

IONIC EQUILIBRIUM

INTRODUCTION

- If pH = 3.31, then find out $[H^+]$ (Approxy)
 - 3.39×10^{-4}
 - 5×10^{-4}
 - 3.0×10^{-3}
 - None
- Find out pH of solution having 2×10^{-3} moles of OH^- ion's in 2 litre solution :-
 - pH = 3
 - pH = 3 + log2
 - pH = 3 - log2
 - pH = 11
- 8 g NaOH is dissolved in one litre of solution, the molarity of the solution is:-
 - 0.2 M
 - 0.4 M
 - 0.02 M
 - 0.8 M
- The number of milli equivalents of acid in 100 mL of 0.5N HCl solution is:-
 - 50
 - 100
 - 25
 - 200
- If the molar concentration of PbI_2 is $1.5 \times 10^{-3} \text{ mol L}^{-1}$, the concentration of iodide ions in g ion L^{-1} is:-
 - 3.0×10^{-3}
 - 6.0×10^{-3}
 - 0.3×10^{-3}
 - 0.6×10^{-6}

OSTWALD'S DILUTION LAW

- Order of dissociation of 0.1 N CH_3COOH is :- (Dissociation constant = 1×10^{-5})
 - 10^{-5}
 - 10^{-4}
 - 10^{-3}
 - 10^{-2}
- If α is the degree of dissociation of weak dibasic organic acid and y is the hydrogen ion concentration, what is the initial concentration of acid (assume both H dissociate in one step) :-
 - $\frac{\alpha(y)^{-1}}{2} M$
 - $y(\alpha)^{-1}M$
 - $\frac{y(\alpha)^{-1}}{2} M$
 - None of them
- The pH of 0.15 M solution of $HOCl$ ($K_a = 9.6 \times 10^{-6}$) is:-
 - 4.42
 - 2.92
 - 3.42
 - None
- The extent of ionisation increases (weak electrolytes)
 - With the increase in concentration of solute
 - On decreasing the temp. of solution
 - On addition of excess of water to the solution
 - On stirring the solution vigorously

EXPLANATION OF WATER

- Ionic product of water will increase, if :-
 - Dissociation the pressure
 - Add H^+
 - Add OH^-
 - Increase the temperature
- At $25^\circ C$, the dissociation constant for pure water is given by :-
 - $(55.4 \times 10^{14})^{-1}$
 - 1×10^{-14}
 - $\frac{1 \times 10^{-14}}{18}$
 - None of these
- At $90^\circ C$, pure water has $[H_3O^+] = 10^{-6.7} \text{ mol L}^{-1}$ what is the value of K_w at $90^\circ C$:-
 - 10^{-6}
 - 10^{-12}
 - 10^{-67}
 - $10^{-13.4}$
- At 373 K, temp. the pH of pure H_2O can be:-
 - < 7
 - > 7
 - = 7
 - = 0
- If it is known that H_2S is a weak acid and it is ionised into $2H^+$ and S^{2-} . Then in this solution HCl is added so, pH becomes less, then what will happen :-
 - Decrease in S^{2-} ion concentration
 - Concentration of S^{2-} is not affected
 - Increase in S^{2-} ion concentration
 - It is not possible, to add HCl in solution

HYDROLYSIS OF SALTS

- $HCOO^- + H_2O \rightleftharpoons HCOOH + OH^-$ is related:-
 - $h = \sqrt{K_h}$
 - $h = \sqrt{\frac{K_h}{C}}$
 - $h = \sqrt{\frac{K_h}{V}}$
 - $K_h = \sqrt{hc}$
- The highest pH value is of :-
 - 0.1 M NaCl
 - 0.1 M NH_4Cl
 - 0.1 M CH_3COONa
 - 0.1 M CH_3COONH_4
- A weak acid react with strong base, ionisation constant of weak acid is 10^{-4} . Find out equilibrium constant for this reaction :-
 - 10^{-10}
 - 10^{10}
 - 10^{-9}
 - 10^9

18. Hydroxyl ion concentration $[\text{OH}^-]$ in the case of sodium acetate can be expressed as (where K_a is dissociation constant of CH_3COOH and C is the concentration of sodium acetate):-

(1) $[\text{OH}^-] = (\text{CK}_w \cdot K_a)^{1/2}$

(2) $[\text{OH}^-] = C \cdot K_w \sqrt{K_a}$

(3) $[\text{OH}^-] = \left(\frac{C \cdot K_w}{K_a} \right)^{1/2}$

(4) $[\text{OH}^-] = C \cdot K_a \cdot K_w$

19. K_a for cyano acetic acid is 3.5×10^{-3} . Then the degree of hydrolysis of 0.05 M. sodium cyano acetate solution will have the following value :-

