CHEMISTRY

BOOKS - VIKRAM PUBLICATION (ANDHRA PUBLICATION)

CHEMICAL EQUILIBRIUM AND ACIDS BASES

Solved Problems

1. The following concentrations were obtained for the formation of NH_3 from N_2 and H_2 at equilibrium at $500K$. $[N_2] = 1.5 \times 10^{-2}M$. $[H_2] = 3.0 \times 10^{-2}$M and $[NH_3] = 1.2 \times 10^{-2}M$. Calculate equilibrium constant.

Watch Video Solution

2. At equilibrium , the concentrations of $N_2 = 3.0 \times 10^{-3} M$, $O_2 = 4.2 \times 10^{-3} M$ and $NO = 2.8 \times 10^{-3} M$ in a sealed vessel at $800K$. What will be K_c for the reaction

$N_2(g) + O_2(g) \Leftrightarrow 2NO(g)$

Watch Video Solution

3. PCl_5, PCl_3 and Cl_2 are at equilibrium at $500K$ and having concentration $1.59MPCl_3$, $1.59MCL_2$ and $1.41MPCl_5$. Calculate K_c for the reaction $PCl_5 \Leftrightarrow PCl_3 + Cl_2$

Watch Video Solution

4. The value of $K_c = 4.24$ at $800K$ for the reaction, $CO(g) + H_2O(g) \Leftrightarrow CO_2(g) + H_2(g)$

Calcualte equilibrium concentrations of CO_2, H_2, CO and H_2O at $800K$, if only CO and H_2O are present initially at concentrations of $0.1M$ each.

Watch Video Solution

Watch Video Solution

5. For the equilibrium , $2NOCl(g) \Leftrightarrow 2NO(g) + Cl_2(g)$ the value of the equilibrium constant, K_c is 3.75×10^{-6} at $1069K$. Calculate the K_p for the reaction at this temperature ?

Watch Video Solution

6. The value of K_p for the reaction, $CO_2(g) + C(s) \Leftrightarrow 2CO(g)$ is 3.0 at $1000K$. If initially $P_{CO_2} = 0.48$ bar and $P_{CO} = 0$ bar and pure graphite is present, calculate the equilibrium partial pressures of CO and CO_2.

Watch Video Solution

7. The value of K_c for the reaction $2A \Leftrightarrow B + C$ is 2×10^{-3}. At a given time, the composition of reaction mixture is $[A] = [B] = [C] = 3 \times 10^{-4}M$. In which direction the reaction will proceed ?

Watch Video Solution

8. $13.8g$ of N_2O_4 was placed in a $1L$ reaction vessel at $400K$ and allowed to attain equilibrium

$N_2O_4(g) \Leftrightarrow 2NO_2(g)$

The total pressure at equilibrium was found to be 9.15 bar . Calcualate K_c , K_p and partial pressure at equilibrium.

Watch Video Solution

9. 3.00 mol of PCl_5 kept in $1L$ closed reaction vessel was allowed to attain equilibrium at $380K$. Calculate composition of the mixture at equlibrium $K_c = 1.80$

Watch Video Solution

10. The value of $\Delta G^{\ominus}$ for the phosphorylation of glucose in glycolysis is 13.8 kJ/mol. Find the value of Kc at 298 K.

Watch Video Solution

11. Hydrolysis of sucrose gives, Sucrose $+ H_2O \Leftrightarrow$ Glucose $+$ Fructose

Equlibrium constant K_c for the reaction is 2×10^{13} at $300K$. Calculate $\Delta G^{\oplus}$ at $300K$.

Watch Video Solution

12. What will be the conjugate bases of the following Bronsted acids: HF, H_2SO_4 and HCO_3^-?

Watch Video Solution

13. Write the conjugate acids for the following Bronsted bases: NH_2^-, NH_3 and $HCOO^-$:

Watch Video Solution

14. The species: H_2O, HCO_3^-, HSO_4^- and NH_3 can act both as Bronsted acids and bases. For each case give the corresponding conjugate acid and conjugate base.

Watch Video Solution

15. Explain Lewis acid base theory with suitable example. Classify the following species into Lewis acids and Lewis bases and show how these act as Lewis acid/base.

a. OH^- b. F^- c. H^+ d. BCl_3

Watch Video Solution

16. The concentration of hydrogen ion in a sample of soft drink is $3.8 \times 10^{-3} M$. What is its pH?

Watch Video Solution

17. Calculate pH of a 1.0×10^{-8} M solution of HCl.

Watch Video Solution

18. The ionization constant of HF is 3.2×10^{-4}. Calculate the degree of dissociation of HF in its $0.02M$ solution. Calculate the concentration of all species present (H_3O^+, F^- and HF) in the solution and its pH.

Watch Video Solution

19. The pH of $0.1M$ monobasic acid is 4.50. Calculate the concentration of species H^+.

A^- and HA at equilibrium . Also, determine the value of K_a and pK_a of the monobasic acid.

Watch Video Solution

20. Calculate the pH of $0.08M$ solution of hypochlorous acid, $HOCl$. The ionization constant of the acid is 2.5×10^{-5}. Determine the percent dissociation of $HOCl$.

Watch Video Solution

21. The pH of $0.004M$ hydrazine solution is 9.7. Calculate its ionization constant K_b and pK_b.

Watch Video Solution

22. Calculate the pH of the solution in which $0.2MNH_4Cl$ and $0.1MNH_3$ are present. The pK_b of ammonia solution is 4.75.

Watch Video Solution

23. Determine the degree of ionization and pH of $0.05M$ of ammonia solution. The ionization constant of ammonia can be taken from Table 7.7 . Also, calculate the ionization constant of the conjugate acid of ammonia.

Watch Video Solution

24. Calculate the pH of $0.10M$ ammonia solution. Calcualte the pH after $50.0mL$ of this solution is treated with $25.0mL$ of $0.10MHCl$. The dissociation constant of ammonia, $K_b = 1.77 \times 10^{-5}$.

Watch Video Solution

25. The pK_a of acetic acid and pK_b of ammonium hydroxide are 4.76 and 4.75 respectively. Calculate the pH of ammonium acetate solution.

Watch Video Solution

26. Calculate the solubility of A_2X_3 is pure water, assuming that neither kind of ion racts with water. The solubility product of A_2X_3, $K_{sp} = 1.1 \times 10^{-23}$

Watch Video Solution

27. The values of K_{sp} of two sparingly soluble salts $Ni(OH)_2$ and $AgCN$ are 2.0×10^{-15} and 6×10^{-17} respectively. Which salt is more soluble ? Explain .

Watch Video Solution

28. Calculate the molar solubility of $Ni(OH)_2$ in $0.10MNaOH$. The ionic product of $Ni(OH)_2$ is 2.0×10^{-15}

Watch Video Solution

Problems

1. Mole of PCl_5 is heated in a closed vessel of 1 litre capacity. At equilibrium 0.4 moles of chlorine is found. Calculate the equilibrium constant.

Watch Video Solution

2. Nitrogen dioxide froms dinitrogen tetroxide according to the equation $2NO_2(g) \Leftrightarrow N_2O_4$ (g) when 0.1 mole of NO_2 is added to a 1 litre flask at $25^\circ C$, the concentration changes so that at equilibrium $[NO_2] = 0.016M$ and $[N_2O_4] = 0.042M$.

a. What is the value of the reaction Quotient before any reaction occurs.

b. What is the value of the equilibrium constant for the reaction.

Watch Video Solution

3. Nitrogen dioxide froms dinitrogen tetroxide according to the equation $2NO_2(g) \Leftrightarrow N_2O_4$ (g) when 0.1 mole of NO_2 is added to a 1 litre flask at

$25^{\circ}C$, the concentration changes so that at equilibrium $[NO_2] = 0.016M$ and $[N_2O_4] = 0.042M$.

a. What is the value of the reaction Quotient before any reaction occurs.

b. What is the value of the equilibrium constant for the reaction.

Watch Video Solution

4. The equilibrium constant for the reaction:

$N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$ at $725K$

is 6.0×10^{-2}. At equilibrium $[H_2] = 0.25\text{mol}L^{-1}$ and $[NO_3] = 0.06\text{mol}L^{-1}$

Calculate the equilirbium concentration of N_2.

Watch Video Solution

5. At certain temperature K_c for the reactioni.

$SO_2(g) + NO_2(g) \Leftrightarrow SO_3(g) + NO(g)$ is 16. If initiallyone mole each of all the four gases are taken in one litre vessel, what are the equilibrium concentrations of NO and NO_2?

Watch Video Solution

6. Under certain conditions, the equilibrium constant for the decomposition of $PCl_5(g)$ into $PCl_3(g)$ and $Cl_2(g)$ is $0.0211 \text{mol} L^{-1}$. What are the equilibrium concentrations of PCl_5, $PCl_3 d$ and Cl_2 if the initial concentration of PCl_5 was $1.00 M$?

