

$$\frac{m}{V} = \text{density of gas } (\rho)$$

$$P = \left(\frac{m}{V} \right) \cdot \frac{RT}{M}$$

$$\boxed{P = \rho \frac{RT}{M}} \quad \text{--- (5)}$$

Example 1: The density of water is 1000 kg m^{-3} . The density of water vapour at 100°C and 1 atm pressure is 0.6 kg m^{-3} . The volume of a molecule multiplied by the total number gives, what is called, molecular volume. Estimate the ratio (or fraction) of the molecular volume to the total volume occupied by the water vapour under the above conditions of temperature and pressure.

Sol: $\rho_{\text{water}} = 10^3 \text{ kg m}^{-3}$ $\rho = \frac{m}{V} \Rightarrow V = \frac{m}{\rho}$

let $m = 1 \text{ kg} \Rightarrow V_{\text{water}} = V_{\text{molecules}} = \frac{m}{\rho_{\text{water}}}$

$$V_{\text{molecule}} = \frac{1 \text{ kg}}{10^3 \text{ kg/m}^3} = 10^{-3} \text{ m}^3 \quad \text{--- (1)}$$