5.6 EFFUSION

Effusion is process where a gas exits from a container through a tiny hole. Ideally the hole should be much smaller than the mean free path so that the molecules do not suffer collisions among themselves when exiting. Thus, effusion is used to study the average speed of molecules in the container. According to Graham's law, the average kinetic energies of molecules of different gases at the same temperature are identical.

Average kinetic energy of two gases at the same temperature is same.

Therefore the ratio of speeds of molecules of two gases at the same temperature is inversely proportional to the square root of their masses.

$$\frac{1}{2}m_a v_a^2 = \frac{1}{2}m_b v_b^2 \quad \text{(same temperature)} \tag{5.26}$$

Therefore,

$$\boxed{\frac{v_a}{v_b} = \sqrt{\frac{m_b}{m_a}} \quad \text{(same temperature)}} \tag{5.27}$$

Hence, hydrogen gas in a balloon will effuse 4 times faster than oxygen and $\sqrt{2}$ times helium.