States of Matter

① Boyle's law : $p \propto 1/V$

Charles law : $V \propto T$

Gay-Lussac's law : $p \propto T$

Avogadro's law : $V \propto n$

② Ideal gas eqn.

$PV = nRT$

$PM = dRT$

③ $P_{total} = P_A + P_B + P_C$

④ $P_A = X_A P_T$ (X_A → mole fraction) $\quad P_B = X_B \cdot P_T$ (P_B → partial pressure)

⑤ $\frac{P_1}{P_2} = \frac{n_1}{n_2} \quad \frac{P_{T_1}}{P_{T_2}} = \frac{n_{T_1}}{n_{T_2}}$

⑥ open container (P = const)

$$\frac{V_1}{n_1 T_1} = \frac{V_2}{n_2 T_2}$$

⑦ Types of vessels

(a) Rigid (V, n = const).

$$\therefore \frac{P_1}{T_1} = \frac{P_2}{T_2}$$

(b) Non-Rigid (n = const)

⑧ Diffusion & Effusion of gases

Rate of diffusion: Volume of gas diffused (V) / time taken (t)

or

$$\text{Rate} = \frac{\text{no. of moles of gas}}{\text{time}} \quad \left(\frac{n}{t}\right)$$

$$\text{Rate} \propto A \cdot P \sqrt{\frac{T}{m}}$$

$$\frac{\text{Rate}_1}{\text{Rate}_2} = \sqrt{\frac{M_2}{M_1}} = \sqrt{\frac{d_2}{d_1}}$$

⑨ Types of molecular speeds.

① V_{rms} : V_{av} : V_{mp}.

$\sqrt{\frac{3RT}{M}}$: $\sqrt{\frac{8RT}{\pi M}}$: $\sqrt{\frac{2RT}{M}}$

$\sqrt{3}$: $\sqrt{8/\pi}$: $\sqrt{2}$

* Van-der waal's eqn *

⑩ $P_{real} = \left(P + \frac{an^2}{V^2}\right)(V - nb) = RT$

a = attraction forces

b = size

(Vander Waals Const.)

⇒ P_{real} behave like P_{ideal} at High temp. and Low pressure.

$$a = \frac{PV^2}{n^2} \rightarrow \text{atm L}^2 \text{ mol}^{-2}$$

and

$$b = V/n \rightarrow \text{L mol}^{-1}$$

⑪ compressibility factor (Z).

$$Z = \frac{V_{obs}}{V_{ideal}} = \frac{V_{real}}{V_{ideal}}$$

① $Z > 1$ (High pressure) ⇒ Repulsion, (+ve) deviation

② $Z < 1$ ⇒ Attractive forces, (−ve) deviation (Intermediate pressure.)

→ जो gas के critical temp. max. होती वही gas सबसे आसान liquify होगी।