Watch Video Solution

7. For the reactions $A + B \Leftrightarrow 3C$ at $25^\circ C$, a 3 litre vessel contains 1,2,4 mole of A, B and C respectively predict the direction of reaction if

a. K_c for the reaction is 10

b. K_c for the reaction is 15

c. K_c for the reaction is 10.66

Watch Video Solution

8. For the reactions $A + B \Leftrightarrow 3C$ at $25^\circ C$, a 3 litre vessel contains 1,2,4 mole of A, B and C respectively predict the direction of reaction if

a. K_c for the reaction is 10

b. K_c for the reaction is 15

c. K_c for the reaction is 10.66

Watch Video Solution

9. For the reactions $A + B \Leftrightarrow 3C$ at $25^\circ C$, a 3 litre vessel contains 1,2,4 mole of A, B and C respectively predict the direction of reaction if

a. K_c for the reaction is 10

b. K_c for the reaction is 15

c. K_c for the reaction is 10.66

Watch Video Solution

10. A mixture of H_2, N_2 and NH_3 with molar concentration $5.0 \times 10^{-3} \text{mol} L^{-1}, 4.0 \times 10^{-3} \text{mol} L^{-1}$ and $2.0 \times 10^{-3} \text{mol} L^{-1}$

respectively was prepared and heated to $500K$. The value of K_c for the reaction:

$3H_2(g) + N_2(g) \Leftrightarrow 2NH_3(g)$ at this temperature is 60. Predict whether ammonia tends to form or decompose at this stage of concenration.

Watch Video Solution

11. At $500K$, K_p value for the reaction

$2SO_2(g) + O_2(g) \Leftrightarrow 2SO_3(g)$ is 2.5×10^{10}.

Find the value of K_p for each of followign reactions at the same temperature.

a. $SO_2(g) + 1/2O_2(g) \Leftrightarrow SO_3(g)$

b. $SO_3(g) \Leftrightarrow SO_2(g) + 1/2O_2(g)$

c. $3SO_2(g) + 3/2O_2(g) \Leftrightarrow 3SO_3(g)$

Watch Video Solution

12. At $500K$, K_p value for the reaction

$2SO_2(g) + O_2(g) \Leftrightarrow 2SO_3(g)$ is 2.5×10^{10}.

Find the value of K_p for each of followign reactions at the same temperature.

a. $SO_2(g) + 1/2O_2(g) \Leftrightarrow SO_3(g)$

b. $SO_3(g) \Leftrightarrow SO_2(g) + 1/2O_2(g)$

c. $3SO_2(g) + 3/2O_2(g) \Leftrightarrow 3SO_3(g)$

Watch Video Solution

13. At $500K$, K_p value for the reaction

$2SO_2(g) + O_2(g) \Leftrightarrow 2SO_3(g)$ is 2.5×10^{10}.

Find the value of K_p for each of followign reactions at the same temperature.

a. $SO_2(g) + 1/2O_2(g) \Leftrightarrow SO_3(g)$

b. $SO_3(g) \Leftrightarrow SO_2(g) + 1/2O_2(g)$

c. $3SO_2(g) + 3/2O_2(g) \Leftrightarrow 3SO_3(g)$

Watch Video Solution

14. K_c for the reaction $N_2O(g) \Leftrightarrow 2NO_2(g)$ is 4.63×10^{-3} at 25^2C.

a. What is the value of K_p at this temperature?

b. At $25^\circ C$, if the partial pressure of $N_2O_4(g)$ at equilibrium is 0.2 atm, calculate equilibrium pressure of $NO_2(g)$

Watch Video Solution

15. K_c for the reaction $N_2O(g) \Leftrightarrow 2NO_2(g)$ is 4.63×10^{-3} at 25^2C.

a. What is the value of K_p at this temperature?

b. At $25^\circ C$, if the partial pressure of $N_2O_4(g)$ at equilibrium is 0.2 atm, calculate equilibrium pressure of $NO_2(g)$

Watch Video Solution

16. At $27^\circ C$, K_p value for the reversible reaction $PCl_5(g) \leftrightarrow PCl_3(g) + Cl_2(g)$ is 0.65, calculate K_c.

Watch Video Solution

17. K_c for the reaction

$N_2(g) + 3H_2(g) \Leftrightarrow 2N_3(g)$ is 0.5 at $400K$ find K_p

Watch Video Solution

18. 1 mole of A and 1 mol3 of B are taken in a 5 litre flask, 0.5 mole of c is formed in the equilibrium of

$A + B \Leftrightarrow C + D$

What is molar concentration of each species if the reaction is carried with 2 mole A, 1 mole of B in a 5 litre flask at the same temperature.

Watch Video Solution

19. For the following reaction

$PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g) 0.4$ mole of Cl_2 are taken in a 1 litre flask. If $K_c = 0.2$ predict the direction in which reaction proceeds.

Watch Video Solution

20. In an equilibrium $A + B \Leftrightarrow C + D$, A and B are mixed in a vessel at temperature T. The initial concentration of A was twice the initial concentration of B. After the attainment of equilibrium, concentration of C was thrice concentration of B, calculate K_c.

Watch Video Solution

21. A mixture of SO_2, SO_3 and O_2 gases are maintained at equilibrium in 10 litre flask at a temperature at which K_c for the reaction $2SO_2(g) + O_2(g) \Leftrightarrow 2SO_3(g)$ is 100. At equilibrium.

a. If no of moles of SO_3 and SO_2 is flask are same, how many moles of O_2 are present.

b. If no. of moles of SO_3 in flask is twice the no. of moles SO_2 how many moles of O_2 are present.

Watch Video Solution

22. A mixture of SO_2, SO_3 and O_2 gases are maintained at equilibrium in 10 litre flask at a temperature at which K_c for the reaction $2SO_2(g) + O_2(g) \Leftrightarrow 2SO_3(g)$ is 100. At equilibrium.

a. If no of moles of SO_3 and SO_2 is flask are same, how many moles of O_2 are present.

b. If no. of moles of SO_3 in flask is twice the no. of moles SO_2 how many moles of O_2 are present.

Watch Video Solution

23. For $A + B \Leftrightarrow C$, the equilibrium concentrations of A and B at a temperature are $15 \text{mol} L^{-1}$. When volume is doubled the reaction has equilibrium concentration of A is $10 \text{mol} L^{-1}$. Calculate

a. K_c

b concentration of C in original equilibrium.

Watch Video Solution

24. For $A + B \Leftrightarrow C$, the equilibrium concentrations of A and B at a temperature are $15 \text{mol} L^{-1}$. When volume is doubled the reaction has equilibrium concentration of A is $10 \text{mol} L^{-1}$. Calculate

a. K_c

b concentration of C in original equilibrium.

Watch Video Solution

25. A vessel at $100K$ contains CO_2 with a pressure of 0.5 atm. Some of the CO_2 is converted into CO on addition of graphite. Calculate the value of K if total pressure at equilibrium is 0.8 atm.

Watch Video Solution

26. The K_p values for the reaction

$H_2(g) + I_2(g) \Leftrightarrow 2HI(g)$ at $460^\circ C$ is 49. If the initial pressure of H_2 and I_2 are 0.5 atm respectively, determine the partial pressure of each gases at equilibrium.

Watch Video Solution

27. 0.5 mol of H_2 and 0.5 mole of I_2 react in 10 litre flast at $448^\circ C$. The equilibrium constant K_c is 50 for

$H_2(g) + I_2(g) \Leftrightarrow 2HI(g)$

a. What is the value of K_p

b. Calculate mole of I_2 at equilibrium.

Watch Video Solution

28. 0.5 mol of H_2 and 0.5 mole of I_2 react in 10 litre flask at $448^\circ C$. The equilibrium brium constant K_C is 50 for

$H_2(g)I_2(g) \Leftrightarrow 2HI(g)$

Calcualte mole of I_2 at equilibrium.

Watch Video Solution

29. How much PCl_5 must be added to a one litre vesel at $250^\circ C$ in order to obtain concentration of 0.1 mole of Cl_2 at equilibrium K_C for $PCl_5(g) \Leftrightarrow PCl_{3\,(g)} + Cl_2$ is 0.0414M

Watch Video Solution

30. K_p for the reaction

$N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$ at 400^2C is 1.64×10^{-4}

a. Calculate K_cd

b. Calculate ΔG° value of K_c value.

Watch Video Solution

31. K_p for the reaction

$N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$ at 400^2C is 1.64×10^{-4}

a. Calculate K_cd

b. Calculate ΔG° value of K_c value.

