Yes Jean you were right about that answer.
- D) Yes, Jean, you were right, about that answer.

**Q.13**

- A) I saw our town's ex-Mayor in the mall.
- B) I saw our town's ex-mayor in the mall.
- C) I saw our town's ex Mayor in the mall.
- D) I saw our town's exMayor in the mall.

**Q.14**

- A) Wherever we go, People recognize us.
- B) Wherever we go. People recognize us.
- C) Wherever we go; people recognize us.
- D) Wherever we go, people recognize us.

**Q.15**

- A) Whenever Cheryl is in town. She visits her sister.
- B) Whenever Cheryl, is in town, she visits her sister.
- C) Whenever, Cheryl is in town, she visits her sister.
- D) Whenever Cheryl is in town, she visits her sister.

**Q.16**

- A) My favorite musician, who is also my cousin, plays a mean fuzz bass.
- B) My favorite musician who is also my cousin plays a mean fuzz bass.
- C) My favorite musician who is also my cousin, plays a mean fuzz bass.
- D) My favorite musician, who is also my cousin plays a mean fuzz bass.

**Q.17**

- A) It may not be the correct part, but I bet that it works.
- B) It may not be the correct part but, I bet that it works.
- C) It may not be the correct part but: I bet that it works.

D) It may not be the correct part but, I bet, that it works.

**Q.18**

- A) You are my friend; however, I cannot afford to lend you any more money.
- B) You are my friend; however; I cannot afford to lend you any more money.
- C) You are my friend, however I cannot afford; to lend you any more money.
- D) You are, my friend, however. I cannot afford to lend you any more money.

**Q.19**

- A) Paul Simon sang, "I am a rock, I am. An island."
- B) Paul Simon sang, "I am a rock; I am an island."
- C) Paul Simon sang I am a rock; I am an island.
- D) Paul Simon sang I am a rock, I am an island.

**Q.20**

- A) I asked Ella, "Did he ask for his ring back"?
- B) I asked Ella did he ask for his ring back.
- C) I asked Ella, "Did he ask for his ring back?"
- D) I asked Ella, "did he ask for his ring back?"

**Q.21**

- A) John F. Kennedy Jr. became a magazine publisher and a pilot before his tragic death.
- B) John F. Kennedy Jr. became a magazine publisher, and a pilot before his tragic death.
- C) John F. Kennedy Jr., became a magazine publisher and a pilot, before his tragic death.
- D) John F. Kennedy Jr. became a magazine, publisher, and a pilot before his tragic death.

**Q.22**

- A) Julio, my friend from Ames, Ohio will join us.
- B) Julio, my friend from Ames, Ohio, will join us.
- C) Julio, my friend, from Ames, Ohio will join us.
- D) Julio my friend from Ames Ohio will join us.

**Q.23**

- A) The elections will be held on: the first Tuesday of November, 2018.
- B) The elections will be held, on the first Tuesday of November 2018.
- C) The elections will be held on the first Tuesday, of November 2018.
- D) The elections will be held on the first Tuesday of November 2018.

**Q.24**

- A) The elections will be held on Tuesday November 6, 2018, and the polls will be kept open until 8:00 p.m.
- B) The elections will be held on Tuesday, November 6, 2018, and the polls will be kept open until 8:00 p.m.
- C) The elections will be held on Tuesday, November 6, 2018 and the polls will be kept open until 8:00 p.m.
- D) The elections will be held on: Tuesday, November 6, 2018, and the polls will be kept open until 8:00 p.m.

**Q.25**

- A) It is good that a caring dedicated teacher like Mr. Fuentes, should be appreciated by students who are usually bored and too busy.
- B) It is good that a caring, dedicated teacher like Mr. Fuentes should be appreciated by students who are usually, bored and too busy.
- C) It is good that a caring dedicated teacher like Mr. Fuentes should be appreciated by students who are usually bored and too busy.
- D) It is good that a caring, dedicated teacher like Mr. Fuentes should be

appreciated by students who are usually bored and too busy.

**Q.26**

- A) Knowing her own strengths and working hard made her a success in school.
- B) Knowing her own strengths and working hard, made her a success in school.
- C) Knowing her own strengths and working hard made her, a success, in school.
- D) Knowing her own strengths, and working hard made her a success in school.

