PART-I (SHORT QUESTIONS)

Q.2 Write short answers to any five questions.

(i) Define physical chemistry. What is its scope?

Ans. Physical Chemistry:

Definition:

"Physical chemistry is defined as the branch of chemistry that deals with the relationship between the composition and physical properties of matter along with the changes in them."

Scope:

The properties such as structure of atoms or formation of molecules, behavior of gases, liquids and solids and the study of the effect of temperature or radiation on matter, all are studied under this branch.

(ii) Differentiate between organic and inorganic chemistry.

Ans. Organic Chemistry:

"Organic chemistry is the study of covalent compound of carbon and hydrogen called hydrocarbons and their derivatives."

Inorganic Chemistry:

"Inorganic chemistry deals with the study of all elements and their compounds except those of compounds of carbon and hydrogen (hydrocarbons) and their derivatives."

(iii) Define biochemistry. Give its scope.

Ans. Biochemistry:

Definition:

"It is the branch of chemistry in which we study the structure, composition and chemical reactions of substances found in living organisms."

Scope:

Biochemistry covers all chemical processes taking place in living organisms. Such as synthesis and metabolism of biomolecules like carbohydrates, proteins and fats.

(iv) What is nuclear chemistry. Give some applications of nuclear chemistry.

Ans. Nuclear Chemistry:

Definition:

"Nuclear chemistry is the branch of chemistry that deals with the radioactivity, nuclear processes and nuclear properties."

Applications:

(1) The main concern of this branch is with the production of energy from the atom and its uses in daily life. In other words it is used for the production of electricity through nuclear reactors.

(2) It also includes the study of the chemical effects resulting from the absorption of radiation within living animals, plants, and other materials.

(3) It has vast applications in medical treatment (radiotherapy).

(4) It is also used for preservation of food.

(v) Differentiate between physical and chemical properties? Give their examples.

Ans. Types of Properties of a Substance:

There are two main types of properties of a substance.

Physical Properties

"The properties that are associated with the physical state of a matter are called physical properties".

Examples: Properties of a substance like, its colour, smell, hardness, shape of a crystal, solubility, melting or boiling points, density, etc. are called physical properties of a substance.

Chemical Properties

"The properties that can be observed only when a substance undergoes a chemical change are called chemical properties of a substance".

Examples: Properties like, rusting of iron, burning of coal or gasoline in air, decomposition of water during electrolysis, burning of Mg, oxidation of food in the body cells, etc. are called chemical properties of a substance.

(vi) Sort out physical and chemical properties from the following:
Colour, smell, rusting of iron, burning of coal, melting point, density, decomposition of water, solubility, etc.

Ans. Physical Properties:

Colour, smell, melting point, density, solubility.

Chemical Properties:

Rusting of iron, burning of coal, decomposition of water.

(vii) What is the modern definition of element? Give some examples of elements.

Ans. Element:

"It is a substance made up of same type of atoms, having same atomic number and it can not be decomposed into simple substances by chemical means."

Examples:

Hydrogen (H), Iron (Fe), Copper (Cu), mercury (Hg), Oxygen (O) etc. are elements.

(viii) How elements are classified according to their physical state?

Ans. Classification of Elements:

According to their physical states, elements can be classified into solids, liquids and gases.

1. **Solids:** Majority of the element exist as solids e.g. sodium, copper, zinc, gold, etc.
2. **Liquids:** There are very few elements which occur in liquid state e.g. mercury and bromine, etc.
3. **Gases:** A few elements exists as gases e.g. nitrogen, oxygen, chlorine and hydrogen, etc.

(ix) How many amu 1g of a substance has?

Ans. Ans. We know that

$1 \text{ amu} = 1.66 \times 10^{-24} \text{ g}$

Or $1 \text{ g} = \frac{1}{1.66 \times 10^{-24}} \text{ amu} = 0.66240 \times 10^{24} \text{amu}$

$= 6.02 \times 10^{23} \text{amu}$

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Q.3 Write short answers to any FIVE (5) questions.

