

## Chemical Industries

### Long Answer Questions

**Q.1** Describe in detail the various process involved in the concentration of ore explain your answer with the help of diagram.

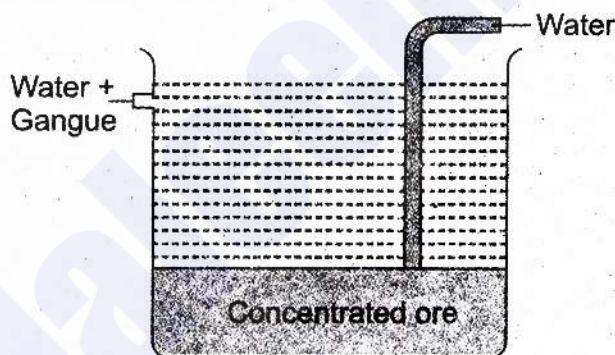
**Ans. Concentration of the Ore**

The process of removal of gangue from the ore is technically known as concentration and the purified ore is called the concentrate. Concentration of the crushed ore is carried out by the following methods:

**a) Gravity separation**

Gravity separation is based on the differences in densities of the metallic ore and the gangue particles.

In the process, the powdered heavy metal bearing ore settles down on agitation in a stream of water, while the lighter gangue particles are carried away by the water as shown in figure

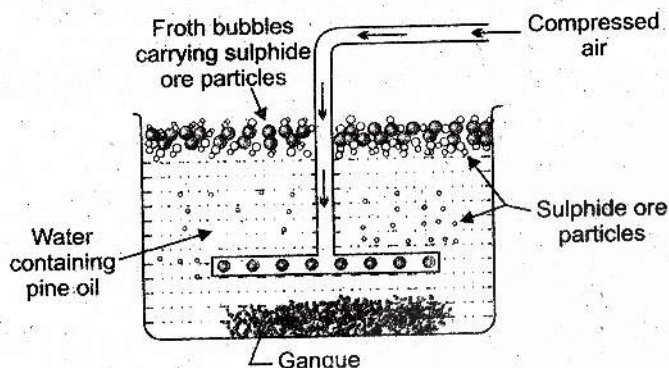


**Fig. Gravity separation**

**b) Froth flotation process**

Froth flotation process is based on the wetting characteristic of the ore and the gangue particles with oil and water, respectively.

The ore particles are preferentially wetted by oil and the gangue particles by the water. The whole mixture is agitated with compressed air. Hence, oil coated ore particles being lighter come to the surface in the form of a froth that can be skimmed as shown in figure:

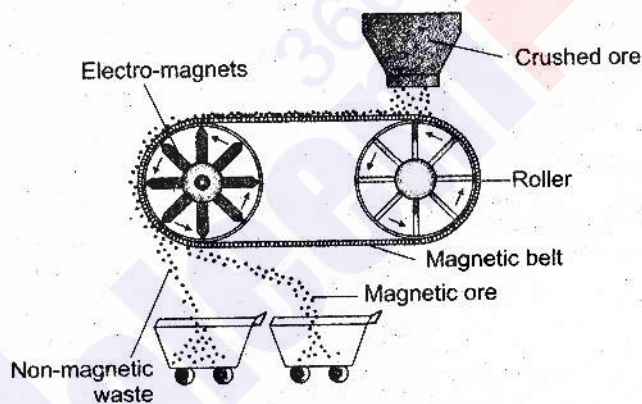


**Fig: Froth flotation process**

### c) Electromagnetic separation

Electromagnetic separation is based on the separation of magnetic ores from the non-magnetic impurities by means of electro-magnets or magnetic separators.

The powdered ore is dropped over a leather belt moving over two rollers, one of which is magnetic. The one gets attracted and is collected nearer to the magnet while the non-magnetic impurities fall further away as shown in figure



**Fig: Magnetic separation**

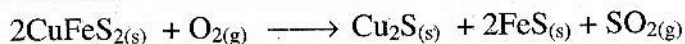
### Q.2 Explain the process of roasting.

**Ans. Roasting**

It is a process of heating the concentrated ore to a high temperature in excess of air.

**Example**

copper pyrite ( $\text{CuFeS}_2$ ) is strongly heated in excess of air to convert it into a mixture of cuprous sulphide and ferrous sulphide ( $\text{Cu}_2\text{S} + \text{FeS}$ ). While impurities react with oxygen to form volatile oxides. Such as

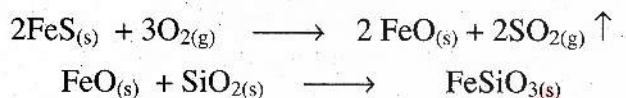


**Q.3 Write a note on smelting and bessemerization, giving a specific examples.**

**Ans. Smelting**

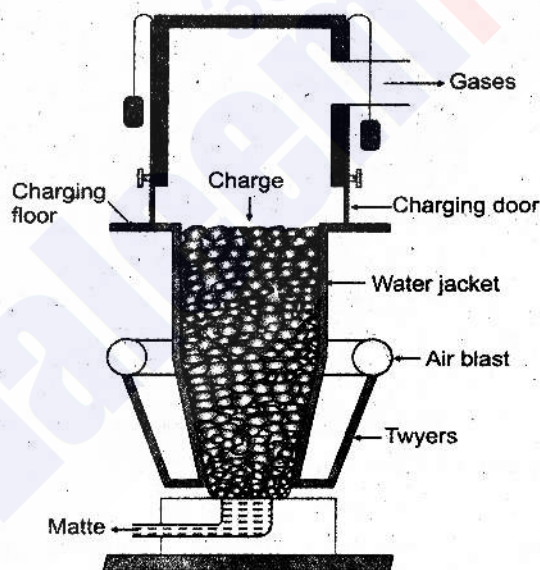
It is the further heating of the roasted ore, sand flux and coke in a blast furnace in the presence of excess of air.

It is highly exothermic process, therefore, a small amount of coke is required in the process. In the process, first ferrous sulphide oxidize to form ferrous oxide which reacts with sand to form iron silicate slag ( $\text{FeSiO}_3$ ). It being lighter rise to the top and is removed from the upper hole.



