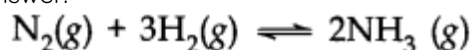




## II. Short Answer Type Questions

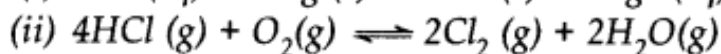
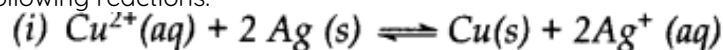
Question 1. The following concentration were obtained for the formation of  $\text{NH}_3$  from  $\text{N}_2$  and  $\text{H}_2$  at equilibrium at 500 K.  $[\text{N}_2(\text{g})] = 1.5 \times 10^{-2} \text{ M}$   $[\text{H}_2(\text{g})] = 3.0 \times 10^{-2} \text{ M}$   $[\text{NH}_3] = 1.2 \times 10^{-2} \text{ M}$ . Calculate equilibrium constant.

Answer:



$$\begin{aligned} K_c &= \frac{[\text{NH}_3]^2}{[\text{N}_2][\text{H}_2]^3} \\ &= \frac{[1.2 \times 10^{-2} \text{ M}]^2}{[1.5 \times 10^{-2} \text{ M}][3.0 \times 10^{-2} \text{ M}]^3} \\ &= 3.55 \times 10^{-2} \text{ M} \end{aligned}$$

Question 2. Write the equilibrium constant ( $K_c$ ) expression for the following reactions.



Answer:

$$(i) \quad K_c = \frac{[\text{Ag}^+(\text{aq})]^2}{[\text{Cu}^{2+}(\text{aq})]}$$

$$(ii) \quad K_c = \frac{[\text{Cl}_2(\text{g})]^2 [\text{H}_2\text{O}(\text{g})]^2}{[\text{HCl}(\text{g})]^4 [\text{O}_2(\text{g})]}$$

Question 3. Given the equilibrium  $\text{N}_2\text{O}_4(\text{g}) \rightarrow 2\text{NO}_2(\text{g})$   $K=0.15 \text{ atm}$  at 298 K

(a) What is  $K_p$  using pressure in torr?

(b) What is  $K_c$  using units of moles per litre.

Answer:

$$\begin{aligned} (a) \quad K_p &= \frac{(760 \text{ torr}) \times (0.15 \text{ atm})}{(1 \text{ atm})} \\ &= 1.14 \times 10^2 \text{ torr} \end{aligned}$$

$$\begin{aligned}
 (b) \quad K_p &= K_c (RT)^{\Delta n} \\
 K_c &= \frac{K_p}{(RT)^{\Delta n}} \\
 &= \frac{(0.15 \text{ atm})}{(0.0821 \text{ L atm K}^{-1} \text{ mol}^{-1} \times 298 \text{ K})^{2-1}} \\
 &= \mathbf{6.13 \times 10^{-3} \text{ mol L}^{-1}}
 \end{aligned}$$

Question 4. In the reaction  $A + B \rightarrow C + D$ , what will happen to the equilibrium if concentration of A is increased?

(b) The equilibrium constant for a reaction is  $2 \times 10^{23}$  at  $25^\circ\text{C}$  and  $2 \times 10^{-2}$  at  $50^\circ\text{C}$ . Is the reaction endothermic or exothermic?

(c) Mention at least three ways by which the concentration of  $\text{SO}_3$  can be increased in the following reaction in a state of equilibrium.

Answer:

(a) The reaction will shift in the forward direction.

(b) Endothermic

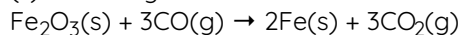
(c) (i) lowering the temperature

(ii) increasing pressure.

(iii) increasing concentration of oxygen.

Question 5. (i) Define Le Chatelier's principle.

(ii) Following reactions occur in a Blast furnace.



use Le chatelier's principle to predict the direction of reaction when equilibrium mixture is disturbed by

(a) adding  $\text{Fe}_2\text{O}_3$

(b) removing  $\text{CO}_2$ .

(c) removing CO.

Answer:

(i) When a system under equilibrium is subjected to a change in temperature, pressure or concentration, then the equilibrium shifts in such a direction so as to undo the effect of the change.

(ii) (a) On adding  $\text{Fe}_2\text{O}_3(\text{s})$ , the equilibrium will remain unaffected.

(b) By removing  $\text{CO}_2(\text{g})$ , the equilibrium will be shifted in the forward direction.

(c) By removing  $\text{CO}(\text{g})$ , the equilibrium will be shifted in the backward direction.

\*\*\*\*\* END \*\*\*\*\*