

(4) Graham's Law of Diffusion: -

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

$$PV = \frac{1}{3} mnc^2, \text{ reduces to -}$$

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

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

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

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), ($\because r \propto c$)

from the above eqn (1)

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

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

This is the Graham'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,

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

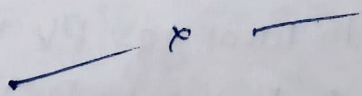
If both the gases are present in $3v$ the same containers, then total pressure,

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

Similarly for n gases, the total pressure,

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

This is Dalton's Law of Partial Pressure.



Ideal gas and real gas

At very low pressures and very high temperatures, the gases tend to obey the gas laws.

A gas which obeys the gas laws under all circumstances has been named as ideal or perfect gas, while a gas does not obey the gas laws is known as a real gas.

The gas which obeys the equation of state $PV = nRT$ strictly is called ideal gas.

Gases which do not obey the equation of state $PV = nRT$ are called real gases.

All gases are real and no one is ideal in true sense. Other differences may be mentioned below.

1. Equation of state i.e. $PV = nRT$
ideal gases strictly obey
Real gases do not obey
2. Compressibility factor Z . ($Z = \frac{PV}{nRT}$)
Compressibility factor $Z = 1$ for ideal gases
" $Z \neq 1$ for real gases
3. Molar Volume -
Molar Volume is 22.4 for ideal gases
Molar Volume is not exact 22.4 for real gases

4. Intermolecular attraction :-
Inter molecular attraction does not exist in ideal gases
Inter molecular attraction exist in Real gases

5. PV vs P Curve :-
In ideal gas PV vs P Curve is Horizontal st. line.
In Real gas PV vs P Curve is not so.

6. PV vs Z Curve :-
In ideal gas PV vs Z Curve is Horizontal st. line.
But In Real gas PV vs Z Curve is not so.