**Q.27**

- A) I need to locate four states on the map: Minnesota, Michigan, California, and Nevada.
- B) I need to locate four states on the map. Minnesota; Michigan; California; and Nevada.
- C) I need to locate four states on the map Minnesota, Michigan, California, and Nevada.
- D) I need to locate four states on the map; Minnesota, Michigan, California, and Nevada.

**Q.28**

- A) Right now I want two things peace and quiet.
- B) Right now I want two things; peace and quiet.
- C) Right now I want two things ... peace and quiet.
- D) Right now I want two things: peace and quiet.

**Q.29**

- A) Our philosophy teacher thinks that Einstein believed: that we cannot stop war by waging war.
- B) Our philosophy teacher thinks that Einstein believed that, we cannot stop war by waging war.
- C) Our philosophy teacher thinks that Einstein believed that we cannot stop war by waging war.



- D) Our philosophy teacher thinks that Einstein believed, that we cannot stop war by waging war.

**Q.30**

- A) A well—made argument was presented for negotiating a peaceful resolution.  
B) A well made argument was presented, for negotiating a peaceful resolution.  
C) A well-made argument was presented for negotiating a peaceful resolution.  
D) A well-made-argument was presented for negotiating a peaceful resolution.

STEP ENTRY TEST 2020

**ANSWER KEY (Worksheet-16)**

1	D	16	A
2	C	17	A
3	C	18	A
4	C	19	B
5	C	20	C
6	B	21	A
7	C	22	B
8	D	23	D
9	B	24	B
10	C	25	D
11	C	26	A
12	A	27	A
13	B	28	D
14	D	29	C
15	D	30	C

**ANSWERS EXPLAINED****Q.1 Correct Answer D:** (just two stitches)

This sentence's error lies in the incorrect way in which it uses a semicolon to introduce a list. "Knit stitches and purl stitches" are the "two stitches" that the sentence introduces earlier, so a colon is the most appropriate punctuation mark to use in this instance. The corrected sentence reads, "Knitting may appear complex, but even its most complicated patterns can be created from a combination of just two stitches: knit stitches and purl stitches."

**Q.2 Correct Answer C:** (player; the)

A comma should be used instead of a semicolon to separate the introductory phrase "without their best player" from the rest of the second independent clause "the team didn't have a chance of winning."

**Q.3 Correct Answer C:** (eileen)

A semicolon is meant to connect two thoughts that are both independent clauses. However, the second clause here

is dependent and is connected by the word "so." In this situation, a comma would be appropriate to link that subordinate clause to the first independent clause. So, the corrected sentence would read, "That book over there belongs to Eileen, so we should help return it to her before she needs to study for the massive English test next week."

**Q.4 Correct Answer C:** (battlefield; but)

A semicolon is used to connect two independent clauses. In this case, the phrase that follows the semicolon is not an independent clause (a complete sentence that can stand on its own), so the use of a semicolon here is incorrect. Changing the semicolon to a comma would correct the sentence's error.

**Q.5 Correct Answer C:** (items; broccoli)

A colon, not a semicolon, should be used to introduce a list of things. Semicolons are only used to connect two independent clauses, or parts of a combined sentence that could each stand alone as an independent sentence. That isn't the case in this sentence; "broccoli, frozen yogurt, bread, pork chops, and eggs" is not a complete sentence.

**Q.6 Correct Answer B:** (today,)

The sentence has two independent clauses. Each could be its own sentence: "I was going to go for a run today" and "the stormy weather caused me to postpone my workout." They are joined by a conjunctive adverb, "however." (Other conjunctive adverbs include "accordingly," "consequently," "hence," "moreover," "otherwise," "therefore," and "thus.") When two independent clauses are joined by a conjunctive adverb, they require a semicolon after the first clause, not a comma. The corrected sentence would read, "I was going to go for a run today; however, the stormy weather caused me to postpone my workout."

**Q.7 Correct Answer C:** (techniques;)

The semicolon used after "techniques" is an inappropriate way to introduce a list. To correct this error, we should replace the semicolon with a colon.

**Q.8 Correct Answer D:** (satured;)

The semicolon after "Saturday;" is the error in the sentence, and should be replaced with a comma to correctly separate the clauses.

**Q.9 Correct Answer B:** (person)

The semicolon after "person" is incorrectly used in this sentence, and should be replaced with a comma.