(1) 4.559×10^{-6}

(2) 5.559×10^{-6}

(3) 6.559×10^{-6}

(4) 7.559×10^{-6}

SOLUBILITY & SOLUBILITY PRODUCT(K_{sp})

20. At 25°C , the K_{sp} value of AgCl is 1.8×10^{-10} . If 10^{-5} moles of Ag^+ are added to solution then K_{sp} will be :-

(1) 1.8×10^{-15}

(2) 1.8×10^{-10}

(3) 1.8×10^{-5}

(4) $18 \times 10^{+10}$

21. Concentration of Ag^+ ions in saturated solution of Ag_2CrO_4 at 20°C is $1.5 \times 10^{-4} \text{ mol L}^{-1}$. At 20°C , the solubility product of Ag_2CrO_4 is :-

(1) 3.3750×10^{-12}

(2) 1.6875×10^{-10}

(3) 1.68×10^{-12}

(4) 1.6875×10^{-11}

22. If the solubility of lithium sodium hexafluoro aluminate $\text{Li}_3\text{Na}_3(\text{AlF}_6)_2$ is 'S' mol L^{-1} . Its solubility product is equal to :-

(1) S^8

(2) $12 S^3$

(3) $18S^3$

(4) $2916 S^8$

APPLICATION OF SOLUBILITY PRODUCT(K_{sp})

23. The solubility product of CuS , Ag_2S and HgS are 10^{-37} , 10^{-44} and 10^{-54} respectively. The solubility of these sulphides will be in the order

(1) $\text{HgS} > \text{Ag}_2\text{S} > \text{CuS}$

(2) $\text{Ag}_2\text{S} > \text{HgS} > \text{CuS}$

(3) $\text{CuS} > \text{Ag}_2\text{S} > \text{HgS}$

(4) $\text{Ag}_2\text{S} > \text{CuS} > \text{HgS}$

24. If the maximum concentration of PbCl_2 in water is 0.01 M at 298 K, Its maximum concentration in 0.1 M NaCl will be:-

(1) $4 \times 10^{-3} \text{ M}$

(2) $0.4 \times 10^{-4} \text{ M}$

(3) $4 \times 10^{-2} \text{ M}$

(4) $4 \times 10^{-4} \text{ M}$

25. 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 KCl

26. 0.5 M HCl solution has ions- Hg^{++} , Cd^{++} , Sr^{++} , Fe^{++} , Cu^{++} . To pass the H_2S gas in this solution, which are precipitated out :-

(1) Cd^{+2} , Fe^{+2} , Sr^{+2}

(2) Cd^{+2} , Hg^{+2} , Cu^{+2}

(3) Hg^{+2} , Cu^{+2} , Fe^{+2}

(4) Cu^{+2} , Sr^{+2} , Fe^{+2}

27. What will happen if the pH of the solution of 0.001 M $\text{Mg}(\text{NO}_3)_2$ solution is adjusted to $\text{pH} = 9$

($K_{sp} \text{Mg}(\text{OH})_2 = 8.9 \times 10^{-12}$)

(1) ppt will take place

(2) ppt will not take place

(3) Solution will be saturated

(4) None of these

28. 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) Enough As^{3+} are present in acidic medium

(2) Zinc salt does not ionise in acidic medium

(3) Solubility product of As_2S_3 is less than that of ZnS

(4) Solubility product changes in presence of an acid

29. H_2S is passed through a solution of cations in HCl medium to precipitate cation of :-

(1) II - A group of cation analysis

(2) II - B group of cation analysis

(3) IV group of cation analysis

(4) Both II - A and II-B gps.

30. The solubility product of hydroxides of Mg^{+2} , Zn^{+2} , and Fe^{+3} decreases as

$K_{sp} \text{Mg}(\text{OH})_2 > K_{sp} \text{Zn}(\text{OH})_2 > K_{sp} \text{Fe}(\text{OH})_3$ The order of precipitation of hydroxides is:-

(1) $\text{Fe}(\text{OH})_3$, $\text{Zn}(\text{OH})_2$, $\text{Mg}(\text{OH})_2$

(2) $\text{Mg}(\text{OH})_2$, $\text{Zn}(\text{OH})_2$, $\text{Fe}(\text{OH})_3$

(3) $\text{Zn}(\text{OH})_2$, $\text{Fe}(\text{OH})_3$, $\text{Mg}(\text{OH})_2$

(4) $\text{Zn}(\text{OH})_2$, $\text{Mg}(\text{OH})_2$, $\text{Fe}(\text{OH})_3$

pH

31. pH of water is 7. When any substance Y is dissolved in water then pH becomes 13. Substance Y is a salt of :-

