CHAPTER : 1

SOME BASIC CONCEPTS OF CHEMISTRY

1 mark questions

1. What is Chemistry?

   Ans: It is a Branch of science deals with the study of composition, properties and interaction of matter.

2. What are the basic constituents of matter?

   Ans: The basic constituents of matter are atoms and molecules

3. Mention any two life saving drugs

   Ans: 1. Cisplatin 2. Taxol

4. Name the drug used in the treatment of AIDS

   Ans: Azidothymidine (AZT)

5. Name the drug used in the cancer therapy

   Ans: 1. Cisplatin 2. Taxol

6. Which chemical is responsible for depletion of Ozone

   Ans: Chloroflurocarbons (CFCs)

7. Mention green house gases

   Ans: Methane (CH_4) and carbon dioxide (CO_2)

8. What is matter?

   Ans: Matter is anything which has mass and occupies space.

9. Define solid

   Ans: Solid is a substance have definite shape and volume

10. Define Liquid

    Ans: Liquid is a substance which has definite volume but not definite shape.

11. Define Gas

    Ans: Gas is a substance which has neither definite volume nor definite shape.

12. Name the SI unit of density

    Ans: S.I unit of density is Kg/m^3 or Kgm^{-3} or gm/cm^3

13. Define Significant figure

    Ans: Significant figures are meaningful digits which are known with certainty.

14. What is meant by dimensional analysis?

    Ans: Any calculation involving the use of the dimensions of the different physical quantities involved is called dimensional analysis.

15. What is atomic mass unit?

    Ans: Atomic mass unit is defined as a mass exactly equal to $1/12^{th}$ the mass of one carbon 12 atom

16. What is the value of 1 a.m.u ?

    Ans: 1 a.m.u = 1.66056×10^{-24} g

17. Define molecular mass

    Ans: Molecular mass is the sum of atomic masses of the elements present in a molecule.

18. What is molar mass in gms?

    Ans: The mass of one mole of a substance in grams is called molar mass.

19. Write the formula used to calculate the % composition of elements

    Ans: Mass percentage of an element =

$$\frac{\text{Mass of that element in the compound}}{\text{Molar mass of the compound}} \times 100$$

20. What is empirical formula?

    Ans: It is a simplest whole number ratio of various atoms present in a compound.

21. What is molecular formula?

    Ans: It is a exact formula indicates number of different types of atoms present in a molecule of a compound.

22. What is a stoichiometry?

    Ans: The quantitative relationships between the various reactants and products interms of moles, masses, molecules and volumes is called stoichiometry.

23. What is limiting reagent?

    Ans: Out of various reactants in a reaction, a reactant that is completely consumed in a chemical reaction is called limiting reagent.

24. Write the general formula of molarity equation

    Ans: Molarity (M) $= \frac{\text{No. of moles of solute}}{\text{Volume of solution in litre}}$

25. Define mole fraction

    Ans: It is a ratio of no of moles of a particular component to the total number of moles of the solution.

26. Define molality

    Ans: Molality is the number of moles of solute present in one Kg of solvent

27. Define mass percentage

    Ans: It is defined as the mass of the component in 100 grams of the solution.

28. Define molarity

    Ans: It is defined as the number of moles of solute present in one litre of solution.

29. Define normality

    Ans: Normality can be defined as gram equivalent mass of the substance present in one dm^3 of the solution.

30. Define mole

    Ans: Mole can be defined as the amount of a substance that contains as many particles or entities as there are atoms in exactly 12 gms of carbon – 12 isotope.

31. Write the equation to give relationship between ^{o}C and ^{o}F

    Ans: $^{o}F = 9/5\ (^{o}C) + 32$

Two marks questions

1. What is the importance of chemistry in daily life ?

   Ans: Chemistry plays an important role in meeting human needs for food, health care products and other materials aimed at improving the quality of life.

2. What is homogeneous mixture? Give an example.

   Ans: Homogeneous mixture is a mixture in which the components are completely mix with each other and its composition is uniform throughout the solution

   Ex: sugar solution, air, sodium chloride solution

3. What is heterogeneous mixture? Give an example.

   Ans: It is a mixture in which the components are not completely mix with each other and its composition is not uniform throughout the solution.

   Ex: mixture of salt and sugar, grains and pulses

4. Distinguish between pure substance and mixture

Pure Substance	**Mixture**
1. Pure substance is composed of the same kind of particles	1. The composition of mixture is variable
2. The pure substance is homogeneous, irrespective of its origin	2. In mixture each of its components retains its characteristic properties.