**Q.10 Correct Answer C:** (from;)

Here, we're separating an independent clause ("The guests will have several desserts to choose from") from a list ("chocolate cake, lemon sorbet, peach pie, and flan"), so the correct punctuation is a colon and not a semicolon. Semicolons are only used to separate two independent clauses, not an independent clause and a list.

**Q.11 Correct Answer C:**

I am asking if you would like to rollerblade together tomorrow. Explanation: this is not a direct quote, nor is it a direct question.

**Q.12 Correct Answer A:**

Yes, Jean, you were right about that answer. Explanation: when you address someone directly by name or title within a sentence, surround the name or title with commas.

**Q.13 Correct Answer B:**

I saw our town's ex-mayor in the mall. Explanation: hyphenate words beginning with the prefix ex; do not capitalize titles unless they directly precede a name. Your Answer: Not Answered

**Q.14 Correct Answer D:**

Wherever we go, people recognize us. Explanation: use a comma after an introductory clause. Your Answer: Not Answered

**Q.15 Correct Answer D:**

Whenever Cheryl is in town, she visits her sister. Explanation: use a comma after an introductory clause.

**Q.16 Correct Answer A:**

My favorite musician, who is also my cousin, plays a mean fuzz bass. Explanation: the nonessential clause "who is also my cousin" should be set off by commas. Your Answer: Not Answered

**Q.17 Correct Answer A:**

It may not be the correct part, but I bet that it works. Explanation: the comma after "part" is not strictly necessary, but it puts a brief, appropriate pause between the two clauses. Your Answer: Not Answered

**Q.18 Correct Answer A:**

You are my friend; however, I cannot afford to lend you any more money. Explanation: use a semicolon between two closely related independent clauses. Your Answer: Not Answered

**Q.19 Correct Answer B:**

Paul Simon sang, "I am a rock; I am an island." Explanation: See Explanation 8. Use quotation marks when writing a direct quote. Your Answer: Not Answered

**Q.20 Correct Answer C:**

I asked Ella, "Did he ask for his ring back?"

Explanation: the question mark belongs inside the quotation marks because the quotation is a question.

Your Answer: Not Answered

**Q.21 Correct Answer A:**

John F. Kennedy Jr. became a magazine publisher and a pilot before his tragic death.

Explanation: no commas are necessary in this sentence.

Your Answer: Not Answered

**Q.22 Correct Answer B:**

Julio, my friend from Ames, Ohio, will join us.

Explanation: when both city and state are mentioned before the end of a sentence, put a comma after the city and another after the state.

Your Answer: Not Answered

**Q.23 Correct Answer D:**

The elections will be held on the first Tuesday of November 2018.

Explanation: no commas are needed here because no complete dates are given.

Your Answer: Not Answered

**Q.24 Correct Answer B:**

The elections will be held on Tuesday, November 6, 2018, and the polls will be kept open until 8:00 p.m.

Explanation: When month, day, and year are mentioned before the end of a sentence, put a comma after the day and another after the year. When, as in this sentence, the day of the week is mentioned first, follow it with a comma also.

**Q.25 Correct Answer D:**

It is good that a caring, dedicated teacher like Mr. Fuentes should be appreciated by students who are usually bored and too busy.

Explanation: a comma is required between “caring” and “dedicated” because the order of these adjectives is

interchangeable and both words have equal weight in describing “teacher.”

**Q.26 Correct Answer A:**

Knowing her own strengths and working hard made her a success in school.

Explanation: the sentence does not require a comma.

Your Answer: Not Answered

**Q.27 Correct Answer A:**

I need to locate four states on the map: Minnesota, Michigan, California, and Nevada.

Explanation: use a colon to introduce a series of items.

Your Answer: Not Answered

**Q.28 Correct Answer D:**

Right now I want two things: peace and quiet.

Explanation: use a colon when examples follow a statement.

Your Answer: Not Answered

**Q.29 Correct Answer C:**

Our philosophy teacher thinks that Einstein believed that we cannot stop war by waging war.

Explanation: This sentence does not require a comma. Avoid colons before a list when they directly follow a verb or preposition.

Your Answer: Not Answered

**Q.30 Correct Answer C:**

A well-made argument was presented for negotiating a peaceful resolution.

Explanation: hyphenate two or more words (“well-made”) that act as one idea in front of a noun.