(i) Define valency and give examples.

Ans. Valency:

"It is combining capacity of an element with other elements."

Examples:

(1) Valency of Cl is 1. One atom of hydrogen combines with Cl to form HCl.

(2) Valcency of O is 2. Two atoms of hydrogen combines with O to form H_2O.

(3) Valency of nitrogen is 3. Three atoms of hydrogen combines with one atom of nitrogen to form an ammonia molecule NH_3.

(4) Valency of carbon is 4. Four atoms of hydrogen combines with one atom of carbon to form a methane molecule CH_4.

(ii) What is meant by a compound? Give examples.

Ans. Compound

"Compound is a substance made up of two or more elements chemically combined together in a fixed ratio by mass."

Examples:

(1) Carbon dioxide (CO_2) is formed when elements of carbon (C) and oxygen (O) combine chemically in fixed ratio of 12:32 or 3:8 by mass.

(2) Water (H_2O) is a compound formed by a chemical combination between hydrogen (H) and oxygen (O) in a fixed ratio of 2: 16 or 1:8 by mass.

(iii) Write down the chemicalformulae of the following compounds:
Water, sodium chloride, sand, sodium hydroxide

Ans. Chemical Formulae of Given Compounds:

Compound	Formula
Water	H_2O
Sodium chloride (Common salt)	NaCl
Silicon dioxide (Sand)	SiO_2
Sodium hydroxide	NaOH

(Caustic Soda)	

(iv) Differentiate between homogeneous and heterogeneous mixtures.

Ans. Homogeneous Mixture:

"A mixture having a uniform composition is called a homogeneous mixture".

Examples: Air, petrol, natural gas, copper sulphate solution, sugar solution, etc.

Heterogeneous Mixture:

"A mixture having a non-uniform composition is called a heterogeneous mixture".

Examples: Milk, blood, ice-cream, soil, rocks, food-products, wood, water, etc.

(v) Define atomic number (Z) and mass number (A)?

(OR)

Define atomic number and mass number? What is the relation between mass number and atomic number of an element?

Ans. Atomic Number (Z) :

"The atomic number of an element is equal to the number of protons present in the nucleus of its atoms."

Symbol :

It is represented by symbol "Z".

Examples :

(1) All hydrogen atoms have one proton, their atomic number Z=1.

(2) All atoms in the carbon have 6 protons, their atomic number Z=6.

Mass Number (A):

"The mass number is the sum of number of protons and neutrons present in the nucleus of an atom."

Symbol:

It is represented by 'A'.

Calculation of Mass Number/Relation between Mass Number and Atomic Number:

It is calculated as $A = Z + n$.

where 'n' is the number of neutrons.

Examples:

(1) Mass number of hydrogen is $A = Z + n = 1 + 0 = 1$.

In case of hydrogen (protium), there is no neutron in the nucleus.

(2) Mass number of carbon is $A = Z + n = 6 + 6 = 12$.

(vi) Differentiate between relative atomic mass and atomic mass unit. What is the relation between an amu and a gram?

Ans. Relative Atomic Mass:

"The relative atomic mass of an element is the average mass of atoms of that element as compared to 1/12th (one twelfth) the mass of one atom of carbon-12 isotope."

(OR)

"Relative atomic mass of an element is the mass of an element compared with 1/12 mass of an atom of C-12 isotope."

Atomic Mass unit:

"Atomic mass unit is $\frac{1}{12^{th}}$ of the mass of one atom of C-12."

Symbol:

Its symbol is 'amu'.

Relation between amu and a Gram:

When atomic mass is expressed in grams it is:

1 amu = 1.66×10^{-24}g

For examples:

Mass of proton = 1.0073 amu
or 1.672×10^{-24}g
Mass of neutron = 1.0087 amu
or 1.674×10^{-24}g
Mass of electron = 5.486×10^{-4} amu
or 9.106×10^{-28}g

(vii) What is the difference between empirical formula and molecular formula?