5. Define atom with an example.

   Ans: Atom is the smallest particle of an element which may or may not be capable of independent existence.

   Ex: Atoms of iron, copper, hydrogen

6. Define molecule with an example

   Ans: A molecule is the smallest particle of an element or a compound which can exist freely

   Ex: Hydrogen molecule (H_2), water molecule (H_2O)

7. Define physical properties of matter with an example

   Ans: The property which can be measured or observed without changing the identity or the composition of the substance is called physical property.

   Ex: Colour, odour, melting point and boiling point

8. Define Chemical properties of matter with an example.

   Ans: Chemical properties are those in which a chemical change in the substance occurs.

   Ex: Acidity, basacity, combustibility

9. Give the units of S.I. systems for the following a) Electric current b) Amount of substance

   Ans: a) Electric current – Ampere (A)

   b) Amount of substance – Mole (mol)

10. Define mass and weight

    Ans: Mass of a substance is the amount of matter present in it and it is constant.

    Weight is the force exerted by gravity on an object it changes one place to another due to change in the gravity.

11. Express the following into scientific notation

    a) 0.00016 b) 33693.68

    Ans: a) $0.00016 = 1.6 \times 10^{-4}$ b) $33693.68 = 3.369368 \times 10^{4}$

12. Define significant figures

    Ans: The total number of digits in a number including the last digit whose value is uncertain is called the number of significant figures.

13. Define precision and accuracy

    Ans: Precision refers to the closeness of various measurements for the same quantity. Accuracy is the agreement of a particular value to the true value of the result.

14. How many significant figures are present in the following ?

    a) 6.005 b) 6.002×10^{23}

    Ans: a) 6.005 = Four because the zeroes between the non zero digits are significant figures

    b) 6.022×10^{23} = Four because the exponential term is not considered.

    c) 4.01×10^{2} = 3 significant figures

15. State the law of conservation of mass and who proposed it ?

    Ans: It states that matter can neither be created nor be destroyed. It was proposed by Antomic Lavoisier.

16. State Law of Definite proportion

    Ans: It states that a given compound always contains exactly same proportion of elements by weight.

17. State Law of Multiple proportions

    Ans: Law of multiple proportions can be defined as if two elements can combine to form more than one compound the masses of one element that combines with a fixed mass of the other element are in the ratio of small whole numbers.

18. State Gay Lussac's law of Gaseous volumes

    Ans: It can be defined as when gases combine or are produced in a chemical reaction they do so in a simple ratio by volume provided all gases are at same temperature and pressure.

19. State Aragadro Law

    Ans: It can be defined as equal volumes of gases at the same temperature and pressure should contain equal no of molecules

20. What are isotopes? Mention the isotopes of carbon

    Ans: Atoms having same atomic number with different mass number are called isotopes. Isotopes of carbon are ^{12}C, ^{13}C, ^{14}C

21. Define Aragadro Number and mention its values

    Ans: The number of particles present in one mole of a substance

    6.022×10^{23}

22. A piece of copper wire is 2.00 inch long. What is its length in centimeter

    Ans: 1 inch = 2.54 cm

    Therefore 2 inch = $\frac{2.54 \times 2}{1}$ = 5.08 Cms

23. A plastic Jug contains 3.5 Ltrs of milk calculate the volume of milk in meter ^{3}

    Ans: 1 L = 1000 Cm^3

    3.5 L = 1000 x 3.5 Cm^3 = 3500.0 Cm^3

    $1m^3$ = 1mx1mx1m

    = 10^2cm x 10^2cm x 10^2cm = 10^6 Cm^3

    = 3.5 x 1000 x $1m^3$ / 10^6

    = $\frac{3.5 \times 10^3}{10^6}$ = 3.5×10^{-3} m^3

24. How many seconds are there in 3 days

    Ans: 1 day = 24 hours

    1 hour = 60 minutes

1 minute = 60 seconds

3 day = 3 x 24 Hrs x 60 min x 60 sec

= 259 200 seconds

25. Calculate the molecular mass of the following a) Ethane (C_2H_6)

b) Ammonia (NH_3)

Ans: a) Ethane (C_2H_6)

Ethane = C_2H_6 2 x atomic mass of carbon + 6 x atomic mass of Hydrogen
= 2 x (12.011u) + 6 x (1.008 U)

= 24.022u + 6.048u

= 30.070u

b) Ammonia (NH_3)

Ammonia=(NH_3) = 1x atomic mass of Nitrogen + 3 x atomic mass of Hydrogen

= 1x(14.01u) + 3 (1.008u)