On the other hand, cuprous sulphide also oxidize to form cuprous oxide which reacts with unreacted ferrous sulphide to form ferrous oxide and cuprous sulphide. In this way, cuprous sulphide and ferrous sulphide form a mixture ( $\text{Cu}_2\text{S.FeS}$ ). This molten mixture is called matte.

It is withdrawn from the lower hole. It contains about 45% of copper.



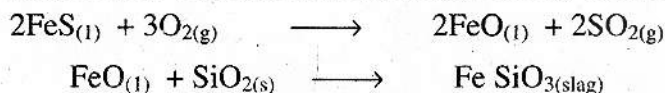
**Fig: Blast furnace for smelting of copper**

**Bassemerization**

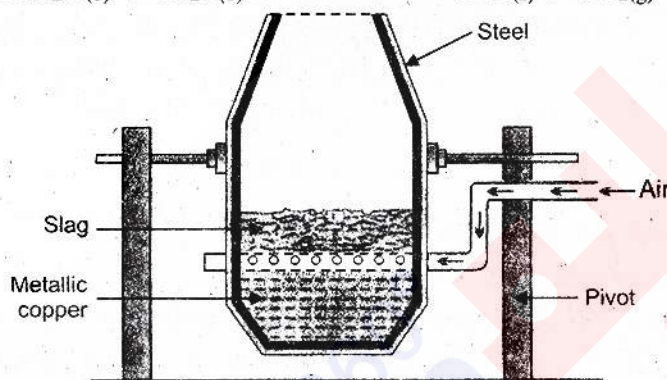
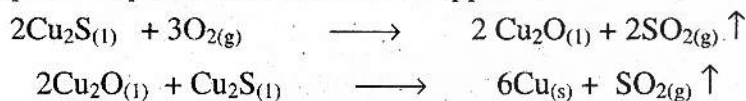
It is the further heating of the molten matte in a pear shaped Bessemer converter as shown in figure. It is fixed on a pivot, so that it can be tilted in any direction. Molten matte is mixed



with sand and heated with a hot blast of air through tuyers. Ferrous sulphide is oxidized to form ferrous oxide. Which reacts with sand to form slag ( $\text{FeSiO}_3$ ) that float on the top.



On the other hand, cuprous sulphide is oxidized to form cuprous oxide, which again reacts with remaining cuprous sulphide to form metallic copper.



**Fig: Bessemer Converter used for Bessemerization of copper**

The molten metal is shifted from the converter to sand moulds and is allowed to cool. The dissolved gases escape out forming blisters on the surface of the solid copper therefore it is called blister copper. It is about 98% pure copper. It is further refined by electrolysis.

#### Q.4 Explain the process of refining with reference to copper.

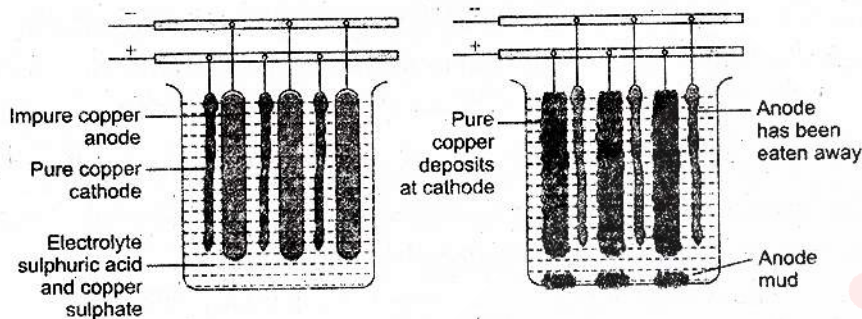
**Ans. Refining or purification of the copper metal.**

Refining the impure metal by electrolysis is the most widely used process of refining metals.

#### Example

Electrolytic refining of copper is carried out in an electrolytic tank having copper sulphate solution in it as shown in figure. Two electrodes; one of impure copper metal that acts as anode and the other of pure copper metal that acts as cathode are suspended in the electrolytic solution.

On passing the electric current through the solution, anode (impure copper) dissolves to provide  $\text{Cu}^{2+}$  ions to the solution. These  $\text{Cu}^{2+}$  ions are discharged by gaining of electrons from the cathode. Thereby copper atoms deposit on the cathode, making it thick block of pure copper metal as is shown in figure. The impurities like gold and silver settle down as anode mud.



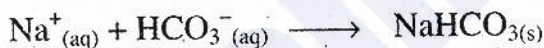
**Fig: Electro refining of copper**

In the process, impure copper from the anode dissolves and goes into the copper sulphate solution. Side by side, pure copper ions from the solution deposit on the cathode. Thus, cathode becomes a pure copper metal. The impurities like gold and silver settle down as anode mud.

#### Q.5 Write detail note on ammonia Solvay process.

##### Ans. Principle of ammonia solvay's process

Principle of Solvay's process lies in the low solubility of sodium bicarbonate at low temperature i.e. at  $15^{\circ}\text{C}$ . When  $\text{CO}_2$  is passed through an ammonical solution of  $\text{NaCl}$  called ammonical brine only  $\text{NaHCO}_3$  precipitates.



##### Raw Materials

The raw materials needed for this process are cheap and easily available. They are in abundance, such as,

- i. Sodium chloride ( $\text{NaCl}$ ) or brine.
- ii. Limestone ( $\text{CaCO}_3$ )
- iii. Ammonia gas ( $\text{NH}_3$ )

##### Basic Reactions

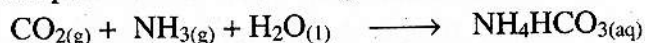
The process consists of the following steps:

##### i. Preparation of ammonical brine

First of all ammonical brine is prepared by dissolving ammonia gas in sodium chloride solution (brine).

##### ii. Carbonation of ammonical brine

Ammonical brine is fed into carbonating tower and carbon dioxide is passed through it. Following reactions take place in the carbonating tower.