Ans. Empirical Formula:

"It is the simplest whole number ratio of atoms present in a compound.

Examples:

(1) The covalent compound silica (sand) has simplest ratio of 1:2 of silicon and oxygen respectively. Therefore, its empirical formula is SiO_2.

(2) Glucose has simplest ratio 1:2:1 of carbon, hydrogen and oxygen respectively. Hence its empirical formula is CH_2O.

Molecular formula:

"Molecular formula gives the actual number of atoms of each element present in a molecule of a certain compound."

Examples:

Molecular formulae of some compounds are derived from their empirical formulae as following:

$$\text{Molecular Formula} = (\text{Empirical Formula})_n$$

(1) The molecular formula of hydrogen peroxide $= (HO)_2 = H_2O_2$

(2) The molecular formula of glucose $= (CH_2O)_6 = C_6H_{12}O_6$

(viii) How many number of protons and neutrons are there in an atom having A = 238 when it's Z = 92.

Ans.

First of all develop data from the given statement of the problem and then solve the problem with the help of data.

Given Data

Mass Number= A= 238
Atomic Number = Z= 92

To Find:

Number of protons = ?
Number of neutrons = ?
Number of protons = Z = 92

Calculations:

Number of Neutrons=A – Z
=238 – 92 = 146

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Q.4 Write short answers to any FIVE (5) questions.

(i) What is meant by molecular mass and formula mass?

Ans. Molecular Mass:

"The sum of atomic masses of all the atoms present in one molecule of a molecular compound is called molecular mass."

Examples:

The molecular mass of water (H_2O) is 18 amu and that of carbon dioxide (CO_2) is 44amu.

Formula Mass:

"The sum of atomic masses of all the atoms present in the formula unit of a substance is called formula mass."

Examples:

The formula mass of sodium chloride is 58.5amu and that of $CaCO_3$ is 100 amu.

(ii) Define Avogadro's Number and mole. What is the relationship between Avogadro's number and a mole.

Ans. Avogadro's Number:

"The 6.02×10^{23} number of particles (atoms, ions, molecules) in one mole of a substance is called Avogadro's number."

Symbol:

It is represented by N_A.

Value of Avogadro's Number:

Mathematically, we can write

$N_A = 6.02 \times 10^{23}$ particles

Relationship between Avogadro's Number and Mole:

1 mole = 6.02×10^{23} particles.

or6.02×10^{23} particles = 1 mole

Examples:

(1) 6.02×10^{23} atoms of carbon are equivalent to one of carbon.

(2) 6.02×10^{23} molecules of water are equivalent to one mole of water.

(3) 6.02×10^{23} formula units of NaCl are equivalent to one mole of sodium chloride.

(iii) Define mole. Give examples.

Ans. Mole:

"A mole is defined as the amount (mass) of a substance that contain 6.02×10^{23} number of particles (atoms, molecules or formula units).

(OR)

"It is also defined as the atomic mass, molecular mass or formula mass of a substance expressed in grams".

Symbol:

It is abbreviated as 'mol'.

Examples:

(1) Atomic mass of carbon expressed as 12 g = 1 mole of carbon.

(2) Molecular mass of H_2O expressed as 18 g = 1 mole of water.

(3) Formula mass of NaCl expressed as 58.5 g = 1 mole of NaCl

(iv) Difference between Atom and Gram Atom:

Atom:

"It is the smallest particle of an element which can take part in a chemical reaction."

Examples:

Atoms of hydrogen and helium are represented by (H) and (He) respectively.

Gram Atom:

"The atomic mass of an element expressed in grams is called gram atom. It is also called a mole."

Examples:

1 gram atom of hydrogen = 1.008g
= 1 mole of H
1 gram atom of carbon = 12.0g
= 1 mole of C

(v) How many atoms are present in 1 amu and 1g of hydrogen (H)?

