CHEMICAL EQUILIBRIUM-4

1.Buffer capacity of acidic buffer solution is maximum when

a) $P^H = P^{Ka}$ **b) [salt] = [acid]** **c) $P^H = 7$** **d) $[H^+] = P^{Kb}$**

1) All are correct 2) b,c,d are correct

3) a and b are correct 4) c and b are correct

2.To a buffer solution of CH_3COOH and CH_3COONa , some HCl is added . Then the reaction involved is

1) $CH_3COOH + OH^- \rightleftharpoons CH_3COO^- + H_2O$

2) $CH_3COO^- + H^+ \rightleftharpoons CH_3COOH$

3) $Na^+ + OH^- \rightarrow NaOH$

4) $CH_3COO^- + Na^+ \rightarrow CH_3COONa$

3.For acetic acid and sodium acetate buffer , addition of which of the following increases the P^H ?

1) CH_3COONa 2) H_2O 3) CH_3COOH 4) None of these

4.For the buffer solution containing NH_4OH and NH_4Cl , P^H of the buffer solution can be increased by

1) Adding some more NH_4Cl 2) Adding some more NH_4OH

3) Removing NH_4Cl 4) Both 2 and 3

5.Which of the following pair of solutions does not form a buffer solution ?

1) NaH_2PO_4 and Na_2HPO_4 2) H_2CO_3 and $NaHCO_3$

3) NH_4OH and NH_4Cl 4) KOH and K_2SO_4

6.Which of the following mixture acts as buffer solution ?

1) 100 ml 0.2 M CH_3COOH +100 ml 0.1M NaOH

2) 100 ml 0.1M CH_3COOH + 100 ml 0.2M NaOH

3) 100 ml 0.2M CH_3COOH + 100 ml 0.2 M NaOH

4) None of the above .

7. Aqueous solution of salt of strong acid and weak base

1) Undergoes cationic hydrolysis 2) Is acidic in nature

3) has P^H less than 7 4) All the above

8.A salt of weak acid and weak base undergoes

1) Only cationic hydrolysis 2) Only anionic hydrolysis

3) Both cationic and anionic hydrolysis 4) No hydrolysis

9.Which of the following salts, does not undergo hydrolysis ?

1) KCN 2) $CuSO_4$ 3) CH_3COONa 4) Na_2SO_4

10.The nature of aqueous solution of $CuSO_4$ is

1) Acidic 2) Basic 3) Neutral 4) Amphoteric

11.Aqueous solution of which of the following shows lower P^H ?

1) K_2SO_4 2) $ZnCl_2$ 3) KCN 4) CH_3COONH_4

12.The hydrolysis constant of CH_3COONa is given by

1) $K_h = K_w/K_a$ 2) $K_h = K_w/K_b$ 3) $K_h = K_a/K_w$ 4) $K_h = K_aK_w$

13.Which of the following shows relatively higher P^H ?

1) Aq. NaCl 2) Aq . NH_4Cl 3) Aq . Na_3PO_4 4) Aq.NaOH

14.MX is the salt of weak base, MOH and weak acid, HX. Aqueous solution of MX is

1) Acidic , if $K_a < K_b$ 2) Basic , if $K_a > K_b$ 3) Neutral , if $K_a = K_b$ 4) All the above

15.Aqueous solution of potash alum is acidic due to the hydrolysis of

1) K^+ 2) Al^{3+} 3) SO_4^{2-} 4) all of these

16.Aqueous solution of KCl is neutral because

1) K^+ undergoes hydrolysis 2) Cl^- undergoes hydrolysis

3) Both K^+ and Cl^- undergo hydrolysis 4) No hydrolysis takes place

17.The P^H of 0.1M solution of the following compounds increases in the order

1) NaCl < NH_4Cl < NaCN < HCl

2) HCl < NH_4Cl < NaCl < NaCN

3) NaCN < NH_4Cl < NaCl < HCl

4) HCl < NaCl < NH_4Cl < NaCN

18.Nature of 0.1M solution of Borax is

1) Acidic 2) Alkaline 3) Neutral 4) Amphoteric

19.The no.of hydroxyl ions produced by one molecule of Na_2CO_3 on hydrolysis is

1) 4 2) 2 3) 3 4) 0

20.A : The aqueous solution of $FeCl_3$ is acidic in nature

R : Ferric ion undergoes cationic hydrolysis.

1) 'A' and 'R' are true, 'R' is correct explanation of 'A'.
2) 'A' and 'R' are true. 'R' is not correct explanation of 'A'.
3) 'A' is true and 'R' are false. 4)both A and R are false

21.A : Aqueous solution of $(NH_4)_2SO_4$ is neutral

R : Salt of strong acid and strong base does not undergo hydrolysis.