Watch Video Solution

Watch Video Solution

32. Calculate pH of

a. $10^{-3}MHCl$

b. $10^{-3}MH_2HO_4$

c. $10^{-6}MHNO_3$

d. $0.02MH_2SO_4$

Watch Video Solution

33. Calculate pH of

a. $10^{-3}MHCl$

b. $10^{-3}MH_2HO_4$

c. $10^{-6}MHNO_3$

d. $0.02MH_2SO_4$

Watch Video Solution

34. Calculate pH of

a. $10^{-3}MHCl$

b. $10^{-3}MH_2HO_4$

c. $10^{-6}MHNO_3$

d. $0.02MH_2SO_4$

Watch Video Solution

35. Calculate pH of

a. $10^{-3}MHCl$

b. $10^{-3}MH_2HO_4$

c. $10^{-6}MHNO_3$

d. $0.02MH_2SO_4$

A. a. 1.7

B. b. 1.4

C. c. 2

D. d. 4

Answer:

Watch Video Solution

36. Calculate the pH for

a. $0.001MNaOH$

b. $0.01MCa(OH)_2$

c. $0.0008MBa(OH)_2$

d. $0.004MNaOH$

Watch Video Solution

37. Calculate the pH for

a. $0.001MNaOH$

b. $0.01MCa(OH)_2$

c. $0.0008MBa(OH)_2$

d. $0.004MNaOH$

Watch Video Solution

38. Calculate the pH for

a. $0.001 M NaOH$

b. $0.01 M Ca(OH)_2$

c. $0.0008 M Ba(OH)_2$

d. $0.004 M NaOH$

Watch Video Solution

39. Calculate the pH for

a. $0.001 M NaOH$

b. $0.01 M Ca(OH)_2$

c. $0.0008 M Ba(OH)_2$

d. $0.004 M NaOH$

Watch Video Solution

40. The pH of a solution is 3.6. Calculate H_3O^+ ion concentration.

Watch Video Solution

41. The pH of a solution is 8.6. Calculate the OH^- ion concentration

$pH = 8.6$

$pOH = 5.4$

$-\log[OH^-] = 10^{-5.4}$

$[OH^-] = 10^{-6} \times 10^{0.6} = 10^{-6} \times$ anto log 0.6

$[OH^-] = 3.98 \times 10^{-6}$

Watch Video Solution

42. What is $[H^+]$ for a solution in which

a. $pH = 3$ b. $pH = 4.75$ c. $pH = 4.4$?

Watch Video Solution

43. What is $[H^+]$ for a solution in which

a. $pH = 3$ b. $pH = 4.75$ c. $pH = 4.4$?

Watch Video Solution

44. What is $\left[H^{+}\right]$ for a solution in which

a. $pH = 3$ b. $pH = 4.75$ c. $pH = 4.4$?

Watch Video Solution

45. A solutioin of 0.005 MH_2SO_4 is diluted 100 times. Calculate the pH of diluted solution.

Watch Video Solution

46. A solution of HCl has a $pH = 3$. If one ml of it is diluted to 1 litre, what will be the pH of the resulting solution?

Watch Video Solution

47. The P^H of 10^{-8} M HCl is

Watch Video Solution

48. Calculate the pH of the following basic solutions

a. $[OH^-] = 0.05M$ b. $[OH^-] = 2 \times 10^{-4}M$

Watch Video Solution

49. Calculate the pH of the following basic solutions

a. $[OH^-] = 0.05M$ b. $[OH^-] = 2 \times 10^{-4}M$

Watch Video Solution

50. 2g of $NaOH$ is dissolved in water to give 1 litre solutioin. What is the pH of the solution?

Watch Video Solution

51. Calculate the pH of the following solutions.

a. 0.37g fo $Ca(OH)_2$ dissolved in water to give 500 ml solution

b. 0.3 g of NaOH dissolved in water to give 200 ml solution

c. 0.1825% HCl aqueous solution

d. 1 ml of 13.6 M HCl is diluted with water to give 1 litre solution.

Watch Video Solution

52. Calculate the pH of the following solutions.

a. 0.37g fo $Ca(OH)_2$ dissolved in water to give 500 ml solution

b. 0.3 g of NaOH dissolved in water to give 200 ml solution

c. 0.1825% HCl aqueous solution

d. 1 ml of 13.6 M HCl is diluted with water to give 1 litre solution.

Watch Video Solution

53. Calculate the pH of the following solutions.

a. 0.37g fo $Ca(OH)_2$ dissolved in water to give 500 ml solution

b. 0.3 g of NaOH dissolved in water to give 200 ml solution

c. 0.1825% HCl aqueous solution

d. 1 ml of 13.6 M HCl is diluted with water to give 1 litre solution.

Watch Video Solution

54. Calculate the pH of the following solution :

$(a) 2g$ of $TlOH$ dissolved in water to give 2 litre of solution.

(b) $0.3g$ of $Ca(OH)_2$ dissolved in water to give $500mL$ of solution.

(c) $0.3g$ of $NaOH$ dissolved in water to give $200mL$ of solution.

(d) $1mL$ of $13.6MHCl$ is diluted with water to give 1 litre of solution.

Watch Video Solution

55. How many grams of NaOH are present in 100 ml solution if pH of the solution is 10?

Watch Video Solution

56. The value of K_w is 9.55×10^{-14} at certain temperature. Calculate the pH of water at this temperature.

Watch Video Solution

57. Caculate the pH of $10^{-8} mNaOH$

Watch Video Solution

58. 150 ml of 0.5 HCl and 100 ml of 0.2 M HCl are mixed. Find the pH of the resulting solution.

Watch Video Solution

59. Calculate the p of solution obtained by mixign 10 ml fo 0.1 M HCl and 40 ml off $0.2MH_2SO_4$.

Watch Video Solution

60. 100 ml of $pH = 4$ solution is mixed with 100 ml of $pH = 6$ solution. What is the pH of resulting solution?

Watch Video Solution

61. Equal volumes of M NaOH and 0.3 M KOH are mixed in an experiment. Find the POH and pH of the resulting solution.

Watch Video Solution

62. 60 ml of 1 M HCl is mixed with 40 ml of 1M NaOH. What is the pHH of resultant solution?

Watch Video Solution

63. Calculate the pH of a solution which contains 100 ml of 0.1 H HCl and 9.9 ml of 1.0 M NaOH.

Watch Video Solution

64. What will be the resultant pH when 200 ml of an aqueous solution of HCl having $pH = 2$ is mixed with 300 ml of a aqueous solution of NaOH having $pH = 12$?

Watch Video Solution

65. 50 ml of 0.2 M HCl is added to 30 ml of 0.1 MKOH solution. Find the pH of the solution.

Watch Video Solution

66. 40 ml of $0.2MHNO_3$ when reacted with 60 ml of $0.3MNaOH$ gave a mixed solution. What is the pH of the resulting solution?

Watch Video Solution

67. 50 ml of $0.1MH_2SO_4$ were added to 100 ml of $0.2MHNO_3$. Then the solution is diluted to 300 ml. What is the pH of the solution?

Watch Video Solution

68. What is the K_w value in the aqueous solution of $pK_w = 13.725$?

Watch Video Solution

69. The ionic product of water at $80^\circ C$ is 2.44×10^{-13}. What are the concentrations of hydronium ion and the hydroxide in pure water at $80^\circ C$?

Watch Video Solution

70. The ionization constnat for water is 2.9×10^{-14} at $40^{\circ} C$. Calculate $\left[H_3O^+\right]$, $[OH]$, pH and pOH for pure water at $40^{\circ} C$.

Watch Video Solution

71. Calculate the pH of

a. 0.002 M acetic acid having 2.3% dissociation.

b. 0.002MNH_4OH having 2.3% dissociation.

Watch Video Solution

72. Calculate the pH of

a. 0.002 M acetic acid having 2.3% dissociation.

b. 0.002MNH_4OH having 2.3% dissociation.

Watch Video Solution

73. Calculate Ka of acetic acid from equilibrium concentration given below:

$\left[H_3O^+\right] = \left[CH_3COO^-\right] = 1.34 \times 10^{-3}M, [CH_3COOH] = 9.866 \times 10^{-2}$

Watch Video Solution

74. Calculate pH of 0.1 M acetic acid having $K_a = 1.8 \times 10^{-5}$

Watch Video Solution

75. The pH of 0.1 M solution of weak mono protic acid is 4.0. Calculate its $\left[H^+\right]$ and Ka.

Watch Video Solution

76. K_a of $0.02MCH^3COOH$ is 1.8×10^{-5} Calculate

a. $\left[H_3O^+\right]$ b. % ionization c. pH

Watch Video Solution

77. K_a of $0.02MCH^3COOH$ is 1.8×10^{-5} Calculate

a. $\left[H_3O^+\right]$ b. % ionization c. pH

Watch Video Solution

78. K_a of $0.02MCH^3COOH$ is 1.8×10^{-5} Calculate

a. $\left[H_3O^+\right]$ b. % ionization c. pH

Watch Video Solution

79. Calculate the pH of 0.01 M solution of $CH_3COOH. K_a$ for CH_3COOH at $298K$ is 1.8×10^{-5}

Watch Video Solution

80. The pH of 0.1 M solution of an organic acid is 4.0. Calculate the dissociation constant of the acid.

Watch Video Solution

81. The ionization constants of $HF, HCOOH$ and HCN at 298 K are $6.8x10^{-4}, 1.8 \times 10^{-4}$ and 4.7×10^{-9} respectively. Calculate the ionization constants of the corresponding conjugate base.