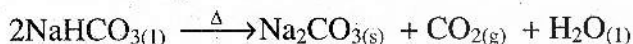
The temperature of the mixture is lowered to  $15^\circ\text{C}$  and precipitates of  $\text{NaHCO}_3$  are obtained.

### iii. Filtration of precipitates

The milky solution from the carbonating tower is filtered to get sodium bicarbonate. It is used as a baking soda.

### iv. Calcinations

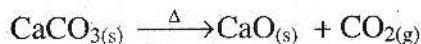
Sodium bicarbonate is heated to get sodium carbonate.



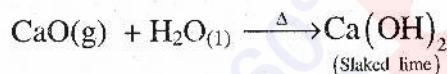
$\text{CO}_2$  is again used in tower. It is about half of  $\text{CO}_2$  needed in the process.

### v. Preparation of carbon dioxide and slaked lime

$\text{CO}_2$  is prepared by heating limestone in a lime kiln. Then it is carried to carbonating tower

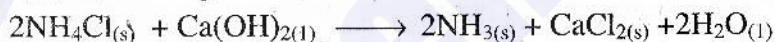


Quick lime ( $\text{CaO}$ ) formed in lime kiln is slaked with water. Then, it is pumped to the ammonia recovery tower.

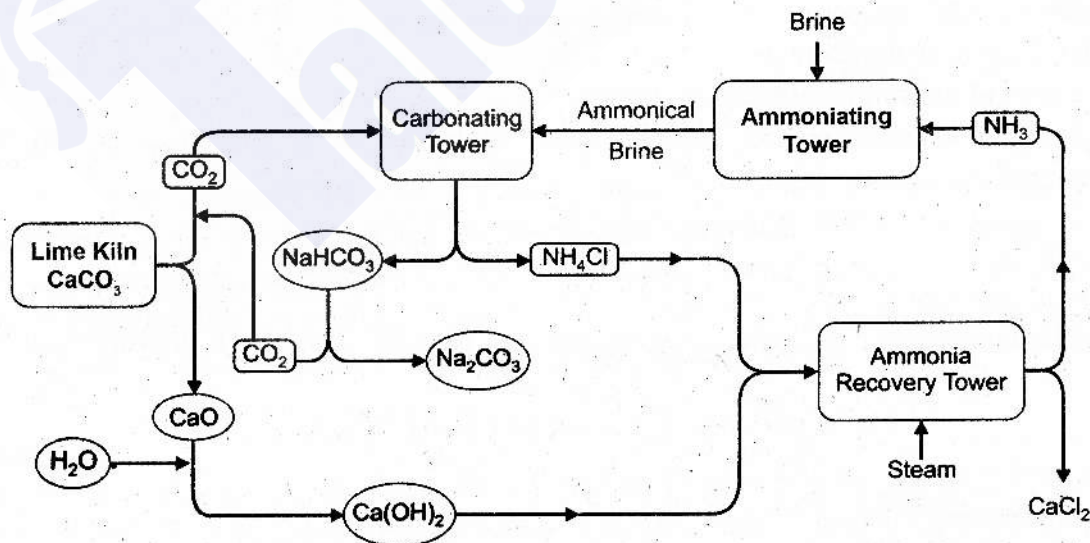


### vi. Ammonia recovery tower

Ammonia is recovered in this tower from ammonium chloride solution produced in the carbonated tower and calcium hydroxide formed in lime kiln.



In fact, all ammonia is recovered in this tower and is reused in the process. There are minor losses of ammonia in the process which are compensated by using fresh ammonia.



**Fig: Flow sheet diagram of Solvay's process for the manufacturing of sodium carbonate**

**Q.6 Write down advantages of Solvay's process.**

**Ans. Advantages of Solvay's process**

Following are the advantages of Solvay's process

- It is a cheap process as raw materials are available at very low prices.
- Carbon dioxide and ammonia are recovered and reused.
- Process is pollution free, because the only waste is calcium chloride solution.
- Sodium carbonate of very high purity is obtained.
- Consumption of fuel is very less since no solution is to be evaporated.

**Q.7 How urea is manufactured. Explain showing the flow sheet diagram?**

**Ans. Manufactured of Urea**

Urea is nitrogenous fertilizer. It consists of 46.6% nitrogen. It is white crystalline compound, highly soluble in water. It is used for the manufacturing of important chemicals, but its major (about 90%) use is as a fertilizer.

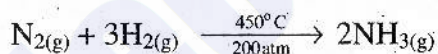
**Raw Material**

The raw materials for the manufacturing of urea are:

- (i) Ammonia ( $\text{NH}_3$ )      (ii) Carbon dioxide ( $\text{CO}_2$ )

**Preparation of Ammonia by Haber's process**

Ammonia is prepared by the "Haber's process". One volume of nitrogen (from air and three volumes of hydrogen (obtained by passing methane and steam over nickel catalyst) is passed over iron catalyst at  $450^\circ\text{C}$  and 200 atm pressure.

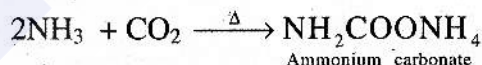


**Process**

Manufacturing of urea involves three stages

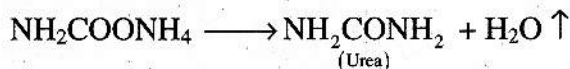
**i. Reaction of ammonia and carbon dioxide**

Carbon dioxide is passed through liquid ammonia under high pressure to form ammonium carbamate



**ii. Urea formation:**

When ammonium carbamate is evaporated with the help of steam, it dehydrates to form urea.





### iii. Granulation of urea

At this stage, liquid urea is evaporated to form granules. When liquid urea is sprayed from top of a tower under pressure and a hot current of air is introduced from the base, it evaporates to form granules. This is stored to be marketed.

