Gas laws

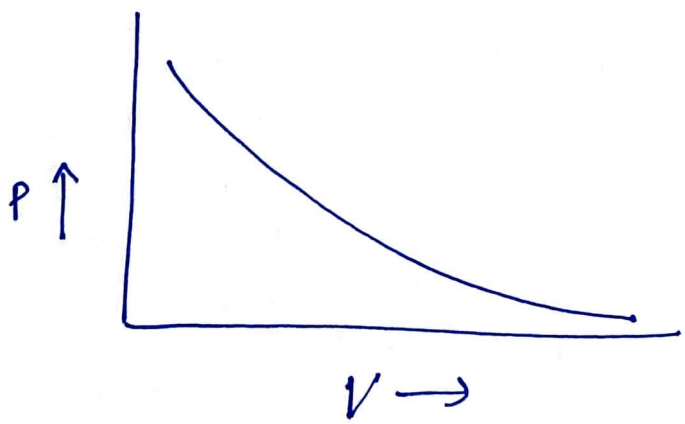
① Boyle's law:

Volume of gas and its pressure are inversely proportional to each other at a constant temperature. In other words if the temperature of gas is constant then pressure decreases with increase in the volume

i.e. $V \propto \frac{1}{P}$ (at constant T)

or $V = \frac{K}{P}$ where K is constant

or $PV = K$



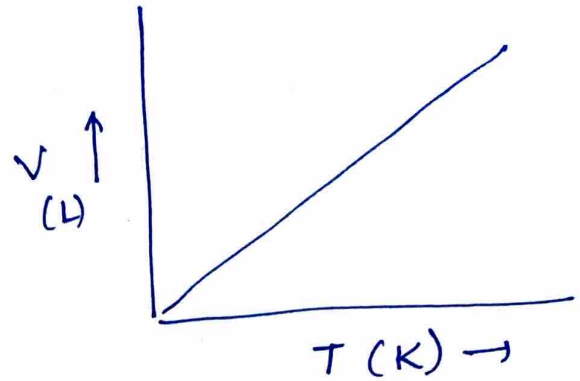
② Charle's law:

When the pressure of a gas is made constant its temperature becomes directly proportional to its volume.

$V \propto T$

$V = KT$

$\frac{V}{T} = K$ (at constant pressure)

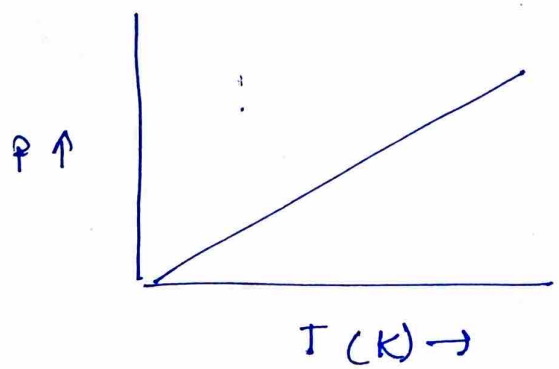


$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$ (at constant pressure)

(3) Gay Lussac's law:

It states that if the volume of gas is fixed then the pressure of gas varies directly proportional to the temperature of the gas.

If the temperature of the gas is increased the pressure will increase too for a fixed volume of gas



$P \propto T$

$P/T = K$

or $P_1/T_1 = P_2/T_2$

(4) Avogadro's Law:

At a given temperature and pressure, the amount of gas in moles is directly proportional to the volume of gas.

$$\frac{V}{n} = \text{constant} \quad (\text{at constant } T \text{ \& } P)$$

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

(5) Combined gas laws:

Charles, Boyles and gay lussac's law combined gives the combined gas laws.

It states that pressure is inversely proportional to volume or higher volume equals to lower pressure.

or

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

(6) Graham's Law:

Process of passing gas through a small opening into an evacuated chamber is called effusion.

Graham's law states that rate of effusion is inversely proportional to the square root of their density.

i.e. $r \propto \frac{1}{\sqrt{\rho}}$

or $r \propto \frac{1}{\sqrt{M_m}}$

Here r = rate of effusion

P = density of gas

$\sqrt{M_m}$ = M_m = molar mass of gas

Kinetic molecular model of gases:

- Developed by Maxwell, Boltzmann and clausius
- used to describe the microscopic properties of gases in term of motion of its molecules.

Assumptions:

→ Gases are made up of large no. of small molecules and that their molecular volume is negligibly small as compared to the occupied volume.

→ Gas molecule stay in constant random motion and hence collide with each other as well as wall of containers.

→ They are independent of each other and the intermolecular forces are negligible.

→ The collisions are elastic and energy passes from one molecule to other but not converted to heat