Watch Video Solution

82. Find the concentration of hydroxide ion in a 0.25 M solution of trimethylamine, a weak base.

$(CH_3)_3N + H_2O \Leftrightarrow (CH_3)_3 + OH^-, K_b = 7.4 \times 10^{-5}$

Watch Video Solution

83. The 0.005 M monobasic acid has a pH of 5. What is the extent of ionization?

Watch Video Solution

84. 50 ml of $0.1MNH_4OH$, 25 ml of $2MNH_4Cl$ were used to make a buffer. What is the pH if pK_a is 4.8?

Watch Video Solution

85. The pH of a buffer prepared by mixing 50 ml of $0.2MCH_3COOH$ and 25 ml of CH_3COONa is 4.8. If the pK_a is 4.8, what is the strength of CH_3COONa?

Watch Video Solution

86. 50 ml o 0.1 M sodium acetate, 25 ml of 0.2 M acetic acid were added together to form the buffer solution. pK_a of CH_3COOH is 4.8. Find the pH of the solution.

Watch Video Solution

87. When 20 ml of 0.1 MNH_4OH are added to 20 ml of MNH_4Cl solution, the pH of the buffer formed is 8.2. What is the pK_b of NH_4OH?

Watch Video Solution

88. One litre of buffer solution contains 0.1 mole of acetic acid add 1 mole of sodium acetate. Find its pH if pK_a of CH_3COOH is 4.8.

Watch Video Solution

89. 50 ml of $1MCH_3COOH$ solutioin, when added to 50 ml of 0.5 M NaOH gives a solution with a pH value 'X'. Find the valuer of $'X'$, pK_a of acetic acid is 4.8.

Watch Video Solution

90. The solibility product of Ag cl is $1.6 \times 10^{-10} \text{mol}^2 / L^2$. What is its solubility?

Watch Video Solution

91. The solubility product of $Zr(OH)_2$ is $4.5 \times 10^{-17} \text{mol}^3 L^{-3}$. What is solubility?

Watch Video Solution

92. The solubility of Ag_2CrO_4 is $1.3 \times 10^{-4} \text{mol} L^{-1}$. What is the solubility product?

Watch Video Solution

93. The solubility of $A_2B = 2 \times 10^{-3} \text{mol} L^{-1}$. What is solubility product?

Watch Video Solution

94. The solubility product of a salt $AB = 10^{-10} \text{mol}^2 L^{-2}$. What is the solubility?

Watch Video Solution

95. PQ and RS_2 are two sparingly soluble salts. Their solubility prodcts are equal and each equal to 4.0×10^{-18}. Which salt is more soluble?

Watch Video Solution

96. In a 0.1 solution, acetic acid is 1.34% ionized. Calculate $\left[H^{+}\right]$, $\left[CH_3COO^{-}\right]$ and $\left[CH_3COOH\right]$ in the solution and calculate K_a of acetic acid.

Watch Video Solution

Important Questions

1. State law of chemical equilibrium.

Watch Video Solution

2. Why the concentrations of pure liquids and pure solids are ignored from equilibrium constant expressions?

Watch Video Solution

3. What is heterogenous equilibrium?

Write two heterogeneous reactions.

Watch Video Solution

4. Define equilbrium constant.

Watch Video Solution

5. Write the relation between K_p and K_c

Watch Video Solution

6. Give two chemcial equilibrium reactions for which $K_p = K_c$

Watch Video Solution

7. Give two chemical equilibrium reactions for which $K_p > K_c$.

Watch Video Solution

8. Give two chemical equilibrium reactions for which $K_p < K_c$.

Watch Video Solution

9. What are the factors which influence the chemical equilibrium?

Watch Video Solution

10. What is the effect of pressure on gaseous chemical equilibrium?

Watch Video Solution

11. The equilibrium constants of a reaction at $27^{\circ}C$ and aet $127^{\circ}C$ are 1.6×10^{-3} and 7.6×10^{-2} respectively. Is the reaction exothermic or endothermic?

Watch Video Solution

12. For an exothermic reaction, what happens to the equilibrium constant if temperature is raised?

Watch Video Solution

13. What is a Bronsted base? Give one example.

Watch Video Solution

14. What is Lewis acid? Give one example.

Watch Video Solution

15. What is meant by ionic product of water?

Watch Video Solution

16. All Bronsted bases are Lewis bases? Explain.

Watch Video Solution

17. All Lewis acids are not Bronsted acids. Why?

Watch Video Solution

18. Give two examples of salts whose aqueous solutions are basic.

Watch Video Solution

19. Give two examples of salts whose aqueous salts are acidic.

Watch Video Solution

20. What equation is used calculating the pH of an acid buffer?

Watch Video Solution

21. Write expression for the equilibrium constant, K_c, for each of the following reactions:

(i) $2NOCl_{(g)} \leftrightarrow 2NO_{(g)} + Cl_{2(g)}$

(ii) $2Cu(NO_3)_{2(s)} \Leftrightarrow 2CuO_{(s)} + 4NO_{2(g)} + O_{2(g)}$

(iii) $CH_3COOC_2H_{5(ag)} + H_2O(I) \Leftrightarrow CH_3COOH_{(aq)} + C_2H_5OH_{(aq)}$

(iv) $Fe^{+3}_{(aq)} + 3OH^{-}_{(aq)} \Leftrightarrow Fe(OH)_{3(S)}$

Watch Video Solution

22. Write expression for the equilibrium constant, K_c, for each of the following reactions:

(i) $2NOCl_{(g)} \leftrightarrow 2NO_{(g)} + Cl_{2(g)}$

(ii) $2Cu(NO_3)_{2(s)} \Leftrightarrow 2CuO_{(s)} + 4NO_{2(g)} + O_{2(g)}$

(iii) $CH_3COOC_2H_{5(ag)} + H_2O(I) \Leftrightarrow CH_3COOH_{(aq)} + C_2H_5OH_{(aq)}$

(iv) $Fe^{+3}_{(aq)} + 3OH^{-}_{(aq)} \Leftrightarrow Fe(OH)_{3(S)}$

Watch Video Solution

23. Write expression for the equilibrium constant, K_c, for each of the following reactions:

(i) $2NOCl_{(g)} \leftrightarrow 2NO_{(g)} + Cl_{2(g)}$

(ii) $2Cu(NO_3)_{2(s)} \Leftrightarrow 2CuO_{(s)} + 4NO_{2(g)} + O_{2(g)}$

(iii) $CH_3COOC_2H_{5(ag)} + H_2O(I) \Leftrightarrow CH_3COOH_{(aq)} + C_2H_5OH_{(aq)}$

(iv) $Fe^{+3}_{(aq)} + 3OH^{-}_{(aq)} \Leftrightarrow Fe(OH)_{3(S)}$

Watch Video Solution

24. Write expression for the equilibrium constant, K_c, for each of the following reactions:

(i) $2NOCl_{(g)} \leftrightarrow 2NO_{(g)} + Cl_{2(g)}$

(ii) $2Cu(NO_3)_{2(s)} \Leftrightarrow 2CuO_{(s)} + 4NO_{2(g)} + O_{2(g)}$

(iii) $CH_3COOC_2H_{5(ag)} + H_2O(I) \Leftrightarrow CH_3COOH_{(aq)} + C_2H_5OH_{(aq)}$

(iv) $Fe^{+3}_{(aq)} + 3OH^{-}_{(aq)} \Leftrightarrow Fe(OH)_{3(S)}$

Watch Video Solution

25. Derive the relation between K_p and K_c for the equilibrium reaction.

$N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$

Watch Video Solution

26. Why sealed soda water bottle on opening shows the evolution of gas with effervescence?

Watch Video Solution

27. Explain the significance of : a very large value of K

Watch Video Solution

28. Explain the significance of : a very small value of K

Watch Video Solution

29. Explain the significance of : a value of K of about 1.0

Watch Video Solution

30. Why is it useful to compare Q with K?

What is the situation when

a. $Q = K$ b. $Q < K$ c.$Q > K$?

Watch Video Solution

31. Does the number of moles of reaction products increase, decrease, or remains same when each of the following equilibrium is subjected to a decrease in pressure by increasing the volume?

$PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g)$

Watch Video Solution

32. Does the number of moles of reaction products increase, decrease, or remains same when each of the following equilibrium is subjected to a decrease in pressure by increasing the volume?

