CONCEPT MAP

SOME BASIC CONCEPTS OF CHEMISTRY

Law of Conservation of Mass

- Proposed by the French Chemist Antoine Lavoisier (1789)
- Mass can neither be created nor destroyed in a chemical reaction.

OR

- For any chemical process in a closed system, the mass of the reactants must be equal to the mass of the products.

e.g., $C + O_2 = CO_2$

$12\,g + 32\,g = 44\,g$

Oxygen + Hydrogen → Water

32 g   4 g   36 g

Law of Definite Proportions

- Proposed by Louis Proust (1799)
- A chemical compound always consists of the same elements combined together in the same ratio, irrespective of the method of preparation or the source from it is taken.

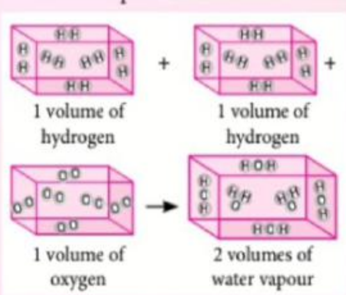
In the formation of water molecule compound, the ratio of the mass of hydrogen to the mass of oxygen is always 1 : 8, whatever be the source of water. Thus, if 9 g of water is decomposed, 1 g of hydrogen and 8 g of oxygen are always obtained.

Law of Multiple Proportions

- Proposed by John Dalton (1804)
- When elements combine, they do so in the ratio of small whole numbers. *e.g.*, carbon and oxygen react to form CO or CO_2, but not $CO_{1.8}$.

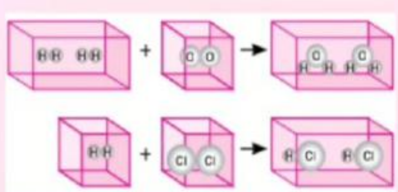
Avogadro's Law

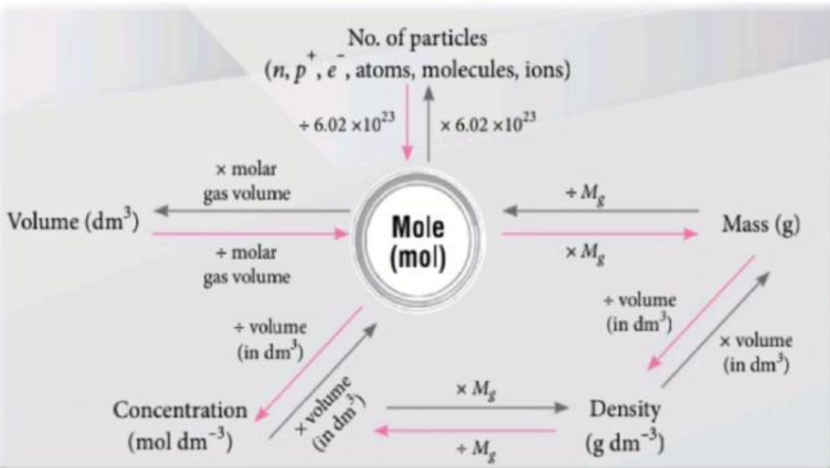
- Proposed by Avogadro (1811)
- Equal volumes of gases at the same temperature and pressure should contain equal number of molecules.



Gay Lussac's Law of Gaseous Volumes

- Proposed by Gay Lussac (1808)
- At given temperature and pressure, the volumes of all gaseous reactants and products bear a simple whole number ratio to each other.





Concentration Terms

- Mass percent (%) = $\frac{w_{\text{solute}}}{w_{\text{solution}}} \times 100$
- Normality, $N = \frac{w_B \times 1000}{\text{eq. wt. of solute} \times V \text{ (in mL)}}$

  $N = (\text{Basicity or Acidity}) \times M$
- Molarity, $M = \frac{w_B \times 1000}{M_B \times V (\text{in mL})}$
- Relation between molarity and molality $\frac{1}{m} = \frac{d}{M} - \frac{M_B}{1000}$
- Molality, $m = \frac{w_B \times 1000}{M_B \times w_A (\text{in g})}$
- Mole fraction, $x_A = \frac{n_A}{n_A + n_B}$, $x_B = \frac{n_B}{n_A + n_B}$
- Relation between molality and mole fraction