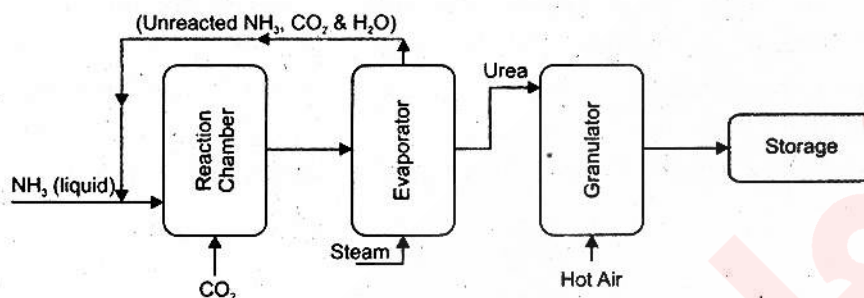


Fig: Flow sheet diagram of urea

### Q.8 Explain importance and status of urea.

#### Ans. Importance and Status of Urea

It is white crystalline organic compound. Its importance is because of following usage:

- Urea is widely used world over in the agriculture sector both as a fertilizer and animal feed additive. About 90% of urea is used as fertilizer. It has the highest nitrogen percentage, i.e. much higher than other nitrogenous fertilizers. It is harmless and is useful for all types of crops and soils. It is non-toxic, non-explosive, therefore, can be stored safely. But it is very soluble in water and hygroscopic, therefore, storage requires better packing.
- It is used as a raw material for the manufacture of many important compounds.
- It is used to make explosives.
- It is used in automobile systems to reduce the NO<sub>x</sub> pollutants in exhaust gases.

There are about six urea manufacturing units in Pakistan. The major four are Fauji Fertilizer company; Engro Chemicals; Fauji Fertilizer, Bin Qasim and Dawood Hercules company. Fauji Fertilizer is the biggest fertilizer manufacturer with 59% market shares.

Government provides an indirect subsidy to manufacturers but this industry is still facing supply shortfall problems. The price of urea has grown since the last years.

### Q.9 Define Petroleum explain the origin of petroleum in detail.

Ans.

#### 1. Petroleum

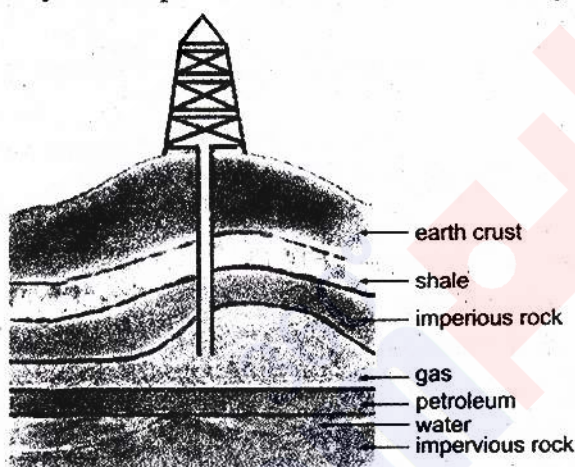
Petroleum is a natural product found under the Earth's crust trapped in rocks. Petroleum means rock oil. It is a complex mixture of several gaseous, liquid and solid hydro carbon



having water, salts and earth particles with it. It is lighter than water is insoluble in it.

## 2. Origin of Petroleum

Petroleum was formed by the decomposition of dead plants and animals buried under earth's crust millions of years ago. It is believed that millions of years ago living plants and animals in the sea died. Their bodies sank and buried under mud and sand. Then decomposition process took place in the absence of air because of high pressure, temperature and bacterial effects. This process took millions of years for completion. Thus, remains of dead plants and animals were converted into a dark brownish viscous **crude oil**. It was trapped between two layers of impervious rocks. As shown in figure



**Fig: Occurrence of petroleum**

Being lighter and insoluble in water it floats over the water and forms an oil trap. The gaseous products accumulated over the petroleum are found as natural gas.

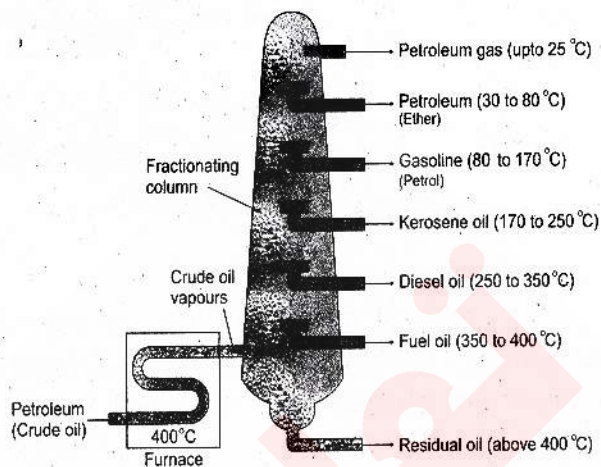
Petroleum is extracted by drilling holes (oil wells) into Earth's crust where the oil is found. When a well is drilled through the rocks, natural gas comes first with a great pressure. For some time crude oil also comes out by itself due to gas pressure. When gas pressure subsides, then crude oil is pumped out.

### **Q.10 Write a note on fractional distillation of petroleum.**

#### **Ans. Refining**

The crude oil is refined in the refineries. **Refining** process is the separation of crude oil mixture into various useful products (fractions). It is carried out by a process called **fractional distillation**. The principle of fractional distillation is based upon separation of substances depending upon their boiling points. The substances having low boiling point out first, living behind others. The next fraction of having slightly higher boiling point boils out. This process remain continue until a residue is left behind. The vapours of each fraction are collected and condensed separately.

The crude oil is heated in a furnace upto a temperature of  $400^{\circ}\text{C}$  under high pressure. Then vapours are passed through a fractionating column from near its bottom as shown in figure. Hot vapours rise up in the column and gradually is cools down and condense. Such that vapours of higher boiling point fraction ( $350^{\circ}\text{C}$  to  $400^{\circ}\text{C}$ ) condense first in the lower part of the tower, while vapours of medium lower boiling point fractions rise upwards in the tower and condense gradually respect to their boiling points at different levels. In this way, crude oil is separated in to six hydrocarbon fractions. Each fraction has its specific boiling range, composition and uses.



#### Q.11 Describe some important fractions of petroleum and their uses.

**Ans. Important fractions of petroleum and their uses**

Each fraction is not a single compound. Each one is a mixture of hydrocarbons having different number of carbon atoms in it. The name of each fraction, its molecular composition, boiling range and uses are given in the following table.