Your Answer: Not Answered

Worksheet-17

PUNCTUATION

**DIRECTIONS:** Some segments of each sentence are underlined. Your task is to identify that underlined segment of the sentence which contains the mistake that needs to be corrected. Fill the circle corresponding to that letter under the segment in the MCQ Response form.

- Q.1 No matter what I do, I can't seem to  
A B  
convince the board of directors that  
achieving the designer's vision will  
C  
be impossible, when considering  
D  
economies of scale.
- Q.2 Being a weak speller I was not able  
A  
to score well when it came time to write  
B  
the inspirational essay; we were given no  
C  
resources to check our spelling or  
grammar before we handed in the  
D  
assignment.
- Q.3 The panel of scientists was fascinated by  
A  
the rare species of tree frog which was  
B  
capable of producing toxins to  
incapacitate or even kill a  
full-grown horse, human, or cow.  
C D
- Q.4 Being an unlikely candidate for governor the  
A  
woman nevertheless charmed voters with  
B  
her candor, fervency, and sardonic sense of  
C D  
humor.
- Q.5 Even with a combination  
of whiskey, opium, and assistants early  
A B

- amputations were grisly, excruciating  
C  
procedures that often resulted in infection  
D  
and death.
- Q.6 Ever since Joachim quit his last job he has  
A  
been free to pursue his solo  
B  
jazz career, and he has actually  
C  
become quite skilled at improvisation.  
D
- Q.7 "Above all you must remember to  
A  
conjugate the verbs correctly  
B  
on tomorrow's test," the French teacher  
C D  
said.
- Q.8 The student body cheered  
A  
loudly and celebrated wildly, when summer  
B C  
vacation arrived once again.  
D
- Q.9 Jane wanted to go  
A  
parasailing over vacation but then, a  
B C  
fierce storm rolled in and flooded the  
D  
harbor.
- Q.10 The crowd jumped out of their seats and  
A  
cheered loudly, when the home team  
B  
scored the game-winning shot at the  
C D  
buzzer.

**DIRECTIONS:** In each of the following questions, four alternative sentences are given. Choose the **CORRECT** one and fill the Circle corresponding to that letter in the MCQ Response Form.

**Q.11**

- A) A state-of-the-art printer is not that expensive.
- B) A state of the art printer is not that expensive.
- C) A state-of the art printer is not that expensive.
- D) A state-of-the art printer is not that expensive.

**Q.12**

- A) A liberally sprinkled dose of humor was very much appreciated.
- B) A liberally-sprinkled dose of humor was very much appreciated.
- C) A liberally-sprinkled-dose of humor was very much appreciated.
- D) A liberally sprinkled dose-of-humor was very much appreciated.

**Q.13**

- A) Our liberal minded clergyman managed to unite the entire congregation.
- B) Our liberal-minded clergyman managed to unite the entire congregation.
- C) Our liberal-minded-clergyman managed to unite the entire congregation.
- D) Our-liberal-minded clergyman managed to unite the entire congregation.

**Q.14**

- A) Our clergyman, who united the entire congregation, was liberal minded.
- B) Our clergyman who united the entire congregation was liberal minded.
- C) Our clergyman, who united the entire congregation, was liberalminded.
- D) Our clergyman, who united the entire congregation, was liberal-minded.

**Q.15**

- A) Jan asked; "What did Joe mean when he said, 'I will see you later.' "
- B) Jan asked, "What did Joe mean when he said, 'I will see you later?' "
- C) Jan asked, "What did Joe mean when he said, 'I will see you later'?"
- D) Jan asked, "What did Joe mean when he said, 'I will see you later' "?

**Q.16**

- A) When I noticed that our dog cut it's paw, I called the veterinarian right away.
- B) When I noticed that our dog cut it's paw. I called the veterinarian right away.
- C) When I noticed that our dog cut its paw, I called the veterinarian right away.
- D) When I noticed that our dog cut its paw; I called the veterinarian right away.

**Q.17**

- A) Just to be sure, I called three more doctors' offices.
- B) Just to be sure, I called three more doctors offices.
- C) Just to be sure, I called three more doctor's offices.
- D) Just to be sure, I called three more doctor offices'.

**Q.18**

- A) "Your right to be concerned," said one veterinarian. "I would like to take a look at your dog."
- B) "Your right to be concerned," said one veterinarian, "I would like to take a look at your dog."
- C) "You're right to be concerned." said one veterinarian. "I would like to take a look at your dog."
- D) "You're right to be concerned," said one veterinarian. "I would like to take a look at your dog."