Solution:

To Find No. of H atoms in 1 amu of hydrogen (H):

1 amu = 1.66×10^{-24} g

Given Data:

Given mass of H = 1 g
Molar mass of H = 1 g

Formula:

No. of particles = No. of moles $\times N_A$

Calculations:

Putting the values we get;

$$\text{No. of H atoms} = \frac{1.66 \times 10^{-24}\ \text{g}}{1\ \text{gmol}^{-}} \times 6.02 \times 10^{23}\ \text{atoms.mol}^{-}$$

$= 9.99 \times 10^{-1}$ atoms = 0.999 atom = 1 atom

To Find No. of H atoms in 1 g of hydrogen (H):

No. of H atoms

$$\text{No. of H atoms} = \frac{1\ \text{g}}{1\ \text{gmol}^{-}} \times 6.02 \times 10^{23}\ \text{atoms.mol}^{-}$$

$= 6.02 \times 10^{23}$ atoms

(vi) If 16 g of oxygen contains 1 mole of oxygen atoms, calculate the mass of one atom of oxygen in grams.

Solution:

1 mole of oxygen atoms = 16 g
Also1 mole of oxygen atoms = 6.02×10^{23} atoms.
Thus,6.02×10^{23} atoms of oxygen has mass = 16 g
1 atom of oxygen atom (O) has mass

$$= 1\ \text{atom} \times \frac{16\ \text{g}}{6.02 \times 10^{23}\ \text{atoms}} = 2.657 \times 10^{-23}\ \text{g}$$

$= 2.65 \times 10^{-23}$ g

(vii) Which one has more formula units? 1g of NaCl or 1g of KCl?

Solution:

No. of Formula Units in 1 g of NaCl :

Given mass of NaCl = 1 g
Formula mass of NaCl= 58.5 gmol^{-}
Avogadro's Number=N_A=6.02×10^{23} molecules.mol^{-}

To Find:

No. of formula units of NaCl = ?

Formula:

No. of atoms of a substance =No. of moles $\times N_A$

or

$$\text{No. of atoms of a substance} = \frac{\text{known mass of a substance}}{\text{formula mass of a substance}} \times N_A$$

or

$$\text{No. of formula units of NaCl} = \frac{\text{known mass of NaCl}}{\text{formula mass of NaCl}} \times 6.02\times10^{23} \text{ molecules.mol}^{-}$$

Calculations:

Putting the values, we get

No. of formula units of NaCl

$$= \frac{1\text{ g}}{58.5\text{ gmol}^{-}} \times 6.02\times10^{23} \text{ formula units.mol}^{-}$$

$$= 0.102 \times 10^{23} \text{ formula units}$$

(viii) What is meant by the theory of dual nature of matter?(OR)What is meant by corpuscular and wave nature of matter?

Ans. Corpuscular Nature of Matter:

In 1924, *de Broglie* put forward the theory of dual nature of matter i.e. matter has both the properties of particles as well as waves. He explained the background of two ideas. He advocated that these two systems could not remain detached from each other. By mathematical evidences he proved that every moving object is attached with waves and every wave has corpuscular nature as well. It formulated a basis to understand corpuscular nature of matter.

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PART-II (LONG/DESCRIPTIVE QUESTIONS)

Q.5 **(a)** Enlist and explain different branches of chemistry. Also describe the Scope/applications of each branch in daily life. **(3)**

(b) Write down seven difference between a compound and a mixture? **(4)**

Ans. (a)See Chapter 1Q.No.6

(b)See Chapter 1Q.No.44

Q.6 **(a)** Define symbol. What rules are adopted to write a symbol of an element. Explain with examples. **(4)**

(b) What is a chemical formula? How a chemical formula is written? Write down its steps. **(3)**

Ans. (a)See Chapter 1Q.No.34

(b)See Chapter 1Q.No.51

Q.7 **(a)** What will be the mass of 2.05×10^{16} molecules of H_2SO_4? **(3)**

(b) How many grams of Mg will have the same number of atoms as 6 grams of C have? **(4)**

Ans. (a)See Chapter 1Numerical No.6

(b)See Chapter 1 Numerical No.10

Q.8 **(a)** Define ion. Describe its kinds. How are **(4)**

formed? Explain with examples.

