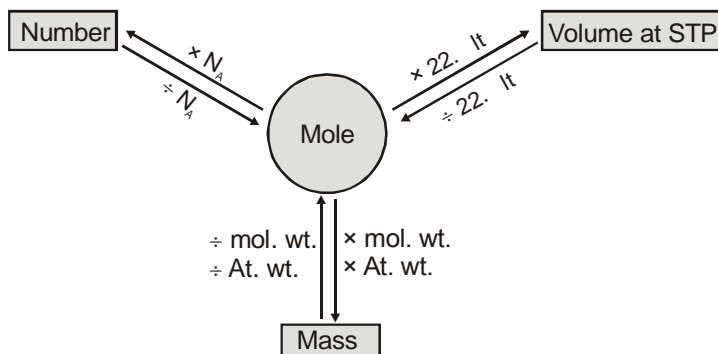


STOICHIOMETRY

☞ Relative atomic mass (R.A.M) = $\frac{\text{Mass of one atom of an element}}{\frac{1}{12} \times \text{mass of one carbon atom}}$

= Total Number of nucleons

☞ **Y-map**



Density :

$$\text{Specific gravity} = \frac{\text{density of the substance}}{\text{density of water at } 4^{\circ}\text{C}}$$

For gases :

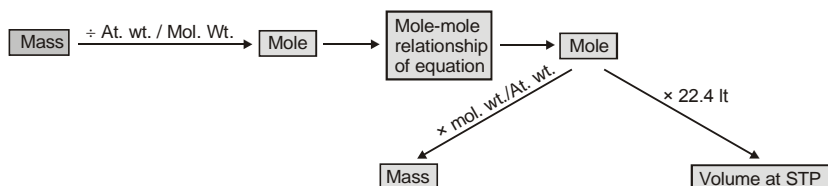
$$\text{Absolute density (mass/volume)} = \frac{\text{Molar mass of the gas}}{\text{Molar volume of the gas}}$$

$$\Rightarrow \rho = \frac{PM}{RT}$$

$$\text{Vapour density} \quad V.D. = \frac{d_{\text{gas}}}{d_{\text{H}_2}} = \frac{PM_{\text{gas}}/RT}{PM_{\text{H}_2}/RT} = \frac{M_{\text{gas}}}{M_{\text{H}_2}} = \frac{M_{\text{gas}}}{2}$$

$$M_{\text{gas}} = 2 \text{ V.D.}$$

Mole-mole analysis :



Concentration terms :

Molarity (M) :

$$\therefore \text{Molarity (M)} = \frac{w \times 1000}{(\text{Mol. wt of solute}) \times V_{\text{in ml}}}$$

Molality (m) :

$$\text{Molality} = \frac{\text{number of moles of solute}}{\text{mass of solvent in gram}} \times 1000 = 1000 w_1 / M_1 w_2$$

Mole fraction (x) :

$$\therefore \text{Mole fraction of solution } (x_1) = \frac{n}{n + N}$$

$$\therefore \text{Mole fraction of solvent } (x_2) = \frac{N}{n + N}$$

$$x_1 + x_2 = 1$$

% Calculation :

$$(i) \% w/w = \frac{\text{mass of solute in gm}}{\text{mass of solution in gm}} \times 100$$

$$(ii) \% w/v = \frac{\text{mass of solute in gm}}{\text{Volume of solution in ml}} \times 100$$

$$(iii) \% v/v = \frac{\text{Volume of solute in ml}}{\text{Volume of solution}} \times 100$$

Derive the following conversion :

1. Mole fraction of solute into molarity of solution $M = \frac{x_2 \rho \times 1000}{x_1 M_1 + M_2 x_2}$
2. Molarity into mole fraction $x_2 = \frac{M M_1 \times 1000}{\rho \times 1000 - M M_2}$
3. Mole fraction into molality $m = \frac{x_2 \times 1000}{x_1 M_1}$
4. Molality into mole fraction $x_2 = \frac{m M_1}{1000 + m M_1}$
5. Molality into molarity $M = \frac{m \rho \times 1000}{1000 + m M_1}$

M_1 and M_2 are molar masses of solvent and solute. ρ is density of solution (gm/mL)

M = Molarity (mole/lit.), m = Molality (mole/kg), x_1 = Mole fraction of solvent, x_2 = Mole fraction of solute

Average/Mean atomic mass :

$$A_x = \frac{a_1x_1 + a_2x_2 + \dots + a_nx_n}{100}$$

Mean molar mass or molecular mass :

$$M_{\text{avg.}} = \frac{n_1M_1 + n_2M_2 + \dots + n_nM_n}{n_1 + n_2 + \dots + n_n} \quad \text{or} \quad M_{\text{avg.}} = \frac{\sum_{j=1}^{j=n} n_j M_j}{\sum_{j=1}^{j=n} n_j}$$

Calculation of individual oxidation number :

Formula : Oxidation Number = number of electrons in the valence shell
– number of electrons left after bonding

Concept of Equivalent weight/Mass :

For elements, equivalent weight (E) = $\frac{\text{Atomic weight}}{\text{Valency -factor}}$

$$\text{For acid/base,} \quad E = \frac{M}{\text{Basicity / Acidity}}$$

Where M = Molar mass

$$\text{For O.A/R.A,} \quad E = \frac{M}{\text{no. of moles of } e^- \text{ gained/lost}}$$

Equivalent weight (E) = $\frac{\text{Atomic or molecular weight}}{\text{v.f.}}$

(v.f. = valency factor)

Concept of number of equivalents :

$$\text{No. of equivalents of solute} = \frac{Wt}{\text{Eq. wt.}} = \frac{W}{E} = \frac{W}{M/n}$$

No. of equivalents of solute = No. of moles of solute \times v.f.

Normality (N) :

$$\text{Normality (N)} = \frac{\text{Number of equivalents of solute}}{\text{Volume of solution (in litres)}}$$

$$\text{Normality} = \text{Molarity} \times \text{v.f.}$$

Calculation of valency Factor :

n-factor of acid = basicity = no. of H^+ ion(s) furnished per molecule of the acid.

n-factor of base = acidity = no. of OH^- ion(s) furnished by the base per molecule.

At equivalence point :

$$N_1 V_1 = N_2 V_2$$

$$n_1 M_1 V_1 = n_2 M_2 V_2$$

Volume strength of H_2O_2 :

20V H_2O_2 means **one litre** of this sample of H_2O_2 on decomposition gives **20 lt. of O_2** gas at **S.T.P.**

$$\text{Normality of } \text{H}_2\text{O}_2 \text{ (N)} = \frac{\text{Volume, strength of } \text{H}_2\text{O}_2}{5.6}$$

$$\text{Molarity of } \text{H}_2\text{O}_2 \text{ (M)} = \frac{\text{Volume strength of } \text{H}_2\text{O}_2}{11.2}$$

Measurement of Hardness :

$$\text{Hardness in ppm} = \frac{\text{mass of } \text{CaCO}_3}{\text{Total mass of water}} \times 10^6$$

Calculation of available chlorine from a sample of bleaching powder :

$$\% \text{ of } \text{Cl}_2 = \frac{3.55 \times x \times V \text{ (mL)}}{W \text{ (g)}} \quad \text{where } x = \text{molarity of hypo solution}$$

and v = mL. of hypo solution used in titration.