  $m = \frac{x_B \times 1000}{(1 - x_B) \times M_A}$

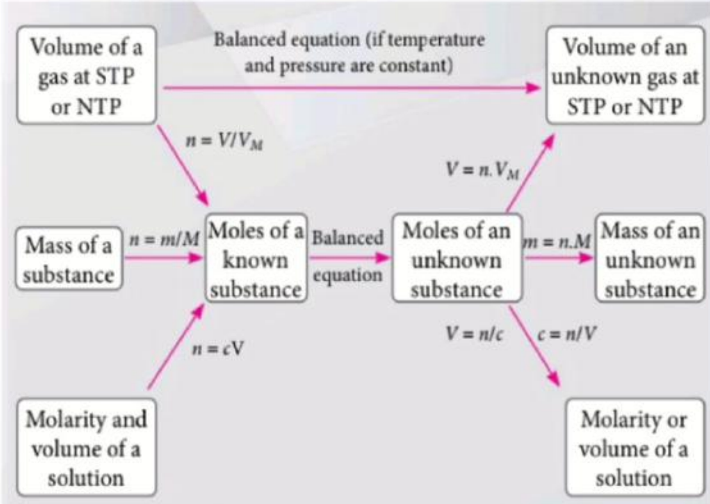
Limiting Reagent

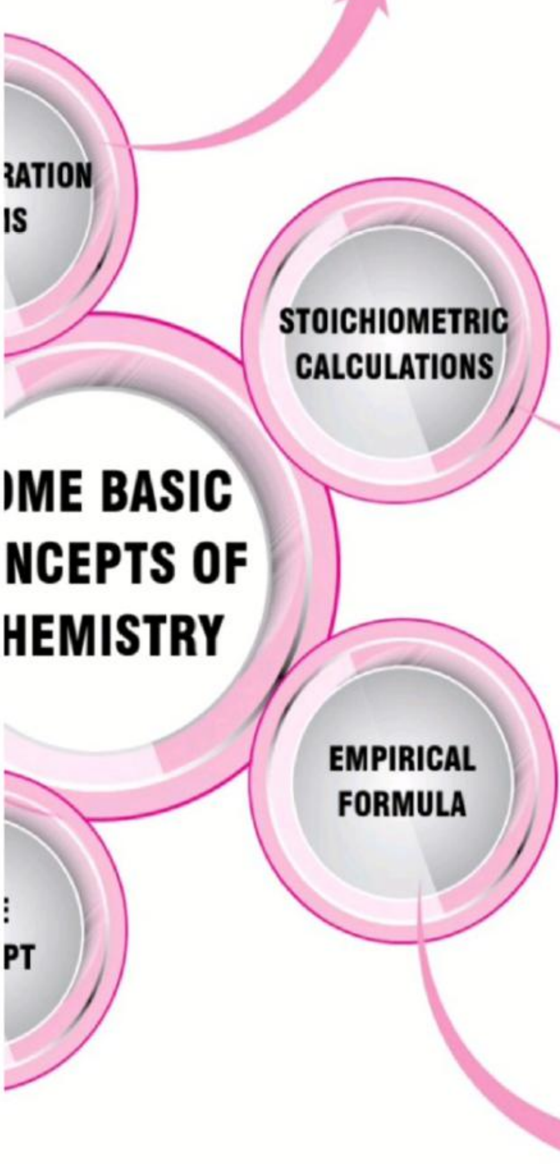
The reactant which present in lesser amount and gets consumed and limits the amount of product formed is called limiting reagent.

e.g., $\underset{2\text{ g}}{H_2} + \underset{16\text{ g}}{1/2O_2} \rightleftharpoons H_2O$

For every 16 g of oxygen, 2 g H_2 is required, if H_2 is present less than 2 g then it will be limiting reagent.

Mole Calculations





Empirical Formula	Molecular Formula
Mass % elements	Empirical formula
⇓ Assume 100 g sample	⇓
Calculate the grams of each element	Empirical formula mass
⇓ Use atomic weights	⇓ Use molecular mass
Calculate the moles of each element	Calculate n = Molecular mass / Empirical mass
⇓ Calculate the molar ratio for each element	⇓
Assign empirical formula	Molecular formula = $n \times$ Empirical formula