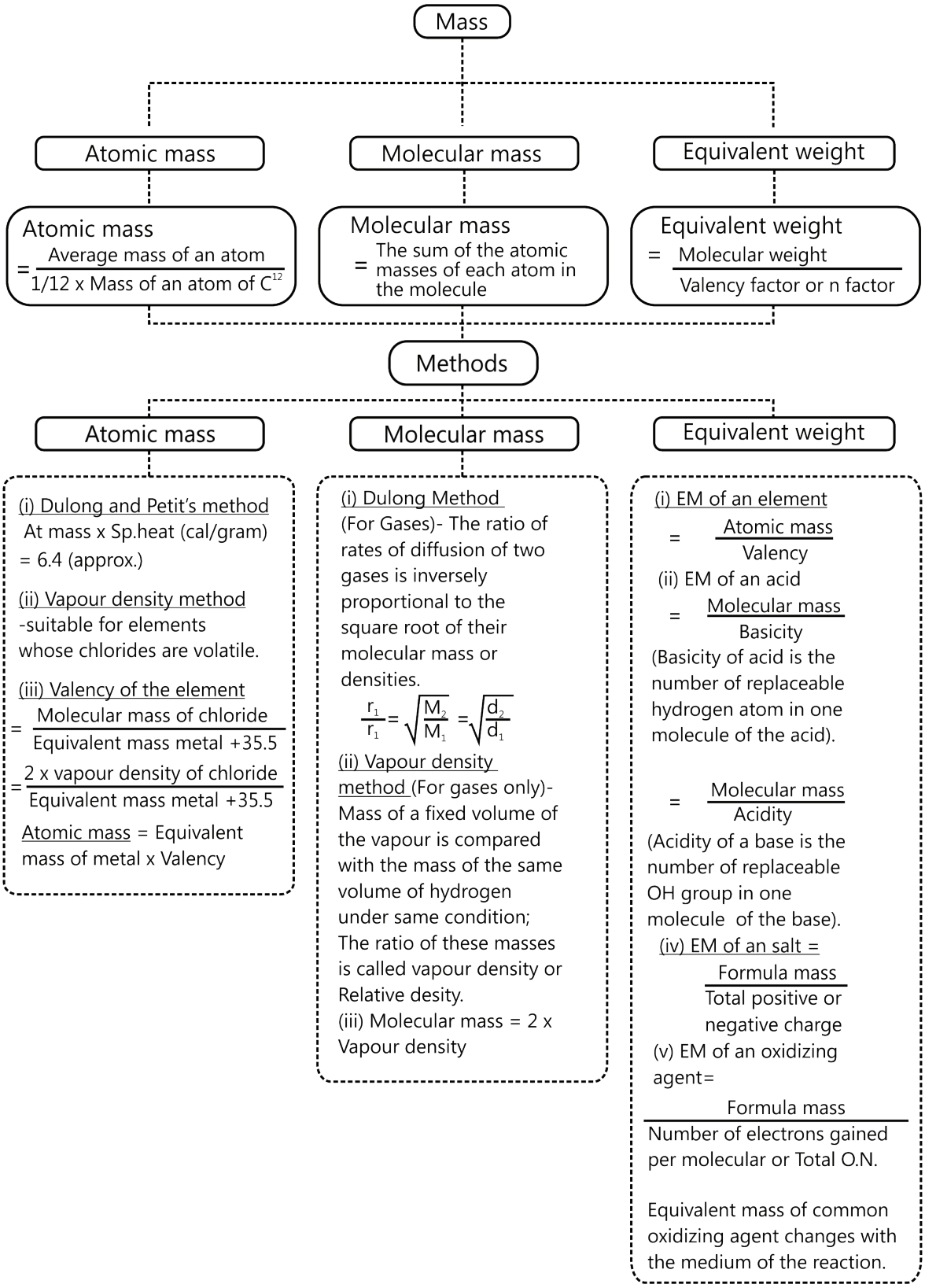