$Cao(s) + CO(\_2)(g) \Leftrightarrow CaCO_3(s)$

Watch Video Solution

33. Which of the following reactions will get affected by increasing the pressure? Also mention whether chasnge will cause the reaction to go into forward or backward direction.

(i) $COCl_2(g) \Leftrightarrow CO(g) + Cl_2(g)$

(ii) $CH_4(g) + 2S_2(g) \Leftrightarrow CS_2(g) + 2H_2S(g)$

(iii) $CO_2(g) + C(s) \Leftrightarrow 2CO(g)$

(iv) $4NH_3 + (g) + 5O_2(g) \Leftrightarrow 4NO(g) + 6H_2O(g)$

Watch Video Solution

34. Which of the following reactions will get affected by increasing the pressure? Also, mention whether change will cause the reaction to go into forward or backward direction.

$(i) COCl_2(g) \Leftrightarrow CO(g) + Cl_2(g)$

$(ii) CH_4(g) + 2S_2(g) \Leftrightarrow CS_2(g) + 2H_2S(g)$

$(iii) CO_2(g) + C(s) \Leftrightarrow 2CO(g)$

$(iv) 2H_2(g) + CO(g) \Leftrightarrow CH_3OH(g)$

$(v) CaCO_3(s) \Leftrightarrow CaO(s) + CO_2(g)$

$(vi) 4NH_3(g) + 5O_2(g) \Leftrightarrow 4NO(g) + 6H_2O(g)$

Watch Video Solution

35. Which of the following reactions will get affected by increasing the pressure? Also mention whether chasnge will cause the reaction to go into forward or backward direction.

(i) $COCl_2(g) \Leftrightarrow CO(g) + Cl_2(g)$

(ii) $CH_4(g) + 2S_2(g) \Leftrightarrow CS_2(g) + 2H_2S(g)$

(iii) $CO_2(g) + C(s) \Leftrightarrow 2CO(g)$

(iv) $4NH_3 + (g) + 5O_2(g) \Leftrightarrow 4NO(g) + 6H_2O(g)$

Watch Video Solution

36. Which of the following reactions will get affected by increasing the pressure? Also, mention whether change will cause the reaction to go into forward or backward direction.

$(i) COCl_2(g) \Leftrightarrow CO(g) + Cl_2(g)$

$(ii) CH_4(g) + 2S_2(g) \Leftrightarrow CS_2(g) + 2H_2S(g)$

$(iii) CO_2(g) + C(s) \Leftrightarrow 2CO(g)$

$(iv) 2H_2(g) + CO(g) \Leftrightarrow CH_3OH(g)$

$(v) CaCO_3(s) \Leftrightarrow CaO(s) + CO_2(g)$

$(vi) 4NH_3(g) + 5O_2(g) \Leftrightarrow 4NO(g) + 6H_2O(g)$

Watch Video Solution

37. How will an increase in pressure and affect each of the following equilibria? An increase in temperature

(i) $2NH_3(g) \Leftrightarrow N_2(g) + 3H_g \Delta H = 932kJ$

(ii) $N_2(g) + O(2)(g) \Leftrightarrow 2NO(g) \Delta H = 181kJ$

(iii) $2O_3(g) \Leftrightarrow 3O_2(g) \Delta H = -285kJ$

(iv) $CaO(s) + CO_2(g) \Leftrightarrow CaCO_3(s) \Delta H = -176kJ$

Watch Video Solution

38. How will an increase in pressure and affect each of the following equilibria? An increase in temperature

(i) $2NH_3(g) \Leftrightarrow N_2(g) + 3H_g \Delta H = 932kJ$

(ii) $N_2(g) + O(2)(g) \Leftrightarrow 2NO(g) \Delta H = 181kJ$

(iii) $2O_3(g) \Leftrightarrow 3O_2(g) \Delta H = -285kJ$

(iv) $CaO(s) + CO_2(g) \Leftrightarrow CaCO_3(s) \Delta H = -176kJ$

Watch Video Solution

39. How will an increase in pressure and affect each of the following equilibria? An increase in temperature

(i) $2NH_3(g) \Leftrightarrow N_2(g) + 3H_g \Delta H = 932kJ$

(ii) $N_2(g) + O(2)(g) \Leftrightarrow 2NO(g) \Delta H = 181kJ$

(iii) $2O_3(g) \Leftrightarrow 3O_2(g) \Delta H = -285kJ$

(iv) $CaO(s) + CO_2(g) \Leftrightarrow CaCO_3(s) \Delta H = -176kJ$

Watch Video Solution

40. How will an increase in pressure and affect each of the following equilibria? An increase in temperature

(i) $2NH_3(g) \Leftrightarrow N_2(g) + 3H_g \Delta H = 932kJ$

(ii) $N_2(g) + O(2)(g) \Leftrightarrow 2NO(g) \Delta H = 181kJ$

(iii) $2O_3(g) \Leftrightarrow 3O_2(g) \Delta H = -285kJ$

(iv) $CaO(s) + CO_2(g) \Leftrightarrow CaCO_3(s) \Delta H = -176kJ$

Watch Video Solution

41. The dissociatiion of HI is independent of pressure, while the dissociation of PCl_3 depends upon the pressure applied explain.

Watch Video Solution

42. Explain the Arrhenius concept of acids and bases.

Watch Video Solution

43. What is a conjugate acid base pair? Illustration with examples.

Watch Video Solution

44. Show by suitable equations that each of the following species can act as a Bronsted base: H_2O

Watch Video Solution

45. The species H_2O, HCO_3^-, HSO_4^- and NH_3 can act both as Bronsted acids and base. Give the corresponding conjugate acid and base for each of them.

Watch Video Solution

46. Classify the species $AlCl_3, NY_3, Mg^{+2}$ and H_2O into Lewis acids and Lewis bases and justify your answer?

Watch Video Solution

47. Define ionic product of water. What is the value at room temperature?

Watch Video Solution

48. Define pH. pH cannot be calculated directly from the molar concentration of a weak acid or weak base. Why? Derive an equation for the pH of a weak acid.

Watch Video Solution

49. What is common ion effect? Illustrate.

Watch Video Solution

50. Define solubility product. Write solubility product expressiions for the following:

$Ag_2Cr_2O_7$

Watch Video Solution

51. Define solubility product. Write solubility product expressions for the following:

$Zr_3(PO_4)_4$

Watch Video Solution

52. Aqueous solution of NH_4Cl is acidic. Explain.

Watch Video Solution

53. Aqueous solution of CH_3COONa is basic. Explain

Watch Video Solution

54. What are equilibrium processes? Explain equilibrium in Physical and Chemical processes with examples.

Watch Video Solution

55. What are the important features of equilibrium constant? Discuss any two applications of equilibrium constant.

Watch Video Solution

56. What is Le Chatelier's principle? Discuss breifly the factors which can influcence the equilibrium.

Watch Video Solution

57. Discuss the application of LE Chatellier's principle for the industrial synthesis of Ammonia and sulphur trioxide.

Watch Video Solution

58. Describe the effect of:

a. addition of H_2

b. addition of CH_3OH

c. removal of CO

d. removal of CH_3OH on the equilibrium of the reaction.

$2H_2(g) + CO(g) \Leftrightarrow CH_3OH(g)$

Watch Video Solution

59. Explain the concept of Bronsted acids and Bronsted bases. Illustrate the answer with suitable examples.

Watch Video Solution

60. Explain Lewis acid base theory with suitable example. Classify the following species into Lewis acids and Lewis bases and show how these act as Lewis acid/base.

a. OH^- b. F^- c. H^+ d. BCl_3

Watch Video Solution

61. Define pH. What is buffer solution? Derive Henderson-Hasselbalch equation for calculating the pH of an acid buffer solution.

Watch Video Solution

62. Explain the term Hydrolysis of salts with examples. Discuss the pH of the following types of salt solutions.

(i) Salts of weak acid and strong base.

(ii) Salts of strong acid and weak base.

Watch Video Solution

63. Explain the term Hydrolysis of salts with examples. Discuss the pH of the following types of salt solutions.

(i) Salts of weak acid and strong base.

(ii) Salts of strong acid and weak base.

Watch Video Solution

64. What is solubilityy product? Explain the common ion effect on solubility of ionic salts.

Watch Video Solution

Very Short Answer Questions

1. State law of chemical equilibrium.

Watch Video Solution

2. Can equilibrium be achieved between water and its vapours in an open vessel? Explain.

Watch Video Solution

3. Why the concentrations of pure liquids and pure solids are ignored from equilibrium constant expressions?

Watch Video Solution

4. What is homogeneous equilibrium? Write two homogeneous reactions.

Watch Video Solution

5. What is heterogenous equilibrium?

Write two heterogeneous reactions.

