Some Basic Concepts in Chemistry

The mole concept

One mole of any substance contains a fixed number (6.022×10^{23}) of any type of particles (atoms or molecules or ions) and has a mass equal to the atomic or molecular weight, in grams. Thus it is correct to refer to a mole of helium, a mole of electrons, or a mole of Na^+, meaning respectively *Avogadro's number* of atoms, electrons or ions.

$\therefore$ Number of moles

$$= \frac{\text{Weight (grams)}}{\text{Weight of one mole (g/mole)}}$$

$$= \frac{\text{Weight}}{\text{Atomic or molecular weight}}$$

Percentage composition & Molecular formula

(1) Percentage composition of a compound

Percentage composition of the compound is the relative mass of each of the constituent element in 100 parts of it. If the molecular mass of a compound is M and B is the mass of an element in the molecule, then

$$\text{Percentage of element} = \frac{\text{Mass of element}}{\text{Molecular mass}} \times 100 = \frac{X}{M} \times 100$$

Molecular formula: Molecular formula $= n \times$ empirical formula where $'n'$ is the whole no. obtained by

$$n = \frac{\text{molecular weight of compound}}{\text{empirical formula weight of compound}}$$

Formula used in solving numerical problems on volumetric analysis

(1) Strength of solution = Amount of substance in $g\ litre^{-1}$

(2) Strength of solution = Amount of substance in $g\ moles\ litre^{-1}$

(3) Strength of solution = Normality × Eq. wt. of the solute
= molarity × Mol. wt. of solute

(4) $\text{Molarity} = \frac{\text{Moles of solute}}{\text{Volume in litre}}$

(5) $\text{Number of moles} = \frac{\text{Wt. in } gm}{\text{Mol. wt.}} = M \times V_{(in\,l)}$

$= \frac{\text{Volume in litres}}{22.4}$ at NTP (only for gases)

(6) Number of millimoles $= \frac{\text{Wt. in } gm \times 1000}{\text{mol. wt.}}$

$= \text{Molarity} \times \text{Volume in } ml.$

(7) Number of equivalents

$= \frac{\text{Wt. in } gm}{\text{Eq. wt.}} = x \times \text{No. of moles} \times \text{Normality} \times \text{Volume in litre}$

(8) Number of milliequivalents (meq.)

$= \frac{\text{Wt. in } gm \times 1000}{\text{Eq. wt.}} = \text{normality} \times \text{Volume in } ml.$

(9) Normality $= x \times \text{No. of millimoles}$

$= x \times \text{Molarity} = \frac{\text{Strength in } gm\ litre^{-1}}{\text{Eq. wt.}}$

where $x = \frac{\text{Mol. wt.}}{\text{Eq. wt.}}$, x = valency or change in oxi. Number.

(10) Normality formula, $N_1V_1 = N_2V_2$

(11) % by weight $= \frac{\text{Wt. of solvent}}{\text{Wt. of solution}} \times 100$

(12) % by volume $= \frac{\text{Wt. of solvent}}{\text{Vol. of solution}} \times 100$

(13) % by strength $= \frac{\text{Vol. of solvent}}{\text{Vol. of solution}} \times 100$

(14) Specific gravity

$$= \frac{\text{Wt. of solution}}{\text{Vol. of solution}} = \text{Wt. of } 1\ ml. \text{ of solution}$$

(15) Formality $= \frac{\text{Wt. of ionic solute}}{\text{Formula Wt. of solute} \times V_{in\ l}}$

(16) Mol. Wt. = V.D × 2 (For gases only)