Q.19

- A) The friendly looking vet examined our dogs paw.
- B) The friendly-looking vet examined our dogs paw.
- C) The friendly-looking vet examined our dog's paw.
- D) The friendly looking vet examined our dog's paw.

Q.20

- A) We had pet insurance but still owed \$40 in fees.
- B) We had pet insurance: but still owed \$40 in fees.
- C) We had pet insurance but, still owed \$40 in fees.
- D) We had pet-insurance but still owed \$40 in fees.

Q.21

- A) I guess she did what any self-respecting dog would do by grooming herself.
- B) I guess she did what any selfrespecting dog would do by grooming herself.
- C) I guess she did what any self respecting dog would do by grooming herself.
- D) I guess she did what any self-respecting-dog would do by grooming herself.

Q.22

- A) These apostrophe's main purpose is to show possession.
- B) These apostrophes' main purpose is to show possession.
- C) These apostrophes main purpose is to show possession.
- D) These apostrophe's main purpose are to show possession.

Q.23

- A) I want that very elegant looking watch.
- B) I want that very elegant-looking watch.
- C) I want that very-elegant-looking watch.
- D) I want that very-elegant looking watch.

Q.24

- A) Our two year old is starting to talk.
- B) Our two-year-old is starting to talk.
- C) Our two year-old is starting to talk.
- D) Our two-year old is starting to talk.

Q.25

- A) Our son will be two years old next week.
- B) Our son will be two-years-old next week.
- C) Our son will be two-years old next week.
- D) Our son will be two years-old next week.

Q.26

- A) When Wendy re-covered, she called her ex-husband.
- B) When Wendy recovered, she called her exhusband.
- C) When Wendy recovered, she called her ex-husband.
- D) When Wendy re-covered, she called her exhusband.

Q.27

- A) The artist used oil-based paints in a Modernist style.
- B) The artist used oil-based paints in a Modernist-style.
- C) The artist used oil based paints in a Modernist-style.
- D) The artist used oil based paints in a Modernist style.

Q.28

- A) Howie—and that crazy friend of his—are coming.
- B) Howie—and that crazy friend of his—is coming.
- C) Howie—and that crazy friend of his are coming.
- D) Howie and that crazy friend of his—is coming.

**Q.29**

- A) “Do you understand her need for privacy,” Wendy asked her husband?
- B) “Do you understand her need for privacy,” Wendy asked her husband.
- C) “Do you understand her need for privacy”? Wendy asked her husband.
- D) “Do you understand her need for privacy?” Wendy asked her husband.

**Q.30**

- A) The two hostess’s jobs are quite different.
- B) The two hostesses’ jobs are quite different.
- C) The two hostesses jobs are quite different.
- D) The two hostess’ jobs are quite different.

**ANSWER KEY (Worksheet-17)**

1	D	16	C
2	A	17	A
3	B	18	D
4	A	19	C
5	B	20	A
6	A	21	A
7	A	22	B
8	C	23	B
9	B	24	B
10	B	25	A
11	A	26	C
12	A	27	A
13	B	28	B
14	A	29	D
15	C	30	B

**ANSWERS EXPLAINED****Q.1 Correct Answer D:** (impossible)

“No matter what I do” is a dependent clause, so it must be separated from the rest of the sentence by a comma; however, “when considering economies of scale” is not a dependent clause in this case, so it shouldn’t be preceded by a comma. It is instead part of the preceding independent clause, and it can’t be removed from the sentence without losing some of the main idea.

**Q.2 Correct Answer :** (being a weak speller)

“Being a weak speller” is a modifier that describes the narrator of the sentence, and it is a dependent clause. A comma is needed after “speller.” The semicolon is used correctly to separate two independent clauses without a conjunction here.

**Q.3 Correct Answer B:** (frog, which)**Q.4 Correct Answer A:** (being an unlikely candidate for governor)

Here, “Being an unlikely candidate for governor” is a dependent clause. It relies on the independent clause (the rest of the

sentence) for meaning, so it should be separated from that independent clause with a comma after “governor.” The list is punctuated correctly with commas here.

**Q.5 Correct Answer B:** (assistants)

Here, “Even with a combination of whiskey, opium, and assistants” is a dependent clause that depends upon the rest of the sentence (“early amputations were grisly, excruciating procedures that often resulted in infection and death”) for its meaning, so it should be separated from that independent clause with a comma after “assistants.”

