Daily Tutorial Sheet-10	Level - 2

116.(D) $n_T = n_1 + n_2 + n_3 + ...$

$$\frac{P_T \cdot V_T}{RT} = \frac{P_1V_1}{RT} + \frac{P_2V_2}{RT} + ... = \sum P_iV_i$$

$$P_TV_T = \sum P_iV_i = 2PV + \frac{P.V}{2} + \frac{P}{2}\cdot\frac{V}{4} + \frac{P}{4}\cdot\frac{V}{8} + ... = 2PV\left[1 + \frac{1}{4} + \frac{1}{16} + \frac{1}{64} + ...\right.$$

$$P_TV_T = 2PV\frac{1}{1-\frac{1}{4}} = 2\,PV\frac{4}{3}$$

$$V_T = V_1 + V_2 + V_3 + ... = V + \frac{V}{2} + \frac{V}{4} + \frac{V}{8} .... = V\left[1 + \frac{1}{2} + ...\right] = V\frac{1}{1-\frac{1}{2}} = 2V$$

$$\therefore \quad P_T \cdot 2V = 2\,PV\frac{4}{3} \quad \Rightarrow \quad P_T = \frac{4}{3}P$$

117.(ABD) (A) $\because$ area under the curve gives fraction of molecules and total area is constant

(B) u_{mp} decreases with decrease in temperature

(C) T_2 is higher temperature

(D) As seen from graph; $\therefore$ A, B, D

118.(A) $\left(P + \frac{a}{V^2}\right)V = RT$

$$PV + \frac{a}{V} = RT \quad \text{or} \quad \frac{PV}{RT} + \frac{a}{RTV} = 1 \quad \text{or} \quad \frac{PV}{RT} = \left(1 - \frac{a}{RTV}\right) = Z$$

119.(D) On moving from region (II) to region (I), pressure tends to zero. So, $Z \to 1$

120.(B) $P_{Total} = \frac{dRT}{M_o} \Rightarrow M_o = \frac{dRT}{P_T} = \frac{1.24 \times 0.0821 \times 300}{760/760} \quad \Rightarrow \quad M_0 = 30.54$

'M_0' here is the molar mass of air

$$M_o = X_{N_2}M_{N_2} + X_{O_2}M_{O_2} = X_{N_2}M_{N_2} + (1 - X_{N_2})M_{O_2}$$

$$30.54 = X_{N_2}(M_{N_2} - M_{O_2}) + M_{O_2} = X_{N_2}(28 - 32) + 32$$

$$30.54 - 32 = -4\,X_{N_2}$$

$$0.365 = X_{N_2}$$

$$P_{N_2} = X_{N_2}P_T = 0.365 \times 1\text{ atm} = 0.365\text{ atm}$$

121.(C) $V_{rms} = \sqrt{\frac{3RT}{M}} = \frac{(V_{rms})_{H_2}}{(V_{rms})_{N_2}} = \sqrt{\frac{T_{H_2}}{M_{H_2}} \times \frac{M_{N_2}}{T_{N_2}}}; \quad (V_{rms})_{H_2} = \sqrt{5}\,(V_{rms})_{N_2}$

$$\therefore \quad \frac{(V_{rms})_{H_2}}{(V_{rms})_{N_2}} \times \sqrt{5} = \sqrt{\frac{T_{H_2}}{M_{H_2}} \times \frac{M_{N_2}}{T_{N_2}}};$$

$$\frac{\sqrt{5}}{1} = \sqrt{\frac{T_{H_2}}{T_{N_2}} \times 14} \quad \Rightarrow \quad 5 = \frac{T_{H_2}}{T_{N_2}} \times 14$$

$$T_{N_2} \times 5 = T_{H_2} \times 14 \quad \therefore \quad T_{N_2} > T_{H_2}$$

122.(D) $\dfrac{n'_{He}}{n'_{CH_4}} = \dfrac{1}{2}\sqrt{\dfrac{16}{4}} = \dfrac{1}{1}$

$\dfrac{n'_{He}}{n'_{SO_2}} = \dfrac{1}{3}\sqrt{\dfrac{64}{4}} = \dfrac{4}{3}$

$n'_{He} : n'_{CH_4} : n'_{SO_2} = 4:4:3$

123.(B) $P = \dfrac{1}{3}\dfrac{nmc^2}{V} = \dfrac{1}{3} \times \dfrac{6 \times 10^{22} \times 10^{-24} \times (100)^2}{10 \times 10^{-3}} = 2 \times 10^4 \, Pa$

124.(B) Moles ratio $= \dfrac{n_{He}}{n_{N_2}} = \dfrac{w/4}{w/28} = \dfrac{7}{1}$

Ratio of transitional K.E. $= \dfrac{n_{He} \cdot T_{He}}{n_{N_2} \cdot T_{N_2}} = \dfrac{7}{1} \times \dfrac{300}{700} = 3:1$

125.(C) $d_A = 2d_B;\ 2M_A = M_B;\ PM = dRT$

$\dfrac{P_A}{P_B} \times \dfrac{M_A}{M_B} = \dfrac{d_A}{d_B} \times \dfrac{RT}{RT} \quad \Rightarrow \quad \dfrac{P_A}{P_B} \times \dfrac{1}{2} = 2 \quad \Rightarrow \quad \dfrac{P_A}{P_B} = \dfrac{4}{1}$