Name	Composition	Boiling range	Uses
Petroleum Gas	$\text{C}_1$ to $\text{C}_4$	Up to $25^{\circ}\text{C}$	As a fuel, as such in the form of LPG, used for the production of carbon black (needed in tyre industry) and hydrogen gas (needed to form $\text{NH}_3$ used to manufacture fertilizer)
Petroleum Ether	$\text{C}_5$ to $\text{C}_7$	$30$ to $80^{\circ}\text{C}$	Used as laboratory solvent and for dry cleaning purposes.
Gasoline or Petrol	$\text{C}_7$ to $\text{C}_{10}$	$80$ to $170^{\circ}\text{C}$	Used as fuel in motor cycles, motor cars and other light vehicles. It is more volatile than kerosene oil. It is also used for dry cleaning.
Kerosene oil	$\text{C}_{10}$ to $\text{C}_{12}$	$170$ to $250^{\circ}\text{C}$	Used as domestic fuel, a special grade of it is sued as jet fuel.



Diesel oil	C <sub>13</sub> to C <sub>15</sub>	250 to 350°C	Fuel for buses, trucks railway engines, tubewell engines and other heavy vehicles.
Fuel oil	C <sub>15</sub> to C <sub>18</sub>	350 to 400°C	Used in ships and industries to heat boilers and furnaces.

### Residual Oil

The residual oil, which does not vapourize under these conditions is collected and heated above 400°C for further fractional distillation. The four fractions of residual oil are: lubricants; paraffin wax; asphalt and petroleum coke.

**Q.12 Explain that natural fertilizers are better than synthetic fertilizers.**

**Ans.** Fertilizer is a substance added to soil to improve plants' growth and yield.

#### Natural Fertilizers

Contain all natural biodegradable materials are decomposed by bacteria. Decomposed materials contain useful nutrient for plants. Organic matter is essential part of fertile soil. Use of natural fertilizers return the nutrients and organic matter of soil. They improve the soil condition to support plant growth.

- i. They improve the porosity of the soil to make it capable of absorbing water. Thus improves crops production.
- ii. They improve the structure of soil which in turn allows more air to get to plant roots.
- iii. The chance of water shortage because of the moisture holding capacity of soil increases.
- iv. Natural fertilizers practically do not contain toxic chemicals. Thus, they do not damage the soil and crops yield increase.

#### Chemical Fertilizers

Include one or more of the three elements most important for plant nutrition; nitrogen, phosphorus and potassium.

- i. They release the nutrients very fastly.
- ii. Their effects are short lived, so they are required again and again, after short intervals may be 4 to 6 times in a year.
- iii. Use of synthetic fertilizers may cause over fertilization resulting in burning of plants instead of greening them.



## Short Answer Question

**Q.1 Define concentration process, is it used in metallurgy of copper?**

**Ans.** The process of removal of gangue from the ore is technically known as concentration and the purified ore is called the concentrate. Yes, concentration process used in metallurgy of copper.

**Q.2 Why a small amount of coke is required in the smelting process?**

**Ans.** Because smelting is carried out in blast furnace. The process in blast furnace is highly exothermic process. Therefore a small amount of coke is required in this process.

**Q.3 Why lime is added in the smelting process?**

**Ans.** Lime is added to remove excess of  $\text{SiO}_2$ . Lime reacts with sand to form slag.



**Q.4 How slag and matte are removed from the blast furnace?**

**Ans.** Slag being lighter rise to the top and is removed from the upper hole of the blast furnace and matte is withdrawn from the lower hole of the blast furnace. It contains about 45% of copper.

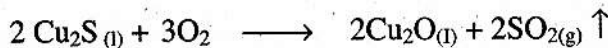
**Q.5 What is the difference between slag and matte?**

**Ans.**

Slag	Matte
When flux combine with gangue it will form slag which being lighted in weight and floats on the molten metal	In blast furnace cuprous sulphide and ferrous sulphide form a mixture ( $\text{Cu}_2\text{S}$ , $\text{FeS}$ ). This molten mixture is called matte.

**Q.6 Mention the chemical reaction for the formation of metallic copper in the bessemerization process.**

**Ans.** Following, chemical reactions for the formation of metallic copper in the bessemerization process



**Q.7 Why anode is eaten up in electro – refining process?**

**Ans.** Because on passing the electric current through the Copper sulphate solution, anode (Impure copper) dissolves to provide  $\text{Cu}^{2+}$  ions to the solution, these  $\text{Cu}^{2+}$  ions are discharged by gaining of electrons from the cathode thereby copper atoms deposit on the cathode, making it thick block of pure copper metal. The impurities like gold and silver settle down as anode mud.

**Q.8 What do you mean by anode mud?**

**Ans.** During the electro refining process of copper which carried out in an electrolytic tank. The impurities like gold and silver settle down as anode mud.

**Q.9 Why only  $\text{NaHCO}_3$  precipitates when  $\text{CO}_2$  is passed through the ammonical brine ?**

**Ans.** When  $\text{CO}_2$  is passed through the ammonical brine, a mixture of  $\text{NH}_4\text{Cl}$  and  $\text{NaHCO}_3$  is obtained. The temperature of the mixture is lowered to  $15^\circ\text{C}$  and precipitates of  $\text{NaHCO}_3$  are formed. Because  $\text{NaHCO}_3$  is insoluble in  $\text{NH}_4\text{Cl}$  at low temperature.

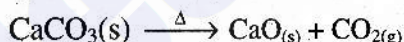
**Q.10 Which raw materials are required for the formation of sodium carbonate?**

**Ans.** The raw materials needed for the formation of sodium carbonates are

- i. Sodium chloride ( $\text{NaCl}$ ) or brine
- ii. Lime stone ( $\text{CaCO}_3$ )
- iii. Ammonia gas ( $\text{NH}_3$ )

**Q.11 How  $\text{CO}_2$  is prepared in the Solvay's process?**

**Ans.**  $\text{CO}_2$  is prepared by heating lime stone in a lime kiln.

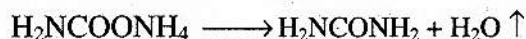


**Q.12 Give the advantages of Solvay's process.**

- Ans.**
- i. It is a cheap process as raw materials are available at very low prices.
  - ii. Carbondioxide and ammonia are recovered and reused.
  - iii. Process is pollution free, because the only waste is calcium chloride solution.
  - iv. Sodium carbonate of very high purity is obtained.
  - v. Consumption of fuel is very less since no solution is to be evaporated.