**Q.6 Correct Answer A:**

“Ever since Joachim quit his last job” is a dependent clause, so it should be separated from the rest of the sentence with a comma. There is also a comma after “career,” as we’re separating two independent clauses with a conjunction (“and”) and therefore we need a comma before that conjunction.

**Q.7 Correct Answer A:** (above all)

Here, “Above all” is an introductory phrase and a dependent clause, so it must be followed by a comma. The direct speech is correctly punctuated in the original sentence.

**Q.8 Correct Answer C:** (wildly, when)

The comma used between “wildly” and “when” is extraneous and creates a grammatical error in this sentence. No comma is needed to separate the subordinate clause “when summer vacation arrived once again” from the independent clause “The student body cheered loudly and celebrated wildly.” Note that if the order of these clauses were reversed and the sentence began with the subordinate clause, a comma would be needed after “again”: “When summer vacation arrived once again, the student body cheered loudly and

celebrated wildly"; however, since the subordinate clause follows the independent clause in the sentence as it is given, no comma is needed.

**Q.9 Correct Answer B:** (vacation but then, a)  
The placement of the comma in this sentence between "then" and "a" is incorrect. The comma should instead appear between "vacation" and "but" in order to correctly connect the compound sentence's two independent clauses using a comma followed by a conjunction.

**Q.10 Correct Answer B:** (loudly, when)  
The comma between "loudly" and "when" is unnecessary, creating and punctuation error in the sentence.

**Q.11 Correct Answer A:**  
A state-of-the-art printer is not that expensive.  
Explanation: in this sentence, the compound adjective "state-of-the-art" requires three hyphens.  
Your Answer: Not Answered

**Q.12 Correct Answer A:**  
A liberally sprinkled dose of humor was very much appreciated.  
Explanation: do not hyphenate ly adverbs.  
Your Answer: Not Answered

**Q.13 Correct Answer B:**  
Our liberal-minded clergyman managed to unite the entire congregation.  
Explanation: hyphenate two or more words ("liberal-minded") that act as one idea in front of a noun.  
Your Answer: Not Answered

**Q.14 Correct Answer A:**  
Our clergyman, who united the entire congregation, was liberal minded.  
Explanation: It is usually not necessary to hyphenate words acting as one idea that follow the noun they are modifying. Also note that the nonessential clause "who

united the entire congregation" should be set off by commas.

Your Answer: Not Answered

**Q.15 Correct Answer C:**  
Jan asked, "What did Joe mean when he said, 'I will see you later'?"  
Explanation: Use single quotation marks for quotes within quotes. In this sentence the question mark is within the double quotation marks because Jan is asking, "What did Joe mean ...?"  
Your Answer: Not Answered

**Q.16 Correct Answer C:**  
When I noticed that our dog cut its paw, I called the veterinarian right away.  
Explanation: it's is a contraction for it is or it has, while its is a possessive pronoun.  
Your Answer: Not Answered

**Q.17 Correct Answer A:**  
Just to be sure, I called three more doctors' offices.  
Explanation: for a plural possessive, write the plural of a word ("doctors") first, then use the apostrophe.  
Your Answer: Not Answered

**Q.18 Correct Answer D:**  
"You're right to be concerned," said one veterinarian. "I would like to take a look at your dog."  
Explanation: the sentence ends after "veterinarian" so use a comma before the end of the first quote and then a period after "veterinarian" before beginning a new quote.

**Q.19 Correct Answer C:**  
The friendly-looking vet examined our dog's paw.  
Explanation: friendly is an ly adjective, not an adverb.

**Q.20 Correct Answer A:**  
We had pet insurance but still owed \$40 in fees.

Explanation: no punctuation is needed before “but” because it does not introduce a new clause.

Your Answer: Not Answered

**Q.21 Correct Answer A:**

I guess she did what any self-respecting dog would do by grooming herself.

Explanation: hyphenate all compound words having self as the prefix.

Your Answer: Not Answered

**Q.22 Correct Answer B:**

These apostrophes’ main purpose is to show possession.

Explanation: The plural of apostrophe is apostrophes. To show possession, write the plural first. If it ends in s, add the apostrophe after the s. Since the subject of the sentence is “purpose,” select the singular verb “is.”