= 14.01u + 3.024u = 17.034u

26. Calculate the formula mass of KCl (Potassium chloride)

Ans: formula mass of potassium chloride = Atomic mass of Potassium + Atomic mass of chlorine

39.10u + 35.5u = 74.60u

27. Calculate the no of molecules present in 2.5 moles of water (H_2O)

Ans: 1 mole of water = 6.022×10^{23}

Therefore 2.5 moles of water = $\frac{2.5 \times 6.022 \times 10^{23}}{1}$

= 15.055×10^{23} molecules

28. Calculate the percent (%) composition of elements in methanol (CH_3OH)

Ans: Molecular formula of methanol CH_3OH

Molecular mass of methanol = 1x12.01+4x1.008+ 1x16.0
= 32.042 gm

Percent composition of carbon = $\frac{\text{Mass of carbon x 100}}{\text{Molecular mass of } CH_3OH}$

= $\frac{12.01}{32.042}$ X 100 = 37.48%

Percent composition of Hydrogen = $\frac{\text{Mass of Hydrogen}}{\text{Molecular mass of } CH_3OH} \times 100$

$= \frac{4.032}{32.042} \times 100 = 12.5\%$

Percent composition of Oxygen $= \frac{16 \times 100}{32.04} = 49.93\%$

29. Calculate the amount of water in gm produced by the combustion of 8 gms of Ethane

Ans: Reaction $C_2H_{6\,(g)} + 3\frac{1}{2}\, O_{2\,(g)} \rightarrow 2CO_{2\,(g)} + 3H_2O_{(g)}$

30 gms of ethane = 1 mole = 3 moles of H_2O

8 gms of ethane

1 mole of H_2O = 18 gm of H_2O

3 mole of H_2O = 18x3 = 54 gms of water

30 gms of ethane produced = 54 gms of water

Therefore 8 gms ethane produced = 14.4 gms

$\frac{8 \times 54}{30} = 14.4$ gms

30. How many moles of methane required to produce 88 gms of CO_2 after combustion

Ans: Combustion reaction

$CH_{4\,(g)} + 2O_{2\,(g)} \rightarrow CO_{2\,(g)} + 2H_2O_{(g)}$

16 gms of Methane = 1 mole = 44 gms of CO_2

44 gms of CO_2 is produced from 1 mole of methane

88 gms of CO_2 is produced from $\frac{88}{44} \times 1 = 2$ moles

31. 25 Kg of N_2 (gm) and 5 Kg of H_2 are mixed to produce Ammonia (NH_3). Calculate the ammonia formed

Ans: Equation $N_{2\,(g)} + 3H_{2\,(g)} \rightarrow 2NH_{3\,(g)}$

= 25 Kg N_2 + 5 Kg H_2 → NH_3

1 Kg of N_2 = 1000gm N_2

25 Kg of N_2 = 25 x 1000 = 25000/28 = 892.85 mol

1 Kg of H_2 = 1000 gm H_2

5 Kg of H_2 = 5x 1000 = 5000/2.016 = 2480.15 mol

According to above equation 1 mol of $N_{2(g)}$ requires 3 moles of $H_{2(g)}$ Hence 892.85 mole of N_2 and the mols of H_2 required would be

892.85 x 3 mol of H_2 / 1 mol N_2

= 2678.55 mol = 2.67855 x 10^3 mol H_2

But we have 2480.15 mol of H_2. Hence in this process 2678.55 mol of H_2 is required.

3 moles of H_2(g) → 2 moles of NH_3

2480.15 mole of H_2 → 1653.43 mole of NH_3 gas is formed

$$\frac{2480.15}{3} \times 2 = 1653.43 \text{ mol of } NH_3$$

32. A solution is prepared by adding 4.00 gm of a substance A to 18 gm of water calculate the mass percent of the solute.

Ans: Mass % of solute (A) = $\frac{\text{Mass of solute (A)}}{\text{Mass of solution}} \times 100$

$$= \frac{4 \times 100}{4+18\text{g } H_2O} = \frac{400}{22\text{gm}} = 18.18\ \%$$

Mass % of solute = 18.18%

33. Calculate the molarity of sodium Hydroxide (NaOH) in the solution prepared by dissolving 4 gm in 500ml of the solution.

Ans : Molarity = $\frac{\text{No of moles of solute}}{\text{Volume of solution in litre}}$

$$= \frac{\text{Mass of NaOH/molar mass of NaOH}}{0.5 \text{ Litre}}$$

$$= \frac{4/40}{0.5} = 0.1/0.5 = 1/5 = 0.2 \text{ mol / litre}$$

34. The density of 2M solution of sodium chloride (NaCl) 1.13 g mol/litre. Calculate molality of the solution. M= 2 mol per litre.