**Q.13 What happens when ammonium carbonate is heated with steam?**

**Ans.** When ammonium carbamate is evaporated with the help of steam, it dehydrate, to form urea.





**Q.14 How many stages are involved in the formation of urea?**

**Ans.** There are three stages are involved in the formation of urea.

- i. Reaction of ammonia and carbondioxide.
- ii. Urea formation
- iii. Granulation of urea.

**Q.15 What role is played by pine oil in the froth flotation process?**

**Ans.** Pine oil is played an important role in froth flotation process because Pine oil coated ore particles being lighter come to the surface in the form of froth that can be skimmed easily.

**Q.16 Name the various metallurgical operation.**

**Ans.** The process involved in metallurgy for extraction of a metal in the pure state from its ore are.

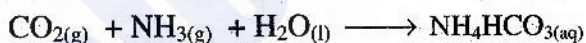
- i. Concentration of the ores
- ii. Extraction the metal
- iii. Refining of metal

**Q.17 How roasting is carried out?**

**Ans.** Roasting process is carried out in a special furnace which is called Reverberatory furnace.

**Q.18 What happens when ammonical brine is carbonated??**

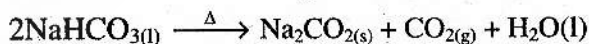
**Ans.** Ammonical brine is fed into carbonating tower and carbondioxide is passed through following reaction take place in carbonating tower.



The temperature of the mixture is lowered to 15°C and precipitates of NaHCO<sub>3</sub> are obtained.

**Q.19 How NaHCO<sub>3</sub> is converted in to Na<sub>2</sub>CO<sub>3</sub>?**

**Ans.** Sodium hydrogen carbonate is heated to get sodium carbonate.

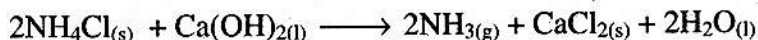


CO<sub>2</sub> is again used in tower. It is about half of CO<sub>2</sub> needed in the process.

**Q.20 How ammonia is recovered in solvay's process?**

**Ans.** Ammonia is recovered in this tower from ammonium chloride solution produced in the carbonated tower and calcium hydroxide formed in lime kiln.

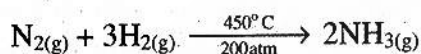




In fact all ammonia is recovered in this tower and is reused in the process.

**Q.21 How ammonia is prepared for synthesis is Urea?**

**Ans.** Ammonia is prepared by the Haber's process". One volume of nitrogen (from air) and three volumes of hydrogen (obtained by passing methane and steam over heated nickel catalyst) is passed over iron catalyst at.  $450^\circ\text{C}$  and 200 atm pressure.



**Q.22 Describe the formation of petroleum?**

**Ans.** Petroleum was formed by the decomposition of dead plants and animal buried under earth's crust millions of years ago.

**Q.23 What is refining of petroleum and how it is carried out?**

**Ans.** Refining process is the separation of crude oil mixture into various useful products (fractions). It is carried out by a process called fractional distillation.

**Q.24 Give uses of kerosene oil.**

**Ans:** It is used as domestic fuel, a special grade of it is used as jet fuel.

**Q.25 Describe the difference between diesel oil and fuel oil.**

**Ans:**

Diesel oil	Fuel oil
i. It contains number of carbon atoms, 13 to 15.	i. It contains number of carbon atoms, 5 to 18.
ii. It is used as fuel for buses, trucks, railway engines, tubewell engines and other heavy vehicles.	ii. It is used in ships and industries to heat boilers and furnace.

**Q.26 Write down the names of four fractions obtained by the fractional distillation, of residual oil.**

**Ans:** The four fractions of residual oil are.

- i. lubricants      ii. wax      iii. Paraffin      iv. Asphalt

**Q.27 What is the difference between crude oil and residual oil?**

**Ans:**

<b>Crude oil</b>	<b>Residual oil</b>
1. It is dark brownish viscous liquid which is formed of dead plants and animals	1. After the fractional distillation of petroleum, the oil is left behind called residual oil.

**Q.28 Which petroleum fraction is used in dry cleaning?**

**Ans:** Gasoline or petrol is used in dry cleaning

**Q.29 Define Metallurgy.**

**Ans.** Metallurgy is the science of extracting metals from ores.

**Q.30 Define Minerals.**

**Ans.** The solid natural materials found beneath the earth surface, which contains compound of metals in the combined state along with earthly impurities are called minerals.

**Q.31 Define ores.**

**Ans.** The minerals from which the metals are extracted commercially at a comparatively low cost with minimum effort are called ores of the metals. For example ores of copper are copper glance ( $\text{Cu}_2\text{S}$ ) and chalcopyrite ( $\text{CuFeS}_2$ )

**Q.32 Why the colour of hairs different from different people?**

**Ans.** The colour of hairs caused by the presence of transition metal compound in the hair. Brown hair contains iron or copper compounds blonde hair contains compounds of titanium and redhead hair is because of the presence of molybdenum compounds

**Q.33 Define Gangue.**

**Ans.** Impurities associated with the ore known as gangue.

**Q.34 Write down the names of steps used in metallurgy.**

**Ans.** The process involved in metallurgy for extraction of a metal in the pure state from its ore are

- (i) Concentration of the ore
- (ii) Extraction of the metals
- (iii) Refining of the metal

**Q.35 What is concentration of the ore?**

**Ans.** The process of removed of gangue from the ore is technically known as concentration and the purified ore is called concentrate



**Q.36 What is gravity separation?**

**Ans.** Gravity separation is based on the difference in densities of the metallic ore and gangue particles.

**Q.37 Define Froth flotation process.**

**Ans.** Froth flotation process is based on the wetting characteristics of the ore and the gangue particles with oil and water respectively.

