i.e Derivation of gas-law's

$$PV = \text{Constant}$$

or $P \propto \frac{1}{V}$ at Constant Temperature T

This is Boyle's law

2. Derivation of Charle's Law from Kinetic gas Equation.

We know,

$$PV = \frac{2}{3} RT$$

or $$V = \frac{2}{3 \cdot P} R.T$$

$$V = \frac{2R}{3P} \cdot T \quad \text{———}$$

If Pressure P is Constant,

then $V \propto T$

3. Avagadro's Law Derivation:-

When two gases have the same Pressure and Volume, then $P_1 V_1 = P_2 V_2$

We know from Kinetic gas eq^n $PV = \frac{1}{3} mnc^2$

Applying Kinetic gas eq^n

$$\frac{1}{3} m_1 n_1 c_1^2 = \frac{1}{3} m_2 n_2 c_2^2$$

$$\frac{2}{3} \cdot \frac{1}{2} m_1 n_1 c_1^2 = \frac{2}{3} \cdot \frac{1}{2} m_2 n_2 c_2^2$$

or $$\frac{1}{2} m_1 n_1 c_1^2 = \frac{1}{2} m_2 n_2 c_2^2 \quad \text{———} (1)$$

When the temperature of these two gases is also the same, then their Kinetic energy per mole will also be the same

i.e $$\frac{1}{2} m_1 c_1^2 = \frac{1}{2} m_2 c_2^2 \quad \text{———} (2)$$

Dividing equation (1) by (2)

we get, $n_1 = n_2$

Thus the equal volumes of all gases under the same Conditions of temperature and Pressure have the same number of moles. This is Avagradro's Law.

(4) Grahm's Law of Diffusion :-

If M is the total mass of a gas, then the Kinetic gas equation,

$PV = \frac{1}{3} mnc^2$, reduces to—

$$PV = \frac{1}{3} Mc^2$$

$$\text{or } c^2 = \frac{3PV}{M} = \frac{3P}{\frac{M}{V}} = \frac{3P}{D} \quad \left[\frac{M}{V} = \text{Density}\right]$$

$$\text{or } c^2 = \frac{3P}{D}$$

$$c = \sqrt{\frac{3P}{D}} \quad \text{——— (1)}$$

Where D is the density of the gas, we know that the rate of diffusion (r) of a gas varies with the mean velocity (C), ($\because r = \frac{c}{t}$)

from the above eq^n (1)

$$c \propto \sqrt{\frac{1}{D}} \quad \text{where P is constant}$$

Thus the rate of diffusion of a gas is inversely proportional to the squre root of density of the gas at constant Pressure.

This is the Grahm's law of diffusion.

5) Dalton's Law of Partial Pressure :-

Let n_1 molecules each of mass m_1 of a gas A are taken in a Container of volume V. Then the Pressure P_a for the gas is given by Kinetic gas eq

$$P_a = \frac{m_1 n_1 c_1^2}{3V}$$

Similarly for gas B,

$$P_b = \frac{m_2 n_2 c_2^2}{3V}$$

If both the gases are present in the same Containers, then total Pressure,

$$P = \frac{m_1 n_1 c_1^2}{3V} + \frac{m_2 n_2 c_2^2}{3V}$$

$$= P_a + P_b$$

Similarly for n gases, the total Pressure,

$$P = P_a + P_b + P_c + \cdots P_n$$

This is Dalton's Law of Partial Pressure.