1) 'A' and 'R' are true, 'R' is correct explanation of 'A'.
2) 'A' and 'R' are true. 'R' is not correct explanation of 'A'.
3) 'A' is true and 'R' are false. 4)both A and R are false

22. A : Aqueous solution of ammonium acetate is neutral

R : Dissociation constants of NH_4OH (K_b) and that of CH_3COOH (K_a) are nearly equal.

1) 'A' and 'R' are true, 'R' is correct explanation of 'A'.
2) 'A' and 'R' are true. 'R' is not correct explanation of 'A'.
3) 'A' is true and 'R' are false. 4)both A and R are false

23. A : Aqueous solution of Na_2CO_3 shows $P^H > 7$.

R : It is a Salt of strong base and weak acid .

1) 'A' and 'R' are true, 'R' is correct explanation of 'A'.
2) 'A' and 'R' are true. 'R' is not correct explanation of 'A'.
3) 'A' is true and 'R' are false. 4)both A and R are false

24.**Dissociation of CH_3COOH is supressed by adding**

1) HCl 2) $HClO_4$ 3) CH_3COONa 4) Any of the above

25.Ionisation of NH_4OH is supressed by the addition of NH_4Cl, because

1) NH_4Cl is a salt of WB and SA
2) NH_4Cl is a salt of strong base and weak acid
3) Of the common ion effect of NH_4^+ ion
4) None of the above

26.The solubility product of the electrolyte of the type , A_2B_3 is (S is the solubility in mol/lit)

1) $108\ S^5$ 2) $72\ S^5$ 3) $108\ S^2$ 4) $10\ S^2$

27.For the electrolyte of type , A_2B , K_{sp} is given. Then its solubility is calculated by

1) $K_{sp}/4$ 2) $\sqrt[3]{\frac{K_{sp}}{4}}$ 3) $\sqrt[3]{K_{sp}}$ 4) $\sqrt{K_{sp}}/4$

28.The solubility of calcium phosphate in water is x mol L^{-1} at 25^0C. Its solubility product is equal to

1) $108\ x^2$ 2) $36x^3$ 3) $36\ x^5$ 4) $108\ x^5$

29.An acidic buffer contains equal concentrations of acid and salt. The dissociation constant of acid is 10^{-6}. The P^H of the buffer solution is

1) 6 2) 9 3) 4.49 4) 5.5

Solution; As[acid]=[salt], $P^H = P^{Ka}$

30.Solution of 0.1 N NH_4OH and 0.1 N NH_4Cl has P^H 9.25. Then P^{Kb} of NH_4OH is

1) 9.25 2) 4.75 3) 3.75 4) 8.25

Solution; As[base]=[salt], $P^{0H} = P^{Kb}$

P^{Kb}=14-9.25=4.75

31.50 ml of 0.1 M solution of sodium acetate and 50 ml of 0.01 M acetic acid are mixed. The pKa of acetic acid is 4.76. The P^H of the buffer solution is

1) 3.76 2) 4.76 3) 5.76 4) 9.24

Hint; $P^H = P^{K_a} + \log\left[\frac{N_{salt}.V_{salt}}{N_{acid}.V_{acid}}\right]$

32.When 0.1 mole of an acid is added to 2 lit of a buffer solution, the P^H of the buffer decreases by 0.5. The buffer capacity of the solution is

1) 0.6 2) 0.4 3) 0.2 4) 0.1

Solution; no.of moles added per lit= 0.1/2=0.05

Buffer capacity= moles added per lit/change in P^H=0.05/0.5=0.1

33.A solution consists of 0.2 M NH_4OH and 0.2 M NH_4Cl. If K_b of NH_4OH is 1.8×10^{-5}, the $[OH^-]$ of the resulting solution is

1) 0.9×10^{-5} M 2) 1.8×10^{-5} M 3) 3.2×10^{-5} M 4) 3.6×10^{-5} M

Hint; in a basic buffer$[OH^-]$= K_b [base]/[salt]= 1.8×10^{-5}X0.2/0.2=1.8×10^{-5}

34.(A) : The P^H of a buffer solution containing equal moles of acetic acid and sodium acetate is 4.8 ($K_a$of acetic acid is 4.8)

(R) : The ionic product of water at 25^0C is 10^{-14} mol^2 lit^{-2}

1) 'A' and 'R' are true, 'R' is correct explanation of 'A'.
2) 'A' and 'R' are true. 'R' is not correct explanation of 'A'.
3) 'A' is true and 'R' are false. 4)both A and R are false

35.The P^H of aqueous solution of NH_4CN (K_a of HCN is 9.2×10^{-10} & K_b of NH_4OH is 1.8×10^{-5})

1) > 7 2) < 7 3) 7 4) 14

Hint; it is a salt of weak acid and weak base but solution is basic as Ka <K_b

36.The hydrolysis constant of NaX (K_a of HX is 2×10^{-6}) is

1) 5×10^{-9} 2) 2×10^{-10} 3) 2×10^{-6} 4) 10^{-7}

Hint; K_h = K_w/K_a

37.Hydrolysis constant of salt derived from strong acid and weak base is 2×10^{-5}. The dissociation constant of the weak base is