**Q.38 Define electromagnetic separation.**

**Ans.** Electromagnetic separation is based on the separation of magnetic ores from the non-magnetic impurities by means of electromagnetic or magnetic separators.

**Q.39 Define Roasting.**

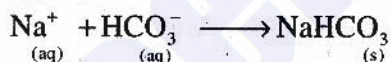
**Ans.** It is the process of heating the concentrated ore to a high temperature in excess of air.

**Q.40 What is blister copper?**

**Ans.** The dissolved gases escape out forming blisters on the surface of the solid copper. Therefore of the solid copper it is called blister copper. It is about 98% pure copper.

**Q.41 Describe the principle of Solvay's process.**

**Ans.** Principle of Solvay's process lies in the low solubility of sodium bicarbonate at low temperature i.e at 15°C. When CO<sub>2</sub> is passed through an ammoniacal solution of NaCl called ammoniacal brine only NaHCO<sub>3</sub> precipitates.



**Q.42 Write down advantages of Solvay's process.**

**Ans.** It is a cheap process as raw materials are available at very low prices

(ii) Carbon dioxide and ammonia are recovered and reused

(iii) Process is pollution free because the only waste is calcium chloride solution

(iv) Consumption of fuel is very less since no solution is to be evaporated

**Q.43 What do you know about Urea?**

**Ans.** Urea is nitrogenous fertilizers. It consists of 46.6% nitrogen. It is white crystalline compound, highly soluble in water. It is used for the manufacturing of important chemical, but its major (about 90%) use is as a fertilizer.

**Q.44 Define petroleum.**

**Ans.** Petroleum means rock oil. It is a complex mixture of several gaseous, liquid and solid hydrocarbons having water, salts and earth particles with it. It is lighter than water and is insoluble in it.



**Q.45 Define refining.**

Ans. Refining process is the separation of crude oil mixture into various useful products (fractions). It is carried out by a process called fractional distillation

**Q.46 Describe the difference between diesel oil and fuel oil.**

Ans.

Diesel oil	Fuel oil
i. It contains number of carbon, 13 to 15.	i. It contains number of carbon, 15 to 18.
ii. It is used fuel for buses, trucks, railway engines, tubewell. Engines and other heavy vehicles.	ii. It is used in ships and industries to heat boilers and furnace.

**Q.47 Write down the name, of our fractions obtained by the fractional distillation of residual oil.**

Ans. The four fractions of residual oil are

- i. lubricants      iii. wax
- ii. paraffin      iv. asphalt

**Q.48 What is the difference between crude oil and residual oil?**

Ans.

Crude oil	Oil
It is dark brownish viscous liquid which is formed of dead plant, and animals; where converted into a dark brownish viscous liquid.	After the fractional distillation of petroleum, the oil is left behind called residual oil

**Q.49 Which petroleum fraction is used in dry cleaning?**

Ans. Gasoline or petrol is used in dry cleaning.

**Multiple Choice Questions**

1. Extraction of metals from its ores is called

- (a) Metallurgy      (b) Mining
- (c) Grinding      (d) All

2. At the time of partition, How many industries were present in Pakistan

- (a) 30      (b) 32
- (c) 34      (d) 40

**3. Which one of the ore of copper?**

- (a) Copper glance (b) Chalcopyrite  
(c) Both a & b (d) None

**4. Brown hair contains**

- (a) Iron compound  
(b) Copper compound  
(c) titanium compound (d) both a & b

**5. Blonde hair contains compounds of**

- (a) Iron (b) copper  
(c) titanium (d) Molybdenum

**6. Red hair contains compounds of**

- (a) Iron (b) copper  
(c) titanium (d) molybdenum

**7. Process of heating the concentrated ore to high temperature in excess of air is called**

- (a) Roasting (b) Smelting  
(c) Bessemerization (d) All

**8. Which one is not metal?**

- (a) Copper (b) Carbon  
(c) Chromium (d) Iron

**9. The elements that do not conduct heat and electricity are called**

- (a) Metallurgy (b) Non metal  
(c) Metalloid (d) alloy

**10. Metallurgy involves which of the following steps?**

- (a) Mining and enrichment  
(b) Reduction  
(c) Refining and casting  
(d) All of these

**11. Blast furnace usually used for the metallurgy of**

- (a) Iron (b) copper  
(c) Aluminum (d) both a & b

**12. The process of roasting during metallurgy of copper is carried out in a special furnace called**

- (a) Blast furnace (b) Fire furnace  
(c) Bessemer converter  
(d) Reverberatory Furnace

**13. Froth flotation process is used to concentrate**

- (a) Copper ore (b) Iron ore  
(c) Chromium ore (d) aluminum ore

**14. Compounds of metals exist under earth crust are called**

- (a) Ore (b) Gangue  
(c) Mineral (d) None

**15. An ore consists of two portions pure metal and impurities called**

- (a) ore (b) Silicates  
(c) Slag (d) gangue

**16. Which contains sufficient amount of metal?**

- (a) Mineral (b) ores  
(c) Rocks (d) Soil

**17. A saturated solution of sodium chloride is called**

- (a) Brine (b) Suspension  
(c) colloidal (d) None

**18. Raw materials used in Solvay's process.**

- (a) Brine (b) Lime stone  
(c) Ammonia gas (d) All

**19. Formula of baking soda is**

- (a)  $\text{Na}_2\text{CO}_3$  (b)  $\text{NaHCO}_3$   
(c)  $\text{Na}_2\text{SO}_4$  (d)  $\text{Na}_3\text{PO}_4$

**20. Formula of soda ash is**

- (a)  $\text{Na}_2\text{CO}_3$  (b)  $\text{NaHCO}_3$   
(c)  $\text{Na}_2\text{SO}_4$  (d)  $\text{Na}_3\text{PO}_4$



