YAKEEN NEET 2.0

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(One Shot)

Some Basic Concept of Chemistry

Physical Chemistry Summary Lecture

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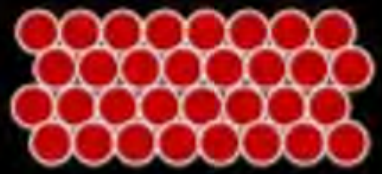
Importance of Chemistry

- In meeting human needs for food, health care products and other products required for improving quality of life.
- In diverse areas as weather patterns, functioning of brain and operation of a computer.
- In chemical industries.

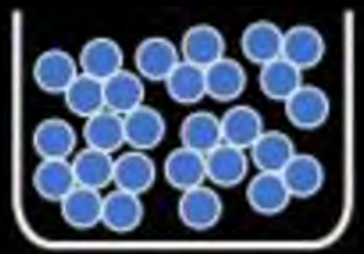
Sates of Matter

(i) Solid : Particles are held very close to each other in an elderly fashion with no freedom of movement.



Have definite volumes and shape

(ii) Liquids : Particles are close and can move around



Have definite volume but no definite shape

(iii) Gases : Particles are far apart and their movement is easy and fast

Neither have definite volume nor definite shape

Properties of matter

(i) Physical : Properties measured/observed without changing the identity or composition of substance (Colour, Odour)

(ii) Chemical : Properties measured/observed when a chemical reaction occurs. (Acidity or Basicity, Combustibility)

Classification

Mixtures : Two or more substances present in any ratio.

Homogenous : Uniform composition (Sugar solution, Air)

Heterogenous : Non-uniform composition (Mixtures of salt and sugar)

Pure Substance : Fixed composition

Compounds : T~~ew~~wo or more atoms of different elements (H_2O, NH_3)

Elements : Contains one type of particles i.e., atoms, molecules (Na, Cu)

Na Cl_2 P_4 S_8

Atoms, Molecules & Ions

Atoms → smallest particle of element which may or may not hv independent existance

Helium → He ✓

Hydrogen → H

Phosphorous → P

H_2

P_4

Molecule :- small particle of element or Compd. which must hv indebendent existance.

$H_2 \rightarrow$

$NaCl \rightarrow$

$HCl \rightarrow$

$H_2SO_4 \rightarrow$

$P_4 \rightarrow$

Ions :

↓

Types of ions

① Cation : Loss of e^-

$Na \longrightarrow Na^+ + 1e^-$

② Anion : Gain of e^-

$Cl + 1e^- \longrightarrow Cl^-$

Calculation of Sub Atomic Particles

Atom $\rightarrow$ ${}^{A}_{Z}X$

$A \rightarrow$ mass no. = no of p + no. of n

$Z \rightarrow$ protons = atomic no = Z

protons = electron = Z

neutron = A - Z

Molecule $\rightarrow X_2$ ${}^{A}_{Z}X$

$e^- = 2 \times Z$

$p = 2 \times Z$

$n = 2 \times (A - Z)$

X^{+} ${}^{A}_{Z}X$

$p = Z$

$e^- = Z - 1$

$n = A - Z$

X^{-}

$p = Z$

$e^- = Z + 1$

$n = A - Z$

R.A.M., A.A.M. & G.A.M.

$1\,a.m.u. = \frac{1}{12} \times \frac{12}{N_A} = \frac{1}{N_A} = 1\,u$ or $1\,Da$

$\overset{16}{\underset{8}{O}}$

R.A.M. = 16 → Relative mass of 1 atom

A.A.M. = 16 a.m.u. → Absolute mass of 1 atom

G.A.M. = 16 g → Absolute mass of N_A atoms

O_2

$\rightarrow$ R.M.M. of O_2 = 32 $\rightarrow$ relative mass of 1 molecule of O_2

$\rightarrow$ A.M.M. of O_2 = 32 a.m.u. $\rightarrow$ Absolute mass of 1 molecule of O_2

$\rightarrow$ G.M.M. of O_2 = 32 g $\rightarrow$ Absolute mass of N_A molecules of O_2

^{16}O

O^{2+}

R.I.M. (R.F.M.) of O^{2+} = 16 $\rightarrow$ Relative mass of 1 ion.

A.I.M. (A.F.M.) of O^{2+} = 16 a.m.u. $\rightarrow$ Absolute

G.I.M. (G.F.M.) of O^{2+} = 16 g $\rightarrow$ Absolute mass of N_A ion.

^{16}O

$1\ a.m.u.$ definition Change $= \frac{1}{x} \times \frac{12}{N_A}$

atom or molecule or ion

Relative mass Change

molecule or ion

Absolute atom mass not Change

Gram atom or molecule or ion not Change

$$A' = A \times \frac{x}{12}$$

A = R.A.M. on Conventional scale

R.M.M. ——

R.F.M. ——

A' = New R.A.M.

—— R.M.M.

—— R.F.M.

Atomic Mass Unit

Atomic Mass Unit (amu) : A mass exactly equal to one-twelfth the mass of one carbon-12 atom.

Molecular Mass : Sum of atomic masses of the elements present in a molecule. One mole is the amount of a substance that contains as many particles/entities as there are atoms in exactly 12 g (or 0.012 kg) of the ^{12}C isotope,

Molar Mass : Mass of one mole of a substance in grams.

