

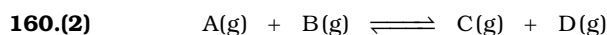


$$\begin{array}{ccc} 1 & & 0 \\ 1-\alpha & & 2\alpha \end{array}$$

$$K_p = \frac{\left(\frac{2\alpha}{1+\alpha}P\right)^2}{\left(\frac{1-\alpha}{1+\alpha}P\right)} \quad P = 1 \text{ atm}$$

$$\frac{(\text{VD})_{\text{initial}}}{(\text{VD})_{\text{equili}}} = \frac{1+\alpha}{1} \Rightarrow (\text{VD})_i = \frac{M_{\text{N}_2\text{O}_4}}{2}$$

$$(\text{VD})_{\text{equili}} = \frac{dRT}{2p} \Rightarrow K_p = K_c (RT)^{\Delta ng}$$



$$\begin{array}{cccc} \text{Initially} & 1 & 1 & 0 & 0 \\ & 1-x & 1-x & x & x \end{array}$$

$$K_p = \frac{x^2}{(1-x)^2}$$

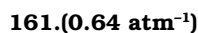
$$\Delta G^\circ = -RT \ln K_p$$

$$\frac{-830}{-RT} = \ln K_p$$

$$\frac{830}{2.303RT} = \log K_p$$

$$10^{\frac{830}{2.303RT}} = K_p \Rightarrow \sqrt{10^{\frac{830}{2.303RT}}} = \frac{x}{(1-x)}$$

$$\Rightarrow \sqrt{10^{\frac{830}{2.303RT}}} = \frac{[\text{C}]}{[\text{A}]}$$

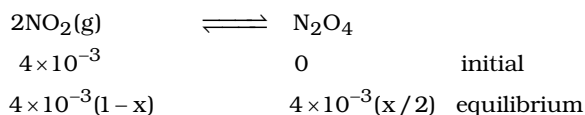


$$\text{Moles of nitric oxide} = \frac{0.46 \times 250 \times 10^{-3}}{0.082 \times 350} = 4 \times 10^{-3}$$

$$\text{Moles of oxygen} = \frac{0.86 \times 100 \times 10^{-3}}{0.082 \times 350} = 3 \times 10^{-3}$$

After the completion of first reaction,

$$\text{Moles of oxygen left} = 10^{-3}, \text{ moles of NO}_2 \text{ left} = 4 \times 10^{-3}$$



$$\text{Total moles at equilibrium} = 4 \times 10^{-3} [(1-x) + (x/2)] + 10^{-3}$$

$$0.37 \times 350 \times 10^{-3} = 10^{-3} (4 - 4x + 2x + 1) \times 0.082 \times 350$$

On solving we get, $x = 0.2439$

$$\text{Partial pressure of NO}_2 = \frac{3 \times 0.37}{4.5} = 0.25$$

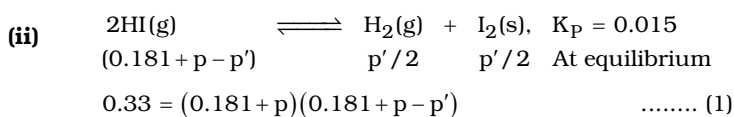
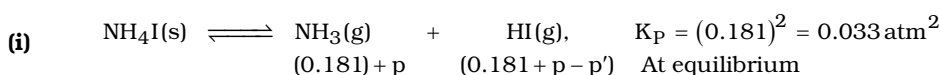
$$\text{and Partial pressure of N}_2\text{O}_4 = \frac{0.5 \times 0.37}{4.5} = 0.04$$

$$\therefore K_P = \frac{0.04}{0.25 \times 0.25} = 0.64 \text{ atm}^{-1}$$

162.(314.64 mm Hg)

$$P = \frac{275}{760} = 0.3618 \text{ atm}$$

$$P_{\text{NH}_3} = P_{\text{HI}} = \frac{0.3618}{2} = 0.181 \text{ atm}$$

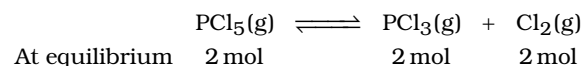


$$0.015 = \frac{p'^2}{4(0.181 + p - p')^2} \quad \dots\dots\dots (2)$$

On solving equation (1) and (2), we get $p' = 0.04 \text{ atm}$ and $p = 0.026 \text{ atm}$

Hence, total pressure = $2(0.181 + p) = 0.414 = 314.64 \text{ mm Hg}$

163.(20/3)



Total pressure = $30.3975 \text{ kPa} = 3 \text{ atm} = P$ (say)

$$K_P = \frac{P_{\text{PCl}_3} \times P_{\text{Cl}_2}}{P_{\text{PCl}_5}} = \frac{\frac{P}{3} \times \frac{P}{3}}{\frac{P}{3}}$$

$$K_P = \frac{P}{3} = 1 \quad \dots\dots\dots (1)$$

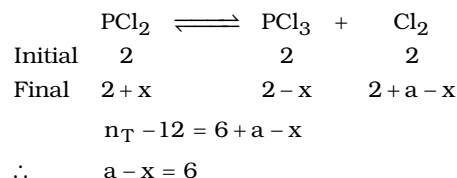
When chlorine is added to the system. The system will try to nullify the effect and hence formation of PCl_5 will be preferred.

Since, P and T are constant

$$\frac{V_1}{V_2} = \frac{n_1}{n_2} = n_1 = 6 \quad [\because V_1 = V, V_2 = 2V]$$

$$\therefore n_2 = 12 \text{ moles}$$

Say, 'a' moles of Cl_2 were added



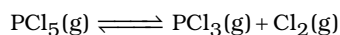
$$K_p = \frac{\frac{2+ax-x}{12} \times \frac{2-x}{12}}{\frac{2+x}{12}} \times P = \frac{(2+a-x)(2-x)}{4(2+x)} = 1 \quad \dots\dots\dots (2)$$

Solving equations (1) and (2), we get

$$a = \frac{20}{3} \text{ moles}$$

Hence, $\frac{20}{3}$ moles of Cl_2 was added.

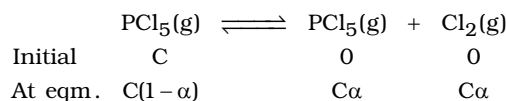
164.(0.3327 atm / (gm/L))



Since $PV = nRT = \frac{w}{M}RT$

$$M = \frac{wRT}{PV} = \frac{\rho RT}{P}$$

$$\therefore \text{V.D.}(d) = \frac{\rho RT}{2P}$$



$$\frac{\text{Total moles at equilibrium}}{\text{Total initial moles}} = \frac{\text{Initial vapour density}}{\text{Vapour density at equilibrium}}$$

$$\frac{C(1+\alpha)}{C} = \frac{D}{d} \Rightarrow 1+\alpha = \frac{M/2}{\rho RT / 2P} = \frac{PM}{\rho RT}$$

$$\therefore \alpha = \frac{PM}{\rho RT} - 1$$

If $d = 62, \frac{M}{2} = \frac{208.5}{2} = 104.25$

$$\alpha = \frac{104.25 - 62}{62} = 0.68$$

$$\therefore \frac{P}{\rho} = \frac{(1+\alpha)RT}{M} = 0.3327 \text{ atm / (gm / L)}$$