21. Imperial chemical industries (ICI) was established in

- (a) 1942 (b) 1944  
(c) 1950 (d) 1996

22. Sindh alkalies limited was established near Karachi in

- (a) 1965 (b) 1966  
(c) 1970 (d) 2000

23. How many % age of nitrogen in urea fertilizers?

- (a) 40.6 (b) 45.6  
(c) 46.6 (d) 50

24. The raw materials for the manufacturing of urea are

- (a) Ammonia (b) Carbondioxide  
(c) Limestone (d) a & b

25. Ammonia is prepared by the process

- (a) Ostwald (b) Haber  
(c) Clark (d) all

26. How many % age of urea is used as fertilizers?

- (a) 80% (b) 90%  
(c) 95% (d) 98%

27. How many % age of nitrogen present in air by volume?

- (a) 70% (b) 75%  
(c) 78% (d) 80%

28. Formula of urea is

- (a) KCNO (b)  $\text{H}_2\text{N}-\text{CO}-\text{NH}_2$   
(c)  $\text{HN}-\text{CO}_2-\text{NH}$  (d)  $\text{H}_3\text{N}-\text{CO}-\text{NH}_3$

29. The number of carbon atoms present in petroleum gas

- (a) 1-2 (b) 1-3  
(c) 1-4 (d) 1-5

30. The number of carbon atoms present in petroleum ether

- (a) 1-5 (b) 2-5

- (c) 3-7 (d) 5-7

31. The number of carbon atoms present in gasoline or petrol

- (a) 5-10 (b) 6-10  
(c) 7-10 (d) 8-10

32. The number of carbon atoms present in kerosene oil

- (a) 8-12 (b) 9-12  
(c) 10-12 (d) 11-12

33. The number of carbon atoms present in diesel oil

- (a) 10-15 (b) 11-15  
(c) 12-15 (d) 13-15

34. The number of carbon atoms present in fuel oil

- (a) 14-18 (b) 15-18  
(c) 16-18 (d) 17-18

35. Concentration is a separating technique in which mineral is separated from

- (a) Gangue (b) Silicates  
(c) Aluminates (d) all

36. Sodium carbonate is manufactured by

- (a) Haber's process  
(b) Ostwald's process  
(c) Solvay's process (d) All

37. Ammonical brine is prepared by dissolving ammonia gas in

- (a) NaCl (b)  $\text{CaCO}_3$   
(c)  $\text{CaCl}_2$  (d)  $\text{Na}_2\text{SO}_4$

38. The residual oil is heated above 400°C to produce

- (a) lubricants (b) Paraffin wax  
(c) Asphalt (d) All

39. Concentration is a

- (a) mixing technique



- (b) separating technique
- (c) boiling technique
- (d) cooling technique

**40. Froth flotation process is used to concentrate the ore on:**

- (a) density basis
- (b) concentration basis
- (c) wetting basis
- (d) magnetic basis

**41. Matte is a mixture of:**

- (a) FeS and CuS
- (b) Cu<sub>2</sub>O and FeO
- (c) Cu<sub>2</sub>S and FeS
- (d) CuS and FeO

**42. In the bessemerization process:**

- (a) roasted ore is heated
- (b) molten matte is removed
- (c) molten matte is heated
- (d) molten matte is added

**43. Concentration of the copper ore is carried out by:**

- (a) calcinations
- (b) roasting
- (c) froth flotation
- (d) distillation

**44. When CO<sub>2</sub> is passed through the ammoniacal brine the only salt that precipitates is:**

- (a) NaHCO<sub>3</sub>
- (b) NH<sub>4</sub>HCO<sub>3</sub>
- (c) Na<sub>2</sub>CO<sub>3</sub>
- (d) (NH<sub>4</sub>)<sub>2</sub>CO<sub>3</sub>

**45. In Solvay's process slaked lime is used to:**

- (a) prepare CO<sub>2</sub>
- (b) prepare quick lime.
- (c) recover ammonia
- (d) Form Na<sub>2</sub>CO<sub>3</sub>

**46. When NaHCO<sub>3</sub> is heated it forms:**

- (a) CO<sub>2</sub>
- (b) Ca(OH)<sub>2</sub>
- (c) CaCO<sub>3</sub>
- (d) CaO

**47. Formula of urea is:**

- (a) NH<sub>2</sub>COONH<sub>4</sub>

- (b) NH<sub>2</sub>COONH<sub>2</sub>
- (c) NH<sub>2</sub>CONH<sub>4</sub>
- (d) NH<sub>2</sub>CONH<sub>2</sub>

**48. Crude oil is heated in the fractionating furnace upto:**

- (a) 300°C
- (b) 350°C
- (c) 400°C
- (d) 450°C

**49. When crude oil is heated in the fractionating tower:**

- (a) vapours of higher boiling point fraction condense first in the lower part of the tower
- (b) vapours of lower boiling point fraction condense first in the lower part of tower
- (c) vapours of higher boiling point condense later in the upper part of tower
- (d) vapours of higher boiling point never condense

**50. Which one of the following is used as jet fuel:**

- (a) kerosene oil
- (b) lubricating oil
- (c) fuel oil
- (d) diesel oil

**51. Which one of the following is not a fraction of crude oil**

- (a) paraffin wax
- (b) asphalt
- (c) fuel oil
- (d) petroleum coke

**52. Which one of the following is not a fraction of petroleum?**

- (a) kerosene oil
- (b) diesel oil
- (c) alcohol
- (d) petrol

**53. The nitrogen present in urea is used by plants to synthesize**

- (a) sugar
- (b) proteins
- (c) fats
- (d) DNA

54. Which one of the following organic compound is found in gasoline?

(a)  $C_2H_4$

(b)  $C_3H_8$

(c)  $C_7H_{10}$

(d)  $C_{12}H_{26}$

**Answer key**

1	a	2	c	3	c	4	b	5	c
6	d	7	a	8	b	9	b	10	d
11	d	12	d	13	a	14	c	15	d
16	b	17	a	18	d	19	b	20	a
21	b	22	b	23	c	24	d	25	b
26	b	27	c	28	b	29	c	30	d
31	c	32	c	33	d	34	b	35	a
36	d	37	a	38	d	39	b	40	c
41	c	42	c	43	c	44	a	45	c
46	a	47	d	48	c	49	a	50	d
51	c	52	c	53	b	54	c		