Watch Video Solution

6. Write reaction equotient, Q, for each of the following reactions.

a. $3O_2(g) \Leftrightarrow 2O_3(g)$

b. $4NH_3(g) + 7O_2(g) \Leftrightarrow 4NO_2(g) + 6H_2O(g)$

Watch Video Solution

7. Write reaction equotient, Q, for each of the following reactions.

a. $3O_2(g) \Leftrightarrow 2O_3(g)$

b. $4NH_3(g) + 7O_2(g) \Leftrightarrow 4NO_2(g) + 6H_2O(g)$

Watch Video Solution

8. Define equilbrium constant.

Watch Video Solution

9. The equilibrium constant expression for a gas reaction is

$$K_c = \frac{[NH_3]^4[O_2]^5}{[NO]^4[H_2O]^6}$$

Write the balanced chemical equation corresponding to this expression.

Watch Video Solution

10. Write the relation between K_p and K_c

Watch Video Solution

11. Under what conditions for a reaction K_p and K_c are numerically equal?

Watch Video Solution

12. Give two chemcial equilibrium reactions for which $K_p = K_c$

Watch Video Solution

13. Give two chemical equilibrium reactions for which $K_p > K_c$.

Watch Video Solution

14. Give two chemical equilibrium reactions for which $K_p < K_c$.

Watch Video Solution

15. Write the equations for the conversion of K_cd to K_p for each of the following reaction.

$CO(g) + H_2O(g) \Leftrightarrow CO_2(g) + H_2(g)$

Watch Video Solution

16. Write the equations for the conversion of K_cd to K_p for each of the following reaction.

$C_3H_8(g) + 5O_2(g) \Leftrightarrow 3CO_2(g) + 4H_2O(g)$

Watch Video Solution

17. What are the factors which influence the chemical equilibrium?

Watch Video Solution

18. What is the effect of pressure on gaseous chemical equilibrium?

Watch Video Solution

19. What is the effect of increase in concentration of reactants of a chemical reaction at equilibrium?

Watch Video Solution

20. Can catalyst disturb the state of equilibrium?

Watch Video Solution

21. On which factor, the equilibrium constant value changer?

Watch Video Solution

22. The equilibrium constants of a reaction at $27^{\circ}C$ and aet $127^{\circ}C$ are 1.6×10^{-3} and 7.6×10^{-2} respectively. Is the reaction exothermic or endothermic?

Watch Video Solution

23. What is the effect of temperature on a system at equilibrium?

Watch Video Solution

24. For an exothermic reaction, what happens to the equilibrium constant if temperature is raised?

Watch Video Solution

25. What kind of equilibrium constant can be calculated from ΔG° value for a reaction involving only gases?

Watch Video Solution

26. What is a Bronsted base? Give one example.

Watch Video Solution

27. What is Lewis acid? Give one example.

Watch Video Solution

28. What is meant by ionic product of water?

Watch Video Solution

29. What is the value of K_w ? What are its units?

Watch Video Solution

30. What is the effect of temperature on ionic product of water?

Watch Video Solution

31. $H_2O + H_2O \Leftrightarrow H_3O^+ + OH^-$

The ionic product of water is 1×10^{-14} at $25^\circ C$ and 3.0×10^{-14} at $40^\circ C$

is the above process endothermic or exothermic?

Watch Video Solution

32. All Bronsted bases are Lewis bases? Explain.

Watch Video Solution

33. All Lewis acids are not Bronsted acids. Why?

Watch Video Solution

34. What is degree of ionisation?

Watch Video Solution

35. What is the measure of strength of an acid and base?

Watch Video Solution

36. Give two examples of salts whose aqueous solutions are basic.

Watch Video Solution

37. Give two examples of salts whose aqueous salts are acidic.

Watch Video Solution

38. What equation is used calculating the pH of an acid buffer?

Watch Video Solution

39. Phosphoric acid (H_3PO_4) have three ionization constants K_{a_1}, K_{a_2} and K_{a_3}. Among these ionization constants which has a lower value ? Give reason for it.

Watch Video Solution

40. Ice melts slowly at high altitudes. Explain Why?

Watch Video Solution

Short Answer Questions

1. Write expression for the equilibrium constant, K_c, for each of the following reactions:

(i) $2NOCl_{(g)} \leftrightarrow 2NO_{(g)} + Cl_{2(g)}$

(ii) $2Cu(NO_3)_{2(s)} \Leftrightarrow 2CuO_{(s)} + 4NO_{2(g)} + O_{2(g)}$

(iii) $CH_3COOC_2H_{5(ag)} + H_2O(I) \Leftrightarrow CH_3COOH_{(aq)} + C_2H_5OH_{(aq)}$

(iv) $Fe^{+3}_{(aq)} + 3OH^{-}_{(aq)} \Leftrightarrow Fe(OH)_{3(S)}$

Watch Video Solution

2. Write expression for the equilibrium constant, K_c, for each of the following reactions:

(i) $2NOCl_{(g)} \leftrightarrow 2NO_{(g)} + Cl_{2(g)}$

(ii) $2Cu(NO_3)_{2(s)} \Leftrightarrow 2CuO_{(s)} + 4NO_{2(g)} + O_{2(g)}$

(iii) $CH_3COOC_2H_{5(ag)} + H_2O(I) \Leftrightarrow CH_3COOH_{(aq)} + C_2H_5OH_{(aq)}$

(iv) $Fe^{+3}_{(aq)} + 3OH^{-}_{(aq)} \Leftrightarrow Fe(OH)_{3(S)}$

Watch Video Solution

3. Write expression for the equilibrium constant, Kc for each of the following reactions.

$$CH_3COOC_2H_{5(aq)} + H_2O(l) \Leftrightarrow CH_3COOH_{(aq)} + C_2H_5OH_{(aq)}$$

Watch Video Solution

4. Write expression for the equilibrium constant, Ke for each of the following reactions.

$$Fe^{+3}_{(aq)} + + 3OH^{-}_{(aq)} \Leftrightarrow Fe(OH)_{3(s)}$$

Watch Video Solution

5. Derive the relation between K_p and K_c for the equilibrium reaction.

$$N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$$

Watch Video Solution

6. Define equilibrium constant. Write the equilibrium constant expression for the reaction of

$H_2(g) + I_2(g) \Leftrightarrow 2HI(g)$

and its reverse reaction. How are the two equilibrium constants related?

Watch Video Solution

7. How does the values of equilibrium constant predict the extent of reaction?

Watch Video Solution

8. State law of chemical equilibrium? What is K_c for the following equilibrium when the equilibrium concentration of each substance is $[SO_2] = 0.60M$, $[O_2] = 0.82M$ and $[SO_3] = 1.90M$

$2SO_2(g) + O_2(g) \Leftrightarrow 2SO_3(g)$

Watch Video Solution

9. Why sealed soda water bottle on opening shows the evolution of gas with effervescence?

Watch Video Solution

10. Explain the significance of : a very large value of K

Watch Video Solution

11. Explain the significance of : a very small value of K

Watch Video Solution

12. Explain the significance of : a value of K of about 1.0

Watch Video Solution

13. Why is it useful to compare Q with K?

What is the situation when

a. $Q = K$ b. $Q < K$ c.$Q > K$?

Watch Video Solution

14. Why is it useful to compare Q with K?

What is the situation when

a. $Q = K$ b. $Q < K$ c.$Q > K$?

Watch Video Solution

15. Why is it useful to compare Q with K?

What is the situation when

a. $Q = K$ b. $Q < K$ c.$Q > K$?

Watch Video Solution

16. For the reaction

$Cl_2(g) + F_2(g) \Leftrightarrow ClF(g), K_c = 19.9$ What will happen in a mixture originally containing $[Cl_2] = 0.04 \text{mol} L^-$,

$[F_2] = 0.2 \text{mol} L^{-1}$ and $[ClF] = 7.3 \text{mol} L^-$?

Watch Video Solution

17. Predict which of the following reactionn will have appreciable concentration of reactants and products:

$Cl_2(g) \Leftrightarrow 2Cl(g), K_c = 5 \times 10^{-39}$

Watch Video Solution

18. Predict which of the following reactionn will have appreciable concentration of reactants and products:

$Cl_2(g) + 2NO(g) \Leftrightarrow 2BNOCl(g), K_c = 3.7 \times 10^8$

Watch Video Solution

19. Predict which of the following reactionn will have appreciable concentration of reactants and products:

$Cl_2(g) + 2NO_2(g) \Leftrightarrow 2NO_2Cl(g), K_c = 1.8$

Watch Video Solution

20. How to recognise the conditions under which changes in pressure would effect system in equilibrium.

Watch Video Solution

21. What property of a reaction can be used to predict the effect of a change in temperature on the magnitude of an equilibrium constant?

Watch Video Solution

22. Does the number of moles of reaction products increase, decrease, or remains same when each of the following equilibrium is subjected to a decrease in pressure by increasing the volume?

$PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g)$

Watch Video Solution

23. Does the number of moles of reaction products increase, decrease, or remains same when each of the following equilibrium is subjected to a decrease in pressure by increasing the volume?

$Cao(s) + CO(\_2)(g) \Leftrightarrow CaCO_3(s)$

Watch Video Solution

24. Which of the following reactions will get affected by increasing the pressure? Also mention whether chasnge will cause the reaction to go into forward or backward direction.

(i) $COCl_2(g) \Leftrightarrow CO(g) + Cl_2(g)$

(ii) $CH_4(g) + 2S_2(g) \Leftrightarrow CS_2(g) + 2H_2S(g)$

(iii) $CO_2(g) + C(s) \Leftrightarrow 2CO(g)$

(iv) $4NH_3 + (g) + 5O_2(g) \Leftrightarrow 4NO(g) + 6H_2O(g)$

Watch Video Solution

25. Which of the following reactions will get affected by increasing the pressure? Also, mention whether change will cause the reaction to go into forward or backward direction.

$(i) COCl_2(g) \Leftrightarrow CO(g) + Cl_2(g)$

$(ii) CH_4(g) + 2S_2(g) \Leftrightarrow CS_2(g) + 2H_2S(g)$

$(iii) CO_2(g) + C(s) \Leftrightarrow 2CO(g)$

$(iv) 2H_2(g) + CO(g) \Leftrightarrow CH_3OH(g)$

$(v) CaCO_3(s) \Leftrightarrow CaO(s) + CO_2(g)$

$(vi) 4NH_3(g) + 5O_2(g) \Leftrightarrow 4NO(g) + 6H_2O(g)$

Watch Video Solution

26. Which of the following reactions will get affected by increasing the pressure? Also mention whether chasnge will cause the reaction to go into forward or backward direction.

(i) $COCl_2(g) \Leftrightarrow CO(g) + Cl_2(g)$

(ii) $CH_4(g) + 2S_2(g) \Leftrightarrow CS_2(g) + 2H_2S(g)$

(iii) $CO_2(g) + C(s) \Leftrightarrow 2CO(g)$

(iv) $4NH_3 + (g) + 5O_2(g) \Leftrightarrow 4NO(g) + 6H_2O(g)$

Watch Video Solution

27. Which of the following reactions will get affected by increasing the pressure? Also, mention whether change will cause the reaction to go into forward or backward direction.

$(i) COCl_2(g) \Leftrightarrow CO(g) + Cl_2(g)$

$(ii) CH_4(g) + 2S_2(g) \Leftrightarrow CS_2(g) + 2H_2S(g)$

$(iii) CO_2(g) + C(s) \Leftrightarrow 2CO(g)$

$(iv) 2H_2(g) + CO(g) \Leftrightarrow CH_3OH(g)$

$(v) CaCO_3(s) \Leftrightarrow CaO(s) + CO_2(g)$

$(vi) 4NH_3(g) + 5O_2(g) \Leftrightarrow 4NO(g) + 6H_2O(g)$

Watch Video Solution

28. How will an increase in pressure and affect each of the following equilibria? An increase in temperature

(i) $2NH_3(g) \Leftrightarrow N_2(g) + 3H_g \Delta H = 932kJ$

(ii) $N_2(g) + O(2)(g) \Leftrightarrow 2NO(g) \Delta H = 181kJ$

(iii) $2O_3(g) \Leftrightarrow 3O_2(g) \Delta H = -285kJ$

(iv) $CaO(s) + CO_2(g) \Leftrightarrow CaCO_3(s) \Delta H = -176kJ$

Watch Video Solution

29. How will an increase in pressure and affect each of the following equilibria? An increase in temperature

(i) $2NH_3(g) \Leftrightarrow N_2(g) + 3H_g \Delta H = 932kJ$

(ii) $N_2(g) + O(2)(g) \Leftrightarrow 2NO(g) \Delta H = 181kJ$

(iii) $2O_3(g) \Leftrightarrow 3O_2(g) \Delta H = -285kJ$

(iv) $CaO(s) + CO_2(g) \Leftrightarrow CaCO_3(s) \Delta H = -176kJ$

Watch Video Solution

30. How will an increase in pressure and affect each of the following equilibria? An increase in temperature

(i) $2NH_3(g) \Leftrightarrow N_2(g) + 3H_g \Delta H = 932kJ$

(ii) $N_2(g) + O(2)(g) \Leftrightarrow 2NO(g) \Delta H = 181kJ$

(iii) $2O_3(g) \Leftrightarrow 3O_2(g) \Delta H = -285kJ$

(iv) $CaO(s) + CO_2(g) \Leftrightarrow CaCO_3(s) \Delta H = -176kJ$

Watch Video Solution

31. How will an increase in pressure and affect each of the following equilibria? An increase in temperature

(i) $2NH_3(g) \Leftrightarrow N_2(g) + 3H_g \Delta H = 932kJ$

(ii) $N_2(g) + O(2)(g) \Leftrightarrow 2NO(g) \Delta H = 181kJ$

(iii) $2O_3(g) \Leftrightarrow 3O_2(g) \Delta H = -285kJ$

(iv) $CaO(s) + CO_2(g) \Leftrightarrow CaCO_3(s) \Delta H = -176kJ$

Watch Video Solution

32. The dissociatiion of HI is independent of pressure, while the dissociation of PCl_3 depends upon the pressure applied explain.

Watch Video Solution

33. Explain the term: Electrolyle

Watch Video Solution

34. Explain the term: Non-electrolyte

Watch Video Solution

35. Explain the term: Strong and weak electrolytes

Watch Video Solution

36. Explain the term: Ionic equilibrium

Watch Video Solution

37. Explain the terms: extent of ionization and on what factors it depends

Watch Video Solution

38. Explain the Arrhenius concept of acids and bases.

Watch Video Solution

39. What is a conjugate acid base pair? Illustration with examples.

Watch Video Solution

40. Acetic acid is a weak acid. List in order of descending concentration all of the ionic and molecular species present in 1M aqueous solution of acetic acid.

Watch Video Solution

41. Show by suitable equations that each of the following species can act as a Bronsted base: H_2O

Watch Video Solution

42. Show by suitable equations that each of the following species can act as a Bronsted base: OH^-

Watch Video Solution

43. Show by suitable equations that each of the following species can act as a Bronsted base: C_2H_5OH

Watch Video Solution

44. Show by suitable equations that each of the following species can act as a Bronsted base: HPO_4^{-2}

Watch Video Solution

45. The species H_2O, HCO_3^-, HSO_4^- and NH_3 can act both as Bronsted acids and base. Give the corresponding conjugate acid and base for each of them.

Watch Video Solution

46. Write equation that showss $H_2PO_4^-$ acting both as an acid and as a base.

Watch Video Solution

47. Write the conjugate acid and conjugate base of each of the following:

H_2O.

Watch Video Solution

48. Identity and label the Bronsted acid and its conjugate base,te Bronsted base and its conjugate acid in each of the following equations.

$H_2SO_4 + Cl^{-1} \rightarrow HCl + HSO_4^-$

Watch Video Solution

49. Classify the species $AlCl_3$, NY_3, Mg^{+2} and H_2O into Lewis acids and Lewis bases and justify your answer?

Watch Video Solution

50. What are the strengths of conjuate bases of a strong acid and a weak acid?

Watch Video Solution

51. What are the strengths of conjuate acids of a strong base and weak base?

Watch Video Solution

52. Define ionic product of water. What is the value at room temperature?

Watch Video Solution

53. Define pH. pH cannot be calculated directly from the molar concentration of a weak acid or weak base. Why? Derive an equation for the pH of a weak acid.

Watch Video Solution

Watch Video Solution

54. Write equations to show the step wise ionization of the polyprotic acids H_2SO_4 and H_3PO_4.

Watch Video Solution

55. Explain how acid strength changes among

i. the hydrides of the group elements and

(ii) the hydrides in the same row of the periodic.

Watch Video Solution

56. Explain how acid strength changes among

i. the hydrides of the group elements and

(ii) the hydrides in the same row of the periodic.

Watch Video Solution

57. Justifyi the statement that water behaves like an acid an also like base on the basis of protonic concept.

Watch Video Solution

58. What is common ion effect? Illustrate.

Watch Video Solution

59. Define solubility product. Write solubility product expressiions for the following:

$Ag_2Cr_2O_7$

Watch Video Solution

60. Define solubility product. Write solubility product expressions for the following:

$Zr_3(PO_4)_4$

Watch Video Solution

61. Give the classification of salts. What types of salts undergo hydrolysis?

Watch Video Solution

62. What must be true of value of ΔG° for a reaction if

$K > 1$

Watch Video Solution

63. What must be true of value of ΔG° for a reaction if

$K = 1$

Watch Video Solution

64. What must be true of value of ΔG° for a reaction if

$K = 1$

Watch Video Solution

65. Aqueous solution of NH_4Cl is acidic. Explain.

Watch Video Solution

66. Aqueous solution of CH_3COONa is basic. Explain

Watch Video Solution

67. Give reason that acetic acid is less acidic in sodium acetate solution than in sodium chloride solution.

Watch Video Solution

68. $AgCl$ is less soluble in $AgNO_3$ solution than in pure water. Explain.

