(c) Thermodynamical Law for Ideal Gas

1. Boyle's Law

At constant temperature (T), the pressure (P) of a given mass of a gas is inversely proportional to its volume (V) i.e., $P \propto \frac{1}{V}$

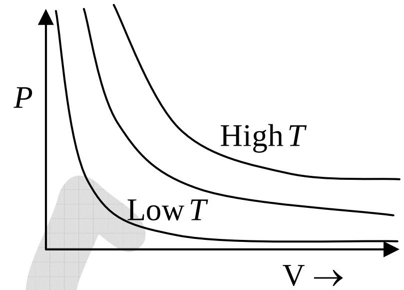

Figure 1

2. Charle's Law at constant pressure and Gay Lussac's law at constant volume

At constant pressure (P) the volume of a given mass of a gas is proportional to its temperature (T), $V \propto T$

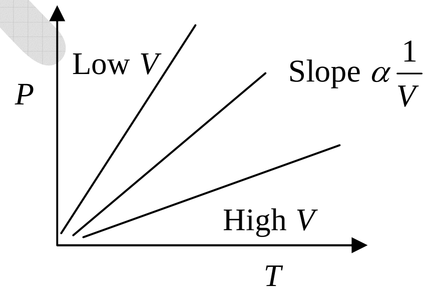

Figure 2

At constant volume (V) the Pressure of a given mass of a gas is proportional to its temperature (T), $P \propto T$

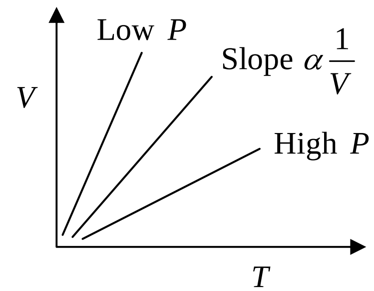

Figure 3

3. Avogadro's Law

At the same temperature and pressure, equal volume of all gases contain equal number of molecules (N)

$$N_1 = N_2$$

4. Graham's Law of Diffusion

When two gases at the same pressure and temperature are allowed to diffuse into each other, the rate of diffusion (r) of each gas is inversely proportional to square root of density of gas (ρ)

$$\frac{r_1}{r_2} = \sqrt{\frac{\rho_2}{\rho_1}}$$

5. Dalton's Law of Partial Pressure

The sum of pressure exerted (P) by each gas occupying the same volume as that of the mixture $(P_1, P_2, P_3.....)$ where $P = P_1 + P_2 + P_3 + ...$

6. Ideal Gas Equation

Consider a sample of an Ideal gas at pressure P, volume V and temperature T, the gas follows the equation

$$PV = nRT$$

where, n is the number of molecules and R is proportionality constant known as gas constant

$$R = 8.314 \text{ J/mol/K}$$

Boltzmann constant K is ratio between R to Avogadro number N_A i.e.,

$$k_B = \frac{R}{N_A} = \frac{8.314}{6.03 \times 10^{23}} \Rightarrow k_B = 1.38 \times 10^{-23} J/K$$