CHEMICAL EQUILIBRIUM

ONE MARK QUESTIONS

1 What happens to the concentration of products when the pressure is increased in the following reaction at equilibrium? $2NO_{2(g)} \rightleftharpoons N_2O_{4(g)}$?

2 Name an acid buffer and an alkaline buffer each.

3 Copper is precipitated as sulphide in the II group while Zn is precipitated as sulphide in the IV group. Explain.

4. Write the formula for the conjugate acid of

(i) F^- (ii) OH^-

5. Write the formula for the conjugate base of

(i) HNO_2 , (ii) OH^-

TWO MARKS QUESTIONS

1. Give reason:

a) Equilibrium can be established only in closed system.

b) Chemical equilibrium is dynamic in nature.

2. An equilibrium mixture contains $[PCl_5] = 0.15$; $[PCl_3] = 0.29$; $[Cl_2] = 0.32$. If K_c for the dissociation of PCl_5 at the same temperature is 3.5, in which direction is the reaction proceeding?

3. Differentiate between

a) hydrolysis and hydration

b) solubility and solubility product

4. Calculate the solubility of $BaSO_4$ if its K_{sp} value is 1.1×10^{-10}

5. State

(i) Henry's law (ii) LeChatelier's principle

6. Classify the following as Lewis acid or Lewis base

H_2O , BF_3 , Al^{3+} , Cl^-

THREE MARKS QUESTIONS

1. The value of $K_c = 6.2$ at 750K for the reaction $CO(g) + H_2O(g) \rightleftharpoons CO_2(g) + H_2(g)$. If initially the quantities of CO and H_2O are 2 moles in a 1 liter vessel, What would be the equilibrium concentrations of all the chemicals?

2. (i) The K_c value for the reaction SO_2 (g) + ½ O_2 (g) ⇌ SO_3 (g) is 72.5. What is the value of K_c for $2SO_3(g) \rightleftharpoons 2SO_2(g) + O_2(g)$?
   (ii) If the K_p value for the reaction $CO_2(g) + C(s) \rightleftharpoons 2CO(g)$ at 1000K is 3, find value of K_c.

3. Calculate the degree of dissociation, pH, and concentration of all species at equilibrium of a 0.05M HCN solution if $K_a = 4.9 \times 10^{-10}$.

4. (i) If K_a for the weak acid niacin is 1.5×10^{-5}, what is K_b for its conjugate base?
   (ii) The pH of an acetic acid solution is 5.6. What is the concentration of the solution if $K_a = 1.8 \times 10^{-7}$?

5. 10ml of 0.1M $CaCl_2$ is mixed with 15ml of 0.11M NaF. Predict whether CaF_2 will precipitate if the K_{sp} of CaF_2 is 5.3×10^{-9}.

6. Which of the following is more soluble?

   a) AgClor AgBr[K_{sp} of AgCl = 1.8×10^{-10} ; AgBr = 5×10^{-13}]

   b) AgCNor $Ni(OH)_2$ [K_{sp}AgCN = 2×10^{-15}; $Ni(OH)_2$ = 6×10^{-17}]

7. A buffer solution contains 0.4mol of ammonium hydroxide and 0.5mol of ammonium chloride to make a buffer solution of 1L.Calculate the pH of the resulting buffer solution. Dissociation constant of ammonium hydroxide at 25°C is 1.81×10^{-5}

VALUE BASED QUESTION (FOUR MARKS)

1. In group III, the cationsFe, and Al are precipitated as hydroxides by the addition of NH_4OH to the aqueous solution of the mixture. But a small amount of NH_4Cl is added before the addition of NH_4OH. Arvinderwas confused to see why common NH^{4+} ion is added. He asked his friend Palvinder the purpose of adding common NH^{4+} ion. Palvinder explained the purpose of adding NH_4Cl and then Arvinder got satisfied.

   (i) What would be the answer of Palvinder.
   (ii) Why magnesium is not precipitated from a solution of it's salt in group III.
   (iii) What is basic principle behind the systematic analysis of cations and group separation? Explain.
   (iv) What values are shown by Palvinder?

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