Important Formulae

- $$\text{Moles (n)} = \frac{\text{given Mass}}{\text{Molar mass}} = \frac{w}{M}$$

- $$\text{Moles (n)} = \frac{\text{given No.of particles (molecules)}}{\textit{Avogadro's number}}$$

  $$= \frac{\text{molecules}}{6.022\times10^{23}}$$

  $(N_A \text{ or } N_0)$

- $$\text{Moles (n)} = \frac{\text{given vol. of Gas}}{\text{Vol.of gas at STP}} = \frac{V_0}{22.4\,l}$$

  at STP

$$\text{Mass Percent} = \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$$

$$\text{Molarity} = \frac{\text{No.of moles of solute}}{\text{Volume of solution in litres}}$$

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

Mole Fraction :

$$\text{Mole fraction of A} = \frac{n_A}{n_A + n_B}$$

$$\text{Mole fraction of B} = \frac{n_B}{n_A + n_B}$$

Concentration Terms

% by strengt (W/V)

↓

%age strength of solute $= \frac{\text{mass of solute}}{\text{Volume of solution}} \times 100$

% by mass & d of solution (g/ml)

$$M = \frac{\%\text{ by mass} \times d \times 10}{M_B}$$

$$m = \frac{x_B \times 1000}{x_A \times M_A}$$

$$M = \frac{x_B \times n_A}{x_A \times V(L)}$$

$$M = \frac{m\,d}{1 + \frac{m M_B}{1000}}$$

unit of M = mol/L or Molar or M

——— m = mol/kg or Molal or m

——— x = no unit

Stoichiometry

$$1\,A(g) + 2\,B(s) \longrightarrow 2\,C(g)$$

S.i. of A = 1

________ B = 2

________ C = 2

S.C. can be

moles

molecules

Volume for gases at same temp. & pressure.

1 mole mass = G.M.M.

1 mole molecules = N_A

1 mole of gas has Volume at N.T.P. = 22.4 L

Limiting Reagent

$$L.R. = \frac{\text{no. of moles}}{\text{Stoichiometric Coefficient}} = \text{Lowest}$$

How to determine Empirical and Molecular Formula

E.F. $\rightarrow CH_2O$ — Glucose E.F.

✓

M.F. $\rightarrow C_6H_{12}O_6 \rightarrow$ Glucose M.F.

E.F.

$$A \quad \frac{\%\text{ge}}{\text{G.A.M.}} = x \qquad B \quad \frac{\%\text{ge}}{\text{G.A.M.}} = y$$

let $x<y$ $\quad A_{\frac{x}{x}} B_{\frac{y}{x}} = m$

$A_1 B_m$

Relation b/w E.F. & M.F.

$$M.F. = (E.F.)_x$$

$$x = \frac{\text{M.F. mass}}{\text{E.F. mass}}$$

Equivalent mass

$$E = \frac{G.M.M.}{n_f}$$

- Acids → n_f = no. of H^+ ion gvn by 1 molecule of acid.
- Base → n_f = no. of $\bar{O}H$ gvn by 1 molecule of Base.
- Ionic compd. → n_f = |Charge Cation or Anion|
- Ion → n_f = |Charge|
- Element → n_f = |Valency|

$$\text{no. of gram equivalent} = \frac{\text{mass } (w)}{\text{Equivalent mass } (E)}$$

Normality

$$N = \frac{\text{no. of g-eq of solute}}{V(L)}$$

Unit of N = g-eq/L or Normal or N

Law of Equivalence

$$A + B \longrightarrow C$$

Molarity of mix. Nature same (do not react with each other)

Total g-eq = g-eq. add

$$N = \frac{\text{g-eq. Total}}{\text{Volume Total}}$$

$N = M \times n_f$

Molarity of mix. → substance react.

$$\text{g-eq. left} = |\text{g-eq acid} - \text{g-eq base}|$$

$$N = \frac{\text{g-eq. Left}}{\text{Total } V(L)}$$

$$N = M \times n_f$$

Laws of Chemical Combination

(i) Gay Lussac's Law of gaseous Volume : When gases combine of all produced in a chemical reaction they do so in simple ration by volume provided all gases are at same temperature and pressure.

$$\underset{1L}{1H_2(g)} + \underset{1L}{1Cl_2(g)} \rightarrow \underset{2L}{2HCl(g)}$$

(ii) Avogadro law : Equal volumes of gases at the same temperature and pressure should contain equal number of molecules.

(iii) Dalton's Atomic Theory :

- Matter consists of indivisible atoms.
- All the atoms of a given elements have identical properties including identical mass.
- Compound are formed when atoms of different elements combine in a fixed rate.
- Atoms are neither created nor destroyed in chemical reaction.

Law of Conservation of Mass : Matter can neither be created nor be destroyed.

Law of Definite Proportion : A given compound always contains exactly the same proportion of elements. It was given by Joseph Proust.

Law of Multiple Proportion : If two elements can combine to form more than one compound, the masses of one elements that combine with a fixed mass of other elements are in ratio of small whole numbers. It was given by Dalton.


THANK YOU