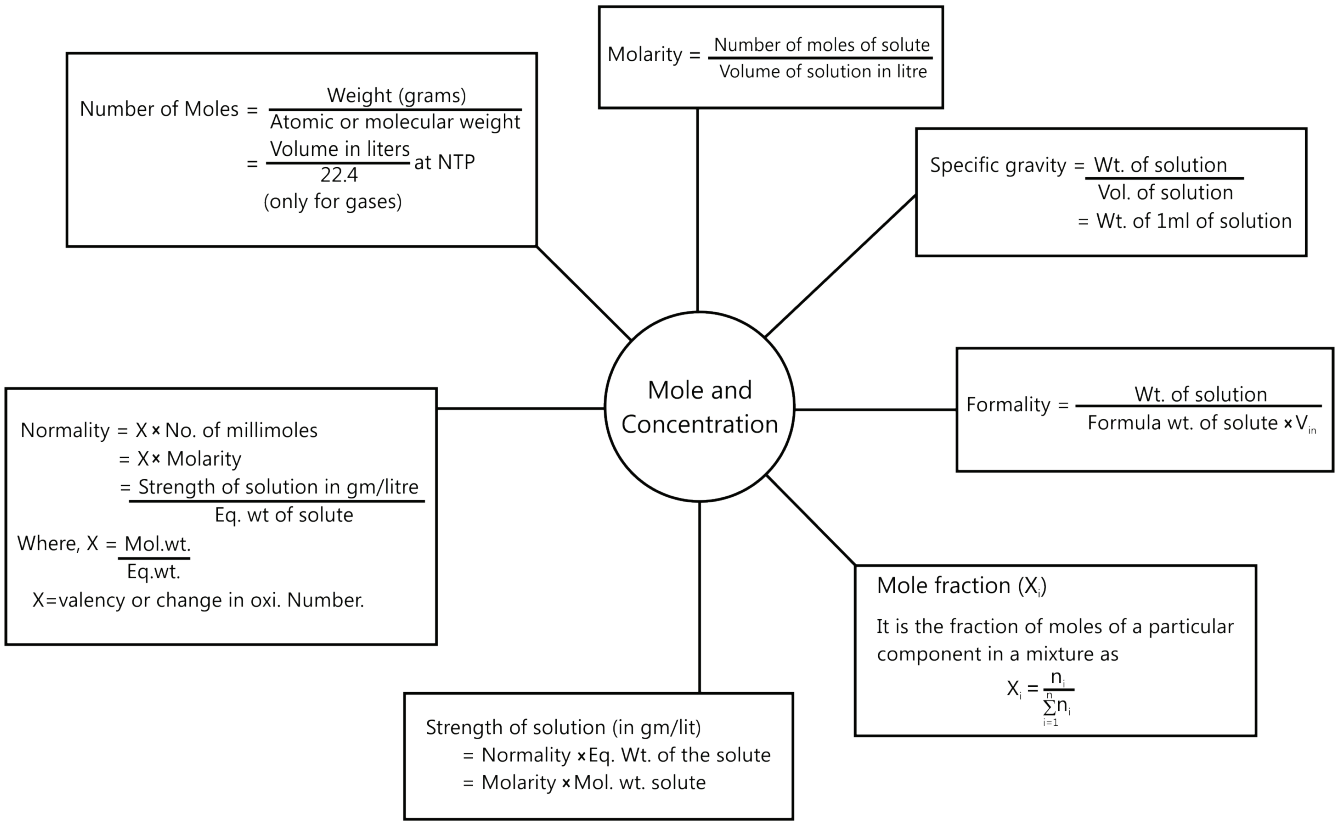
FORMULAE SHEET