1) 5×10^{-8} 2) 5×10^{-9} 3) 5×10^{-10} 4) 2×10^{-19}

Hint; K_h = K_w/K_b

38.The solubility product of $BaSO_4$ at 18^0C is 1.6×10^{-9}. Its solubility (mole lit^{-1}) at the same temperature is

1) 1.6×10^{-9} 2) 1.6×10^{-5} 3) 4×10^{-9} 4) 4×10^{-5}

Hint; $K_{SP} = S^2 = 1.6 \times 10^{-9} = 16 \times 10^{-10}$ Hence S=4×10^{-5}

39.The solubility of CaF_2 is 2×10^{-4} mole/litre. Its solubility product is

1) 2.0×10^{-4} 2) 4.0×10^{-8} 3) $4 \times 8.0 \times 10^{-12}$ 4) 3.2×10^{-4}

Hint; $K_{SP} = 4S^3 = 4[2 \times 10^{-4}]^3 = 4 \times 8.0 \times 10^{-12}$

40.The solubility of AgCl in 0.1M NaCl is ($K_{sp}$of AgCl = 1.2×10^{-10})

1) 0.1M 2) 1.2×10^{-5} 3) 1.095×10^{-5} 4) 1.2×10^{-9}

41.The solubility product of a rare earth metal hydroxide M $(OH)_3$ at room temperature is $4.32X10^{-14}$. Its solubility is

1) 2×10^{-3}M 2) 2.0×10^{-4} M 3) 2×10^{-5}M 4) 2.0×10^{-6} M

Hint; $K_{SP} = 27S^4$

42.The solubility of PbS in 2×10^{-12} M Na_2S solution is (K_{sp} of PbS is $9X10^{-28}$)

1) $4.5X10^{-16}$ 2) $9X10^{-28}$ 3) $4.5X10^{-28}$ 4) $9X10^{-16}$

Solution: **Solubility of lead sulphide is given as, $PbS_{(s)} \rightleftharpoons Pb^{2+}_{(aq)} + S^{2-}_{(aq)}$; $K_{sp} = 9X10^{-28}$**

Solubility in pure water = $\sqrt{K_{sp}}$ = 3×10^{-14} mol L^{-1}

Solubility in 2×10^{-12} M Na_2S solution = $\frac{K_{sp}}{[Na_2S]} = \frac{9\times10^{-28}}{2\times10^{-12}} = 4.5\times10^{-16}$ mol L^{-1}

43.Why only As^{+3} gets precipitated as As_2S_3 and not Zn^{2+} as ZnS when H_2S is passed through an acidic solution containing As^{+3} and Zn^{+2} ?

1) Solubility product of As_2S_3 is less than that of ZnS
2) Enough As^{+3} are present in acidic medium
3) Zinc salt does not ionize in acidic medium
4) Solubility product changes in presence of an acid.

44. In which of the following, the solubility of AgCl will be maximum ?

1) 0.1 M $AgNO_3$ 2) Water 3) 0.1 M NaCl 4) 0.1 M HCl

Hint; presence of common ino decrease the solubility.

45)50 ml of 1M CH_3COOH solution when added to 50 ml of 0.5 M NaOH gives a solution with pH value 'X' Find the value of X (pK_a *of* CH_3COOH = 4.8)

1)5.1010 2) 4.2990 3)4.8 4)5.8

Solution : Acetic acid reacts with sodium hydroxide to form sodium acetate.

$$CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$$

No. of millimoles of CH_3COOH=50X1=50

No. of millimoles of NaOH = 50X1=50

No. of millimoles of CH_3COOH remain unreacted = 50 – 25 = 25

Total volume of solution = 50 + 50 =100

No. of millimoles of CH_3COONa formed = 25

Therefore molarity of CH_3COONa = $\frac{25}{100}$ = 0.25 M

Molarity of $CH_3COOH = \frac{25}{100} = 0.25M$, $pH = pK_a + \log\left[\frac{CH_3COONa}{CH_3COOH}\right] = 4.8 + \log\left[\frac{0.25}{0.25}\right]$ = 4.8 + log 1 = 4.8

KEY

1) 3	2) 2	3) 1	4) 4	5) 4	6) 2	7) 2	8) 4	9) 1	10) 4
11) 3	12) 4	13) 4	14) 3	15) 2	16) 4	17) 2	18) 2	19) 2	20) 1
21) 4	22) 1	23) 1	24) 4	25) 3	26) 1	27) 2	28) 4	29) 1	30) 2
31) 3	32) 4	33) 2	34) 2	35) 1	36) 1	37) 3	38) 4	39) 3	40) 4

41) 2 42) 1 43)1 44)2 45)3