IDEAL GAS

1. 0.5 moles of gas A and x moles of gas B exert a pressure of 200 Pa in a container of volume 10 m^3 at 1000 K. Given R is the gas constant in JK^{-1} mol^{-1}, x is :

(1) $\frac{2R}{4+12}$ (2) $\frac{2R}{4-R}$

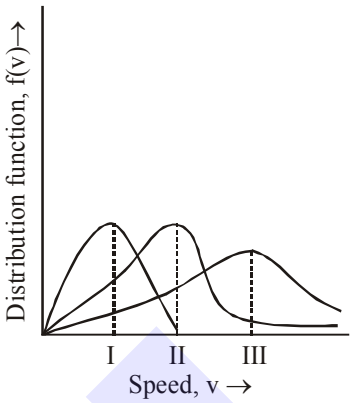
(3) $\frac{4-R}{2R}$ (4) $\frac{4+R}{2R}$

2. An open vessel at 27°C is heated until two fifth of the air (assumed as an ideal gas) in it has escaped from the vessel. Assuming that the volume of the vessel remains constant, the temperature at which the vessel has been heated is :

(1) 750°C (2) 500°C

(3) 750 K (4) 500 K

3. Points I, II and III in the following plot respectively correspond to
(V_{mp} : most probable velocity)



(1) V_{mp} of N_2 (300K); V_{mp} of H_2(300K); V_{mp} of O_2(400K)

(2) V_{mp} of H_2 (300K); V_{mp} of N_2(300K); V_{mp} of O_2(400K)

(3) V_{mp} of O_2 (400K); V_{mp} of N_2(300K); V_{mp} of H_2(300K)

(4) V_{mp} of N_2 (300K); V_{mp} of O_2(400K); V_{mp} of H_2(300K)

SOLUTION

1. Ans. (3)

$n_T = (0.5 + x)$

$PV = n \times R \times T$

$200 \times 10 = (0.5 + x) \times R \times 1000$

$2 = (0.5 + x)\ R$

$$\frac{2}{R} = \frac{1}{2} + x$$

$$\frac{4}{R} - 1 = 2x$$

$$\boxed{\frac{4 - R}{2R} = x}$$

2. Ans. (4)

$\frac{2}{5}$ air escaped from vessel,

$\therefore \frac{3}{5}$ air remain is vessel. P, V constant

$n_1T_1 = n_2T_2$

$$n_1(300) = \left(\frac{3}{5}n_1\right)T_2 \Rightarrow T_2 = 500\ K$$

3. Ans. (4)

$$V_{mp} = \sqrt{\frac{2RT}{M}} \Rightarrow V_{mp} \propto \sqrt{\frac{T}{M}}$$

For N_2, O_2, H_2

$$\sqrt{\frac{300}{28}} < \sqrt{\frac{400}{32}} < \sqrt{\frac{300}{2}}$$

$$V_{mp}\ of\ N_2(300K) < V_{mp}\ of\ O_2(400K) < V_{mp}\ of\ H_2(300K)$$