Your Answer: Not Answered

**Q.23 Correct Answer B:**

I want that very elegant-looking watch.

Explanation: the adverb very is not hyphenated.

Your Answer: Not Answered

**Q.24 Correct Answer B:**

Our two-year-old is starting to talk.

Explanation: when hyphens are involved, two hyphens are required with ages.

Your Answer: Not Answered

**Q.25 Correct Answer A:**

Our son will be two years old next week.

Explanation: do not use hyphens when the period of time (years, months, weeks, days, etc.) is written plural.

Your Answer: Not Answered

**Q.26 Correct Answer C:**

When Wendy recovered, she called her ex-husband.

Explanation: hyphenate words with the prefix ex.

Your Answer: Not Answered

**Q.27 Correct Answer A:**

The artist used oil-based paints in a Modernist style.

Explanation: “oil-based” is a compound adjective requiring a hyphen.

Your Answer: Not Answered

**Q.28 Correct Answer B:**

Howie—and that crazy friend of his—is coming.

Explanation: words and phrases between dashes are not part of the subject.

Your Answer: Not Answered

**Q.29 Correct Answer D:**

“Do you understand her need for privacy?” Wendy asked her husband.

Explanation: the question is within the quote so the question mark must go inside the quotation marks.

Your Answer: Not Answered

**Q.30 Correct Answer B:**

The two hostesses’ jobs are quite different.

Explanation: The plural of hostess is hostesses. To form the possessive of a plural noun ending in s, add an apostrophe.

Your Answer: Not Answered



**Worksheet-18**

**FREGMENT + CLAUSE,  
TYPE OF SENTENCE RUN  
ON COMMA SPEACE**

**DIRECTIONS:** In each of the following questions, four alternative sentences are given. Choose the **CORRECT** one and fill the Circle corresponding to that letter in the MCQ Response Form.

**Q.1**

- A) She decided to quit her high-pressured Job, she didn't want to develop heart trouble.
- B) She decided to quit her high-pressured Job, for she didn't want to develop heart trouble.
- C) She decided to quit her high-pressured Job, and she didn't want to develop heart trouble.
- D) She decided to quite her high-pressured Job because; she didn't want to develop heart trouble.

**Q.2**

- A) I asked the clerk if the store had Yuval Noah's latest book.
- B) I asked the clerk that the store had Yuval Noah's latest book.
- C) I asked the clerk that whether or the store had Yuval Noah's latest book.
- D) I asked the clerk what if the store had Yuval Noah's latest book.

**Q.3**

- A) Company manager, seeking higher profit, hired temporary workers to replace full-time staff.
- B) Company manager seeking higher profit hired temporary workers to replace full-time staff.
- C) Company manager, seeking higher profit hired temporary workers; to replace full-time staff.
- D) Company manager; sought higher profit, hired temporary worker's to replace full-time staff.

**Q.4**

- A) The heart though a cone shaped organ pumps blood through out the body.
- B) The heart, a cone shaped organ, pumps blood throughout the body.
- C) The heart so a cone shaped organ pump blood through out the body.
- D) The heart because a cone shaped organ, pump blood through out the body.

**Q.5**

- A) The order was requested six weeks ago therefore I expected the Shipmate to arrive by now.
- B) The order was requested six weeks ago; therefore, I expected the Shipmate to arrive by now.
- C) The order was requested six weeks before, therefore, I expected the Shipmate to arrive by now.
- D) The order requested six weeks ago therefore I expected the Shipmate to arrive by now.

**Q.6**

- A) However, your finance your college education is upto you
- B) However; you finance your college education is upto you
- C) However you finance your college education is upto you
- D) However: you finance your college education is upto you

**Q.7**

- A) The idea that knowledge makes people good was a popularly belief during the 19<sup>th</sup> Century
- B) The idea ,that knowledge makes people good, was a popular belief during the 19<sup>th</sup> Century
- C) The idea which knowledge makes people good was a popular believe during the 19<sup>th</sup> Century
- D) The idea that knowledge make people good was a popular belief during the 19<sup>th</sup> Century



Q.8

- A) While history cannot prove that Isaac Newton really had an apple fall on his head, yet he certainly was an influential scientist in exploring exactly how gravity works.
- B) Although history cannot prove that Isaac Newton really had an apple fall on his head, but he certainly was an influential scientist in exploring exactly how gravity works.
- C) But history cannot prove that Isaac Newton really had an apple fall on his head, yet he certainly was an influential scientist in exploring exactly how gravity works.
- D) While history cannot prove that Isaac Newton really had an apple fall on his head, he certainly was an influential scientist in exploring exactly how gravity works.

