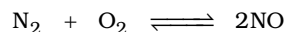


Daily Tutorial Sheet-11

Numerical Value Type

126.(21%)



Initial mole a (100 - a) 0

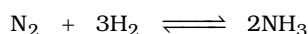
Mole at eq. (a - x) (100 - a - x) 2x

Given, $\frac{2x}{100} = \frac{1.8}{100} \quad \therefore x = 0.9$

Also, $K_p = K_c = \frac{[\text{NO}]^2}{[\text{N}_2][\text{O}_2]} = \frac{(2x)^2}{(a-x)(100-a-x)} = 2.1 \times 10^{-3}$

a = 79% 100 - a = 21%

127.(17.72%)



Mole before equilibrium 1 3 0

Mole after equilibrium (1 - x) 3(1 - x) 2x

$$K_p = \frac{(2x)^2}{(1-x)[3(1-x)]^3} \times \left[\frac{4-2x}{P} \right]^2; \quad K_p = \frac{16x^2 \times (2-x)^2}{27(1-x)^4 \times P^2}$$

Or $1.6 \times 10^{-5} = \frac{16x^2 \times (2-x)^2}{27(1-x)^4 \times (200)^2}$

$$\frac{x^2(2-x)^2}{(1-x)^4} = \frac{1.6 \times 10^{-5} \times 27 \times (200)^2}{16} = 1.08$$

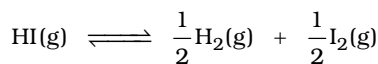
$$\frac{x(2-x)}{(1-x)^2} = 1.039 \quad \Rightarrow \quad x = 0.301$$

Mole of NH_3 formed = $2 \times 0.301 = 0.602$

Total mole at equilibrium = $4 - 2 \times 0.301 = 3.398$

% of NH_3 at equilibrium = $\frac{0.602}{3.398} \times 100 = 17.72\%$

128.(0.125)



Initial mole 1 0 0

Mole at equilibrium (1 - α) $\frac{\alpha}{2}$ $\frac{\alpha}{2}$

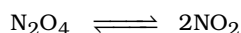
Where, α is degree of dissociation: let volume of container be V litre. Also, α = 0.2, i.e., 20%

$$\Delta n = 0$$

$$K_p = K_c = \frac{(\alpha/2V)^{1/2}(\alpha/2V)^{1/2}}{[(1-\alpha)/V]} = \frac{\alpha}{2(1-\alpha)}$$

$$K_p = K_c = \frac{0.2}{2 \times (1-0.2)} = 0.125$$

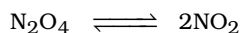
129.(0.64)



Pressure at equilibrium 0.28 1.1

$$K_p = \frac{(P'_{\text{NO}_2})}{(P'_{\text{N}_2\text{O}_4})} = \frac{(1.1)^2}{0.28} = 4.32 \text{ atm}$$

If volume of container is doubled, i.e., pressure becomes half, the reaction will also proceed in the direction where the reaction shows an increase in mole. i.e., decomposition of N_2O_4 is favoured.



$$\text{New pressure at equilibrium} \left[\frac{0.28}{2} - p \right] \quad \left[\frac{1.1}{2} + 2p \right]$$

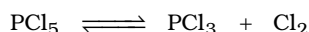
Where, N_2O_4 equivalent to pressure P is used up in doing so.

$$\text{Again, } K_p = \frac{[(1.1/2) + 2P]^2}{[(0.28/2) - P]} = 4.32 \Rightarrow P = 0.045$$

$$P_{N_2O_4} \text{ at new equilibrium} = 0.14 - 0.045 = 0.095 \text{ atm}$$

$$P_{NO_2} \text{ at new equilibrium} = 0.55 + 2 \times 0.045 = 0.64 \text{ atm}$$

130.(4.54)



$$\text{Initial mole} \quad 1 \quad 0 \quad 0$$

$$\text{Mole at eq.} \quad 1 - 0.4 \quad 0.4 \quad 0.4$$

$$\text{Total mole at equilibrium} = 1 - 0.4 + 0.4 + 0.4 = 1.4$$

$$\text{Also, } \frac{\text{Normal molar mass of } PCl_5}{\text{Exp. molar mass of } PCl_5} = 1 + \alpha = 1.4$$

$$\frac{208.5}{\text{Exp. molar mass of } PCl_5} = 1.4$$

$$\text{Exp. Molar mass of } PCl_5$$

$$\text{Or Molar mass of mixture} = \frac{208.5}{1.4}$$

$$\text{Now using, } PV = \frac{w}{m} RT \text{ for mixture}$$

$$d = \frac{w}{V} = \frac{Pm}{RT} = \frac{1 \times 208.5}{1.4 \times 0.082 \times 400} = 4.54 \text{ g/litre}$$

