

## Behaviour of Gases

**1. Boyle's law :** At constant temperature, the volume of a definite mass of a gas is inversely proportional to pressure.

$$V \propto 1/p \text{ (at constant } T) \text{ or, } V = K \cdot 1/p$$

$$pV = K \text{ (where } K \text{ is a constant)}$$

$$p_1V_1 = p_2V_2$$

**2.Charle's law :** At constant pressure, the volume of a definite mass of a gas is directly proportional to absolute temperature.

$$\text{i.e. } V \propto T \text{ (at constant } p) \text{ or, } V = K \cdot T \text{ or, } V/T = k$$

$$\therefore V_1/T_1 = V_2/T_2$$

**3. Gay-Lussac's law :** At constant volume, the pressure of given mass of a gas is directly proportional to the temp in Kelvin.

$$p \propto T \text{ (at constant } V) \text{ or, } p = K \cdot T$$

$$\text{or, } p/T = K \therefore p_1/T_1 = p_2/T_2$$

**4. Avogardo's gas law :** At constant temperature and pressure the volume of a gas is directly proportional to the number of molecules.

$$V \propto n \text{ (at constant } T \text{ \& } p)$$

**5. Ideal gas equation :**  $pV = nRT$  is called ideal gas equation. Where

$p$  = Pressure,  $V$  = volume

$n$  = number of mole  $T$  = temperature in Kelvin.

$R$  = gas constant

$$= 0.0821 \text{ lit atm K}^{-1} \text{ mol}^{-1}$$

$$= 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$$

$$= 1.987 \text{ cal K}^{-1} \text{ mol}^{-1}$$

## 6. S.T.P. & N.T.P. :

S.T.P. — Standard temperature and pressure.

N.T.P. — Normal temperature and pressure.

At S.T.P., for 1 mole gas

$$V = 22.4 \text{ litre} = 22400 \text{ ml}$$

$$p = 1 \text{ atm} = 76 \text{ cm of Hg} = 760 \text{ mm of Hg}$$

$$T = 273 \text{ K}$$

**Diffusion of gases** : The process of intermixing of gases irrespective of the density relationship and without the effect of external agency is called diffusion of gases.

In a gas, the molecules are far separated and the empty space among the molecules are very large. Therefore the molecules of one gas can move into the empty spaces or voids of the other gas and vice-versa. This leads to diffusion.

**Dalton's law of partial pressure** : It states that– If two or more gases which do not react chemically are enclosed in a vessel, the total pressure of the gaseous mixture is equal to the sum of the partial pressure that each gases which exert pressure when enclosed separately in the same vessel at constant temperature.

Let  $p_1$ ,  $p_2$  and  $p_3$  be the pressure of three non-reactive gases when enclosed separately. Let total pressure be  $p$  then  $p = p_1 + p_2 + p_3$