Mole Concept and Stoichiometry

Boyle's Law

- Relation between pressure (p) and volume (V)
- Statement − At constant temperature, the pressure of a fixed amount (number of moles, n) of a gas is inversely proportional to its volume.

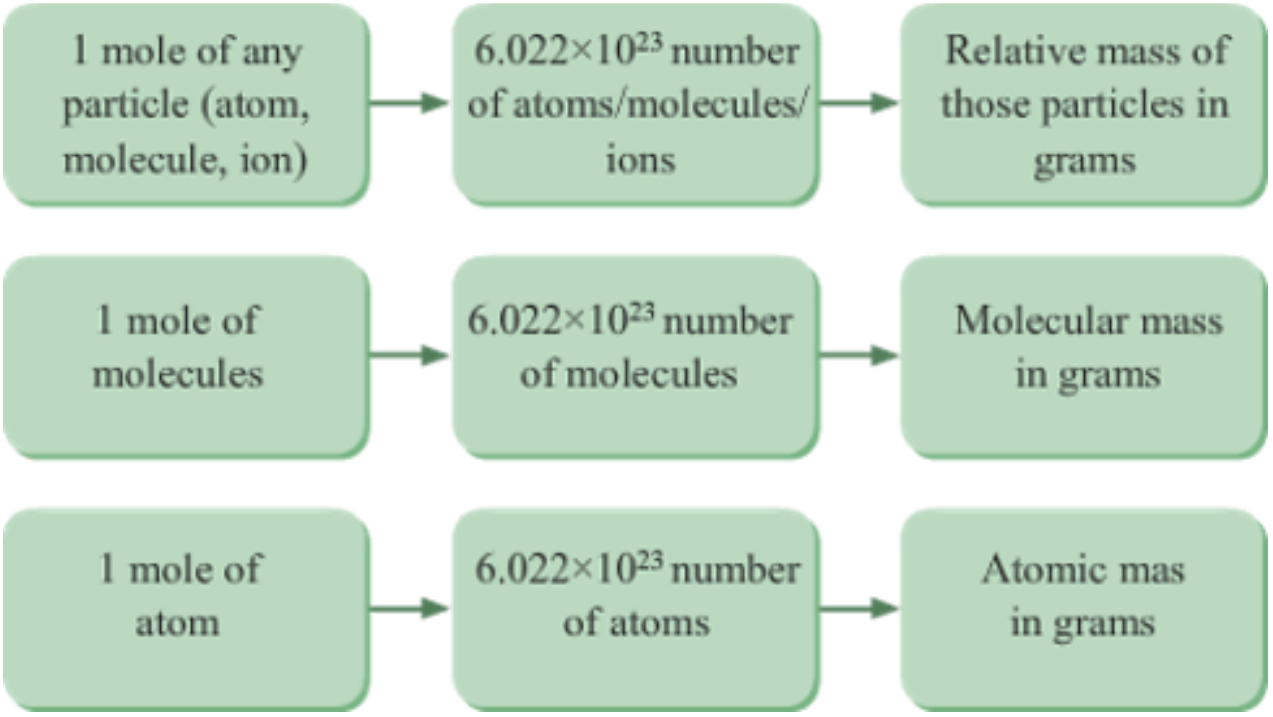
Charles' Law

- Relation between temperature (T) and volume (V)
- Statement − At constant pressure, the volume of a fixed amount of a gas is directly proportional to its absolute temperature.

Standard Temperature and Pressure(STP)

The standard values are 0^0C or 273K for temperature and 1 atm or 760 mm of Hg for pressure and are commonly known as **S.T.P.**

- **Mole Concept**
  - One mole of a substance is the quantity of the substance containing 6.022×10^{23} numbers of particles (atoms, molecules, or ions). The number i.e., 6.022×10^{23} is known as the Avogadro number. It means that one mole of any substance (element or compound) contains 6.022×10^{23} particles (atoms of molecules).
  - The mass of 1 mole of a substance is known as its molar mass.
- $$\text{Molar mass} = \frac{\text{Mass of substance}}{\text{Number of moles}}$$
- Avogadro's Law: Under the same conditions of temperature and pressure, equal volumes of all gases contain the equal number of moles.

- 

- Gay-Lussac's Law: At constant volume, the pressure of a fixed amount of a gas is directly proportional to the temperature.
- $\frac{p_1}{T_1} = \frac{p_2}{T_2}$

1 mole of any substance can be defined as:

- Amount of a substance that contains as many particles (atoms, molecules or ions) as there are atoms in 12 g of the ^{12}C isotope
- Avogadro number or Avogadro constant (N_A); equal to 6.022×10^{23} particles

Percentage Composition

$$\text{Mass percent of an element} = \frac{\text{Mass of that element in the compound} \times 100\%}{\text{Molar mass of the compound}}$$

Empirical formula and molecular formula:

Empirical formula	Molecular formula
Represents the simplest whole number ratio of various atoms present in a compound	Represents the exact number of different types of atoms present in a molecule of a compound

Limiting reagent (Limiting reactant): Limiting reagent is the reactant present in the lesser amount, which gets consumed after sometime. After that, no reaction takes place further, whatever is the amount of the other reactant present.

Expression for concentration of a solution:

- Mass per cent (w/w %) = $\frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100\%$
- $$\text{Mole fraction of A} = \frac{\text{No. of moles of A}}{\text{No. of moles of solution}} = \frac{n_A}{n_A + n_B}$$

[Here, A and B are the components of the solution]

- Molarity (M) = $\frac{\text{No. of moles of solute}}{\text{Volume of solution in litres}}$
- Molality (m) = $\frac{\text{No. of moles of solute}}{\text{Mass of solvent in kg}}$