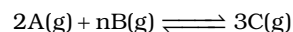
131.(1)

$$\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ = -30 - 300 \times (-0.1) = -30 + 30 = 0$$

$$\Delta G^\circ = 2.303 RT \log K_p$$

$$K_p = 1$$

132.(2)



$$\frac{K_p}{K_c} = (RT)^{\Delta n}$$

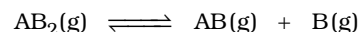
$$\left(\frac{0.0105}{0.45} \right) = (0.0821 \times 523)^{\Delta n}$$

$$\Delta n = -1$$

$$\Delta n = 3 - (2 + n) = -1$$

$$n = 2$$

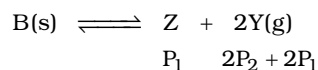
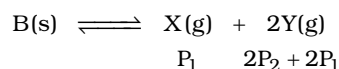
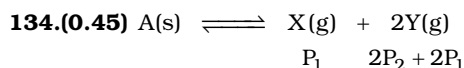
133.(1)



$$P \quad 0 \quad 0$$

$$P - P' \quad P' \quad P'$$

$$\text{Given } P = 6 \text{ atm} \Rightarrow P + P' = 8 \text{ atm} \Rightarrow K_p = \frac{2 \times 2}{4} = 1$$



Thus,
$$\frac{K_{P_1}}{K_{P_2}} = \frac{P_1 \times (2P_1 + 2P_2)^2}{P_2 (2P_1 + 2P_2)^2} = \frac{P_1}{P_2} = \frac{9 \times 10^{-3}}{4.5 \times 10^{-3}} = 2$$

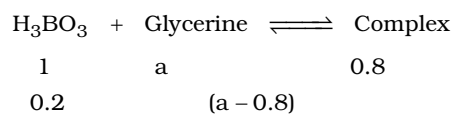
$$P_1 = 2P_2$$

Also,
$$K_{P_1} = 9 \times 10^{-3} = P_1 \times (2P_1 + 2P_2)^2 = P_1 \times (2P_1 + P_1)^2 = 9P_1^3$$

$$P_1 = 0.1 \text{ atm}, P_2 = 0.05 \text{ atm},$$

$$P_T = 2P_1 + 2P_2 + P_1 + P_2 = 3(P_1 + P_2) = 3 \times 0.15 = 0.45 \text{ atm}$$

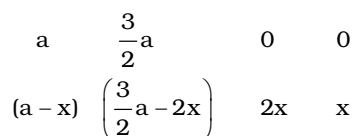
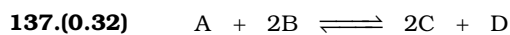
135.(5.24) Let a mole of glycerine be added



$$K_c = \frac{[\text{Complex}]}{[\text{H}_3\text{BO}_3][\text{glycerine}]} = 0.90 \text{ or } \frac{0.8}{0.2 \times (a - 0.8)} = 0.90$$

$$(a - 0.8) = \frac{4}{0.9} = 4.44 \Rightarrow a = 4.44 + 0.8 = 5.24$$

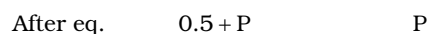
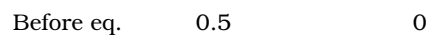
136.(50) K_p is independent of initial concentration as $\Delta n_g = 0$.



Given, $a - x = 2x \Rightarrow x = \frac{a}{3}$

Now,
$$K_c = \frac{[\text{C}]^2[\text{D}]}{[\text{A}][\text{B}]^2} = \frac{\left(\frac{2a}{3}\right)^2 \times \frac{a}{3}}{\left(a - \frac{a}{3}\right)\left(\frac{3a}{2} - \frac{2a}{3}\right)^2} = 0.32$$

138.(200)
$$K_p = \frac{P_{\text{CH}_3\text{OH}}}{P_{\text{CO}} \times P_{\text{H}_2}^2} = \frac{2}{1 \times (0.1)^2} = 200 \text{ atm}^{-2}$$



$$P_T = 0.84 = 0.5 + P + P$$

$$K_P = P'_{\text{NH}_3} \times P_{\text{H}_2\text{S}} = (0.5 + 0.17) \times 0.17 = 0.11 \text{ atm}^2$$

140.(53.85)

Equilibrium constant K_c for backward reaction is

$$K_c = \frac{K_b}{K_f} = \frac{2.1 \times 10^{-3}}{3.9 \times 10^{-5}} = 53.85 \text{ litre mol}^{-1}$$