RULES IN BRIEF

The following are the definitions of 'mole' represented in the form of equations:

(a) Number of moles of molecules = $\frac{\text{Weight in g}}{\text{Molecular weight}}$

(b) Number of moles of atoms = $\frac{\text{Weight in g}}{\text{Atomic weight}}$

(c) Number of moles of gases = $\frac{\text{Volume at NTP}}{\text{Standard molar volume}}$

(Standard molar volume is the volume occupied by 1 mole of any gas at NTP, which is equal to 22.4 litres.)

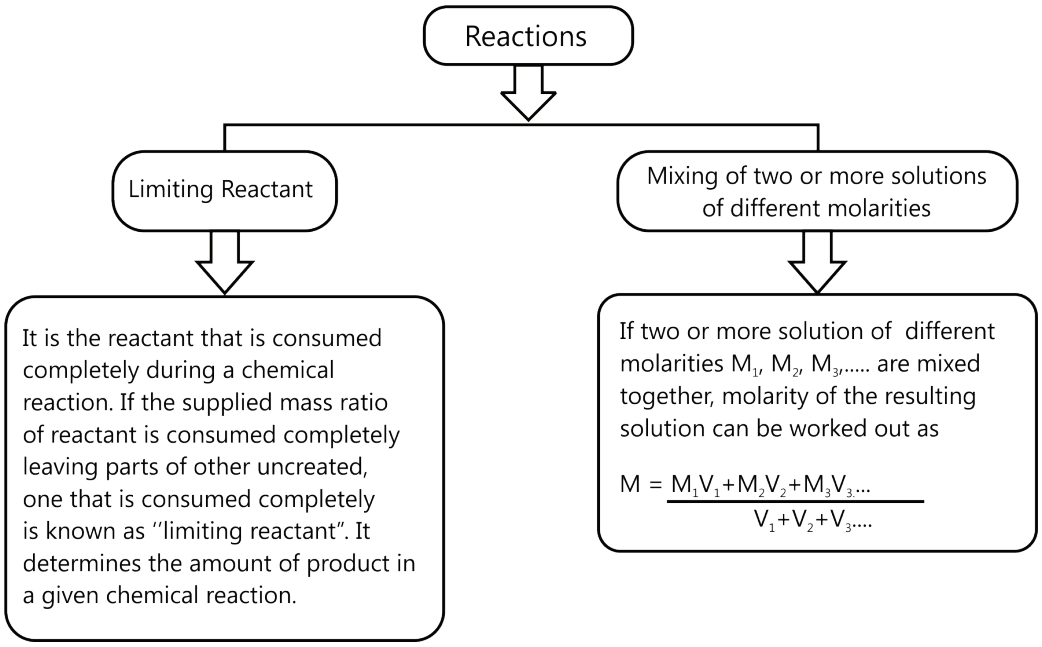
(d) Number of moles of atoms / molecules / ions / electrons = $\frac{\text{No. of atoms / molecules / ions / electrons}}{\text{Avogadro constant}}$

(e) Number of moles of solute = Molarity × Volume of solution in litres

Or No. of millimoles = Molarity × Volume in mL.

$$\frac{\text{Millimoles}}{1000} = \text{moles}$$

(f) For a compound M_x , N_y , x moles of N = y moles of M



Solved Examples

JEE Main/Boards

Example 1: Calculate the composition of 109% oleum.

Sol: Let the mass of SO_3 in the sample be 'w' g, then the mass of H_2SO_4 would be (100 – w)g. On dilution,

$$\underset{80g}{SO_3} + \underset{18g}{H_2O} \longrightarrow H_2SO_4$$

Moles of SO_3 in oleum = $\frac{w}{80}$ = Moles of H_2SO_4 formed after dilution.

$\therefore$ Mass of H_2SO_4 formed on dilution $= \frac{98w}{80}$

Total mass of H_2SO_4 present in oleum after dilution $= \frac{98w}{80} + (100 - w) = 109$; w = 40

Thus oleum sample contains 40% SO_3 and 60% H_2SO_4.

Example 2: 20g of a sample of $Ba(OH)_2$ is dissolved in 10 mL. of 0.5 N HCl sol. The excess of HCl was titrated with 0.2 N NaOH. The volume of NaOH used was 10 cc. Calculate the percentage of $Ba(OH)_2$ in the sample.

Sol: The titration principle is applied wherein milli-equivalents of the neutralization reactions is calculated.

Solving further, one gets the mass and % of the base.

Milli eq. of HCl initially = 10 × 0.5 = 5

Milli eq. of NaOH consumed

= Milli eq.of HCl in excess = 10 × 0.2 = 2

$\therefore$ Milli eq. of HCl consumed

= Milli eq. of $Ba(OH)_2$ = 5 – 2 = 3

$\therefore$ Eq. of $Ba(OH)_2$ = 3/1000 = 3×10^{-3}

Mass of $Ba(OH)_2$ = 3×10^{-3} (171/2) = 0.2565 g

% $Ba(OH)_2$ = (0.2565/20) × 100 = 1.28%

Example 3: One litre of mixture of CO and CO_2 is passed through red hot charcoal in tube. The new volume becomes 1.4 litre. Find out % composition of original mixture by volume. All measurements are made at same P and T.

Sol: Assuming the mixture contents as a and b, the reaction is framed and values are laid down.

Let the mixture contains

CO = a litre; CO_2 = b litre

$\therefore$ a + b = 1 ...(i)