Watch Video Solution

69. Predict whether the following reaction will proceed from left to the right to any measurable extent:

$CH_3COOH(aq) + Cl^-(aq) \rightarrow$

Watch Video Solution

70. Aqueous solution of H_2S contains $H_2S, HS^-, S^{2-}, H_3O^+, OH^-$ and H_2O in varying concentrations. Which of these species can act only as a base? Which can act only as an acid? Which can act both as an acid and as a base?

Watch Video Solution

Long Answer Questions

1. What are equilibrium processes? Explain equilibrium in Physical and Chemical processes with examples.

Watch Video Solution

2. What is meant by dynamic equilibrium?

Explain with suiitable examples.

Watch Video Solution

3. Give the general characteristics of equilibrium involving physical processes.

Watch Video Solution

4. What are the important features of equilibrium constant? Discuss any two applications of equilibrium constant.

Watch Video Solution

5. What is Le Chatelier's principle? Discuss breifly the factors which can influcence the equilibrium.

Watch Video Solution

6. Discuss the application of LE Chatellier's principle for the industrial synthesis of Ammonia and sulphur trioxide.

Watch Video Solution

7. Dihydrogen gas is obtained from natural gas by partial oxidation with stream as per the following endothermic reaction.

$CH_4(g) + H_2O(g) \Leftrightarrow CO(g) + 3H_2(g)$

a. Write an expression for K_p for the above reaction.

b. How will the values o K_p and composition of equilibrium mixture be affected by

(i) increasxing the pressure (ii) increasing the temperature (iii) using a catalyst?

Watch Video Solution

8. Dihydrogen gas is obtained from natural gas by partial oxidation with stream as per the following endothermic reaction.

$CH_4(g) + H_2O(g) \Leftrightarrow CO(g) + 3H_2(g)$

a. Write an expression for K_p for the above reaction.

b. How will the values o K_p and composition of equilibrium mixture be affected by

(i) increasxing the pressure (ii) increasing the temperature (iii) using a catalyst?

Watch Video Solution

9. Dihydrogen gas is obtained from natural gas by partial oxidation with stream as per the following endothermic reaction.

$CH_4(g) + H_2O(g) \Leftrightarrow CO(g) + 3H_2(g)$

a. Write an expression for K_p for the above reaction.

b. How will the values o K_p and composition of equilibrium mixture be affected by

(i) increasxing the pressure (ii) increasing the temperature (iii) using a catalyst?

Watch Video Solution

10. Dihydrogen gas is obtained from natural gas by partial oxidation with stream as per the following endothermic reaction.

$$CH_4(g) + H_2O(g) \Leftrightarrow CO(g) + 3H_2(g)$$

a. Write an expression for K_p for the above reaction.

b. How will the values o K_p and composition of equilibrium mixture be affected by

(i) increasxing the pressure (ii) increasing the temperature (iii) using a catalyst?

Watch Video Solution

11. Describe the effect of:

a. addition of H_2

b. addition of CH_3OH

c. removal of CO

d. removal of CH_3OH on the equilibrium of the reaction.

$2H_2(g) + CO(g) \Leftrightarrow CH_3OH(g)$

Watch Video Solution

12. Decribe the effect of :

addition of CH_3OH on the equilibrium of the reaction

$2H_2(g) + CO(g) \Leftrightarrow CH_3OH(g)$

Watch Video Solution

13. Decribe the effect of :

removal of CO on the equilibrium of the reaction

$2H_2(g) + CO(g) \Leftrightarrow CH_3OH(g)$

Watch Video Solution

14. Describe the effect of:

a. addition of H_2

b. addition of CH_3OH

c. removal of CO

d. removal of CH_3OH on the equilibrium of the reaction.

$2H_2(g) + CO(g) \Leftrightarrow CH_3OH(g)$

Watch Video Solution

15. At 473K, equilibrium constant K_C for the decompositioni of phosphorus pentachloride, PCl_5 is 8.3×10^{-3}. If the decomposition is depicted as:

$PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g) \Delta H = 124.0 kJ \text{mol}^{-1}$

a. Write an expression of K_c for the reaction.

b. What is the value of K_c for the reverse reaction at the same temperature?

c. What would be effect on K_c if

(i) more PCl_5 is added (ii) pressure is increased (iii) the temperature in increased.

Watch Video Solution

16. At 473K, equilibrium constant K_C for the decompositioni of phosphorus pentachloride, PCl_5 is 8.3×10^{-3}. If the decomposition is depicted as:

$PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g) \Delta H = 124.0 kJ \text{mol}^{-1}$

a. Write an expression of K_c for the reaction.

b. What is the value of K_c for the reverse reaction at the same temperature?

c. What would be effect on K_c if

(i) more PCl_5 is added (ii) pressure is increased (iii) the temperature in increased.

Watch Video Solution

17. At 473K, equilibrium constant K_C for the decompositioni of phosphorus pentachloride, PCl_5 is 8.3×10^{-3}. If the decomposition is depicted as:

$PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g) \Delta H = 124.0 kJ \text{mol}^{-1}$

a. Write an expression of K_c for the reaction.

b. What is the value of K_c for the reverse reaction at the same temperature?

c. What would be effect on K_c if

(i) more PCl_5 is added (ii) pressure is increased (iii) the temperature in increased.

Watch Video Solution

18. At 473K, equilibrium constant K_C for the decompositioni of phosphorus pentachloride, PCl_5 is 8.3×10^{-3}. If the decomposition is depicted as:

$PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g) \Delta H = 124.0 kJ \text{mol}^{-1}$

a. Write an expression of K_c for the reaction.

b. What is the value of K_c for the reverse reaction at the same temperature?

c. What would be effect on K_c if

(i) more PCl_5 is added (ii) pressure is increased (iii) the temperature in increased.

Watch Video Solution

19. At 473K, equilibrium constant K_C for the decompositioni of phosphorus pentachloride, PCl_5 is 8.3×10^{-3}. If the decomposition is depicted as:

$PCl_5(g) \Leftrightarrow PCl_3(g) + Cl_2(g) \Delta H = 124.0 kJ \text{mol}^{-1}$

a. Write an expression of K_c for the reaction.

b. What is the value of K_c for the reverse reaction at the same temperature?

c. What would be effect on K_c if

(i) more PCl_5 is added (ii) pressure is increased (iii) the temperature in increased.

Watch Video Solution

20. Explain the concept of Bronsted acids and Bronsted bases. Illustrate the answer with suitable examples.

Watch Video Solution

21. Explain Lewis acid base theory with suitable example. Classify the following species into Lewis acids and Lewis bases and show how these act as Lewis acid/base.

a. OH^- b. F^- c. H^+ d. BCl_3

Watch Video Solution

22. Explain Lewis acid base theory with suitable example. Classify the following species into Lewis acids and Lewis bases and show how these act as Lewis acid/base.

a. OH^- b. F^- c. H^+ d. BCl_3

Watch Video Solution

23. Explain Lewis acid base theory with suitable example. Classify the following species into Lewis acids and Lewis bases and show how these act as Lewis acid/base.

a. OH^- b. F^- c. H^+ d. BCl_3

Watch Video Solution

24. Explain Lewis acid base theory with suitable example. Classify the following species into Lewis acids and Lewis bases and show how these act as Lewis acid/base.

a. OH^- b. F^- c. H^+ d. BCl_3

Watch Video Solution

25. What is degree of ionization is respect of weak acids and weak bases? Derive the relationship between degree of ionization (α) and ionization

constant (K_a) for thke weak acid HX.

Watch Video Solution

26. Define pH. What is buffer solution? Derive Henderson-Hasselbalch equation for calculating the pH of an acid buffer solution.

Watch Video Solution

27. Explain the term Hydrolysis of salts with examples. Discuss the pH of the following types of salt solutions.

(i) Salts of weak acid and strong base.

(ii) Salts of strong acid and weak base.

Watch Video Solution

28. Explain the term Hydrolysis of salts with examples. Discuss the pH of the following types of salt solutions.

(i) Salts of weak acid and strong base.

(ii) Salts of strong acid and weak base.

Watch Video Solution

29. What is solubilityy product? Explain the common ion effect on solubility of ionic salts.

Watch Video Solution

30. Write notes on

(i) Common ion effect

(ii) The relation between K_{sp} and solubility (S) of a sparingly soluble salt $BaSO_4$.

Watch Video Solution

31. Write notes on

(i) Common ion effect

(ii) The relation between K_{sp} and solubility (S) of a sparingly soluble salt $BaSO_4$.

Watch Video Solution