Ans: Mass of Nacl in 1 litre solution = 2 x 58.5

= 117.0 g

Mass of 1 litre solution = 1000 x 1.13 = 1130 g

Mass of water in solution = 1130 g – 117.0 g = 1013 g

$$\text{Molality} = \frac{\text{No of moles of solute}}{\text{Mass of solvent in Kg}}$$

= 2 mol / 1.013 Kg = 1.9743 Molality

4 Marks questions

1. Write any four postulates of Daltons atomic theory

   Ans: Dalton published a new system of chemical philosophy in 1808 in which the proposed the following:

   1) Matter consists of indivisible atoms
   2) All the atoms of a given element have identical properties including identical mass. Atoms of different elements differ in mass.
   3) Compounds are formed when Atoms of different elements combine in a fixed ratio.
   4) Chemical reactions involve reorganization of atoms these are neither created nor destroyed in a chemical reaction.

2. A Organic compound contain 57.14% of carbon, 6.16% Hydrogen, 9.52% Nitrogen 27.18% oxygen. Calculate the empirical formula and molecular formula. If its molecular mass is 294.3 gm/mole.

Ans:

Element	%	At mass	% at mass	Nearest whole no	
Carbon	57.14	12	57.14/12	4.76	4.76/0.68=7
Hydrogen	6.16	1	6.16/1	6.16	6.16/0.68=9.06
Nitrogen	9.52	14	9.52/14	0.68	0.68/0.68=1
Oxygen	27.18	16	27.18/16	1.698	1.698/0.68=2.45

Empirical formula = $C_7H_9N_1O$

Empirical formula mass = $C_7H_9N_1O_{2.5}$

= 12x7 + 1x9 + 1x14 + 2.5x16

= 84+9+14+40

= 147

Molecular formula mass = 294.3

Molecular formula = Empirical formula x n

$$n = \frac{\text{Molecular formula mass}}{\text{Empirical formula}} = \frac{294.3}{147}$$

n = 2

Therefore Molecular formula = Empirical formula x n

= $(C_7H_9N_1O_2)_2$

= $C_{14}H_{18}N_2O_4$

3. Compound contains 4.07% Hydrogen 24.27% Carbon and 71.65% chlorine. Its molecular mass is 98.96 gm what are its empirical formula and molecular formula?

Ans:

Element	Symbol	% of element	At mass of element	Moles of the element = %	Simpler molar mass
Hydrogen	H	4.07	1	4.07/1 = 4.07	4.04/2.018=2.01
Carbon	C	24.27	12	24.27/12 = 2.022	2.022/2.018 =1.0019
Chlorine	Cl	71.65	35.5	71.65/35.5 = 2.018	2.018/2.018 = 1

Therefore Empirical formula = $H_2C\ Cl = CH_2Cl$

Empirical formula weight = 1x12 + 2x1 + 35.5x1

= 12+2+35.5 = 49.5

Molecular formula = Empirical formula x n

Therefore $n = \frac{98.96}{49.5} = 2$

Therefore molecular formula = $(CH_2Cl)_2 = C_2H_4Cl_2$

4. An organic substance containing carbon Hydrogen and oxygen gave the percentage composition as C=40.687 % H=5.085 % and 0=54.228%
   The vapour density of the compound is 59 calculate the molecular formula of the compound.

   Ans: Solution = Step 1

Element	Symbol	% of element	At mass of element	Moles of the element = %	Simplest molar ratio	Simplest whole No. multiplied by 2
Carbon	C	40.687	12	40.687/12 = 3.390	3.390/3.389 = 1	2
Hydrogen	H	5.085	1	5.085/1 = 5.085	5.085/3.389=1.5	3
Oxygen	O	54.228	16	54.228/16 = 3.389	3.389/3.389=1	2

   Empirical formula $C_2H_3O_2$

   Step 2

   To calculate the empirical formula mass

   Empirical formula $C_2H_3O_2$

   Therefore Empirical formula mass 2x12+3x1+2x16 = 59

Step 3

To calculate the molecular mass of the compound

The vapour density of the compound = 59

Molecular mass = Vapour density x 2

= 59 x 2 = 118

Step 4

To calculate the value of 'n'

$$n = \frac{\text{molecular mass}}{\text{Empirical formula mass}} = \frac{118}{59} = 2$$

Step 5

Molecular formula = Empirical formula x n

= $C_2H_3O_2$ x 2

= $C_4H_6O_4$

Therefore Molecular formula is $C_4H_6O_4$

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