(b) What is molecular ion? Describe its types. **(3)**

Ans. (a)See Chapter 1Q.No.19

(b)See Chapter 1Q.No.21

Q.9 (a) What is mole? Explain with examples. **(4)**
(OR) What is the relationship between Avogadro's Number and mole?

(b) How many ions of Na^+ and Cl^- will be present in 30g of NaCl? **(3)**

Ans. (a)See Chapter 1Q.No.29

(b)See Chapter 1 Exc. Q.No.8

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PART-III (PRACTICAL QUESTIONS)

10. (i) What are different types of mixture? (2)

Ans. Types of Mixtures: Mixture is divided into two main types:

(i) Homogeneous Mixtures

(ii) Heterogeneous Mixtures

(ii) How many physical method are used to separate mixture's ingredient?

Ans. Components of a mixture can be separated by the following methods:

(i) Filtration (ii) Distillation
(iii) Evaporation (iv) Using bar magnet
(v) Crystallization (vi) Sublimation

11. (i) What happened, when a mixture of scrambled egg placed in cold vacuum chamber?

Ans. When a mixture of scrambled egg is cooled at such a place where atmospheric pressure is very low, it will changes to powder form.

(ii)

prepare 0.02 M of its 500cm3 solution?

Solution:

Molarity of KOH = 0.2 M

Molar mass of KOH = 39+16+1 = 56

Required volume of KOH in $dm^3 = \frac{500}{1000}\ dm^3$

$= 0.5\ dm^3$

According to formula, we get

Required moles of KOH

= Molarity of KOH × Required volume of KOH

= 0.02 × 0.5 dm^3 = 0.01 moles

Required volume of KOH

= No. of moles of KOH × Molar mass of KOH

= 0.01 × 56 = 0.56 g (Ans)

OR

According to formula

$$\text{Molarity} = \frac{\text{Mass of solute}}{\text{Molar mass of solute}} \times \frac{1}{\text{volume}}$$

Putting the values we get

$$0.02\ M = \frac{\text{Mass of KOH}}{56} \times \frac{1}{500/1000}$$

$$\text{Mass of KOH} = \frac{56 \times 0.02}{2} = 0.56 \text{ g (Ans)}$$

12. (i) **Which method will be used to separate the components of the following mixtures?**

(a) mixture of sodium chloride and aluminium particles.

(b) Mixture of sodium chloride and ammonium chloride.

(c) Mixture of sodium chloride, sand and iron fillings.

Ans. **(a) Filtration**

Explanation:

Mineral salt dissolves in water to make a solution while aluminium is insoluble in water.

Through filtration aluminium can be separated while mineral salt is obtained by evaporation the water.

(b) Mixture of sodium chloride and ammonium chloride.

Sublimation:

Ammonium chloride after sublimation directly converts into vapours and these vapours can be condensed to form solid ammonium chloride again. In this way ammonium chloride and mineral salt can be separated from each other.

(c) Mixture of sodium chloride, sand and iron fillings.

Separation of Iron Fillings:

First of all, iron fillings are separated from the said mixture (a mixture a mineral salt, sand and iron fillings) by the magnet.

Separation of Sand from Mineral Salt:

Now the remaining mixture of a mineral salt (sodium chloride) and sand is dissolved in water. Sand settles down at the bottom. After filtration sand is separated from the mineral salt.

How much KOH will be required to

Separation of Mineral Salt:

At last the solution of mineral salt is evaporated in a china dish to get the mineral salt.

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