Q.9

- A) Melanie was meeting her cousin in New Jersey; and there was a mild earthquake in her California hometown
- B) As Melanie was meeting her cousin in New Jersey, but there was a mild earthquake in her California hometown
- C) While Melanie was meeting her cousin in New Jersey, there was a mild earthquake in her California hometown
- D) Because Melanie was meeting her cousin in New Jersey, there was a mild earthquake in her California hometown

Q.10

- A) Did you notice the smart attractive man sitting in the corner
- B) Did you noticed the smart attractive man sitting in the corner?
- C) Did you notice the smart attractive man to have sit in the corner?
- D) Did you notice the smart, attractive man sitting in the corner?

Q.11

- A) You will come to my dance recital; will you.
- B) You won't come to my dance recital: won't you?
- C) You will come to my dance recital, won't you!
- D) You will come to my dance recital, won't you?

Q.12

- A) Service professions such as social work and teaching offer many non-monetary benefits.
- B) Service professions, such as social work and teaching, offer many non-monetary benefits.
- C) Service professions, such as social work and teaching, offers many non-monetary benefits.
- D) Service professions ,such as social work or teaching ,offer many non-monetary benefits.

Q.13

- A) To get the full value of this vacation package; people need to buy their tickets early.
- B) To get the full value of this vacations package, people need to buying their tickets early.
- C) To get the full value of this vacation package, people need to buy their tickets early.
- D) To get the full value, of this vacation package, people need to buy his tickets early.

Q.14

- A) Here is our honest opinion: we think you are a genius.
- B) Here are our honest opinion: we think you are a genius.
- C) Here is our honest opinion, We think you are a genius.
- D) Here is our honest opinion; we think you are a genius.

Q.15

- A) During the felid trip the Smithsonian institute , the museum's displays that were like a time travel machine, allowing us the chance to glimpse the past .
- B) During our felid trip to the Smithsonian Institute, the museum's displays were like a time travel machine, allowing us the chance to glimpse the past.
- C) During the felid trip the Smithsonian institute , the museum's displaying that were like a time travel machine, allowing us the chance to glimpse the past .
- D) During the felid trip the Smithsonian institute , the museum's display that were like a time travel machine, allowing us the chance to glimpse the past .

Q.16

- A) Whatever you want to do tonight is all right by me.
- B) Whatever you want to do tonight are, all right by me.
- C) Whatever you want to do tonight is: alright by me.
- D) Whatever you wants to do tonight; is all right by me.

Q.17

- A) It was proposed by the gunman that the victim remains lying on the ground.
- B) It was proposed by the gunman that the victim remained lying on the ground.
- C) It was proposed by the gunman that the victim remain lying on the ground.
- D) It was proposed by the gunman that the victim remains laying on the ground.

Q.18

- A) The fight was caused by both a bad referee as well as cheating athletes who were capable of hiding their behaviour from the fan.
- B) The fight was caused by both a bad referee and cheating athletes who were capable of hiding their behaviour from the fan.
- C) The fight was caused by both a bad referee as well as cheating athletes whom were capable of hiding their behaviour from the fan.
- D) The fight was caused by both a bad referee and cheating athletes which were capable of hiding his behaviour from the fan.

Q.19

- A) The reason I came late was because I over slept.
- B) The reason I came late was that I over slept.
- C) The reason I come late was that I over slept.
- D) The reason I came late being that I over slept.

Q.20

- A) The actor is out of Jail, and not exactly a free man, Since he will be under house arrest for an additional 90 day
- B) The actor is out of Jail and not exactly a free man since he will be under house arrest for an additional 90 day
- C) The actor is out of Jail; though not exactly a free man he will be under house arrest for an additional 90 day.
- D) The actor is out of Jail but not exactly a free man since he will be under house arrest for an additional 90 day.

ANSWER KEY (Worksheet-18)			
1	B	11	D
2	A	12	B
3	A	13	C
4	B	14	A
5	B	15	B
6	C	16	A
7	B	17	C
8	D	18	B
9	C	19	B
10	D	20	D

STEP ENTRY TEST 2020

# STOP

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