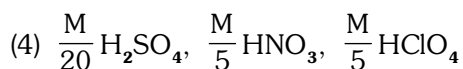
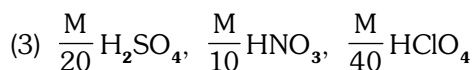
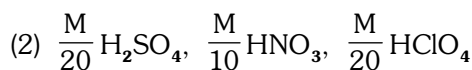
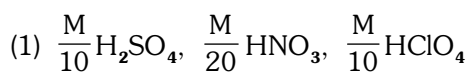
(1) Strong acid and strong base

(2) Weak acid and weak base

(3) Strong acid and weak base

(4) Weak acid and strong base

- 32.** In the following solutions, the conc. of different acids are given, which mixture of the acid has highest pH (If equal volume of each mixed together) :-



- 33.** The pH of solution is increased from 3 to 6. Its H^+ ion concentration will be :-

- (1) Reduced to half
(2) Doubled
(3) Reduced by 1000 times
(4) Increased by 1000 times

- 34.** Which of the following statements are (is) correct

- (a) The pH of $1.0 \times 10^{-8} \text{ M}$ solution of HCl is 8.
(b) The conjugate base of H_2PO_4^- is HPO_4^{2-} .
(c) Autoprotolysis constant of water increases with temperature.
(d) When a solution of a weak monoprotic acid is titrated against a strong base, at half neutralization point $\text{pH} = 1/2 \text{ pK}_a$

- (1) a (2) a, b (3) a, b, d (4) b, c

- 35.** The hydrogen ion concentration in a given solution is $6 \times 10^{-4} \text{ M}$. Its pH will be :-

- (1) 6 (2) 3.22 (3) 4 (4) 2.

- 36.** The pOH of beer is 10.0. The hydrogen ion concentration will be :-

- (a) 10^{-10} (b) $\frac{K_w}{10^{-10}}$ (c) $\frac{K_w}{10^{-8}}$ (d) 10^{-4}

- (1) a, d (2) b, c (3) a, b, c (4) None

- 37.** Following five solution of KOH were prepared as-

First $\rightarrow$ 0.1 moles in 1 L

Second $\rightarrow$ 0.2 moles in 2 L

Third $\rightarrow$ 0.3 moles in 3 L

Fourth $\rightarrow$ 0.4 moles in 4 L

Fifth $\rightarrow$ 0.5 moles in 5 L

The pH of resultant solution is :-

- (1) 2 (2) 1 (3) 13 (4) 7

- 38.** How many moles of HCl must be removed from 1 litre of aqueous HCl solution to change its pH from 2 to 3 :-

- (1) 1 (2) 0.02 (3) 0.009 (4) 0.01

- 39.** What is the quantity of NaOH present in 250 cc of the solution, so that it gives a pH = 13 :-

- (1) 10^{-13} g (2) 10^{-1} g
(3) 1.0 g (4) 4.0 g

BUFFER SOLUTIONS and INDICATOR

- 40.** In a buffer solution the ratio of concentration of NH_4Cl and NH_4OH is 1 : 1 when it changes in 2 : 1 what will be the value of pH of buffer :-

- (1) Increase (2) Decrease
(3) No effect (4) N.O.T.

- 41.** In the volumetric estimation of HCl, if we make use of phenolphthalein as an indicator, which base is unsuitable for the titration :-

- (1) NaOH (2) RbOH
(3) KOH (4) NH_4OH

- 42.** Phenolphthalein does not act as an indicator for the titration between :-

- (1) KOH and H_2SO_4
(2) NaOH and CH_3COOH
(3) Oxalic acid and KMnO_4
(4) $\text{Ba}(\text{OH})_2$ and HCl

- 43.** Which can act as buffer :-

- (1) $\text{NH}_4\text{OH} + \text{NaOH}$
(2) $\text{HCOOH} + \text{CH}_3\text{COONa}$
(3) 40 mL 0.1 M NaCN + 20 mL of 0.1 M HCl
(4) None of them

- 44.** From the following in which titration methyl orange is a best indicator :-

- (1) $\text{CH}_3\text{COOH} + \text{NaOH}$
(2) $\text{H}_2\text{C}_2\text{O}_4 + \text{NaOH}$
(3) $\text{HCl} + \text{NaOH}$
(4) $\text{CH}_3\text{COOH} + \text{NH}_4\text{OH}$

- 45.** The pH of blood is maintained by CO_2 and H_2CO_3 in the body and chemical constituents of blood. This phenomenon is called :-

- (1) Colloidal (2) Buffer action
(3) Acidity (4) Salt balance

46. Which of the following solutions does not act as buffer :-

- (1) $\text{H}_3\text{PO}_4 + \text{NaH}_2\text{PO}_4$
- (2) $\text{NaHCO}_3 + \text{H}_2\text{CO}_3$
- (3) $\text{NH}_4\text{Cl} + \text{HCl}$
- (4) $\text{CH}_3\text{COOH} + \text{CH}_3\text{COONa}$

47. Half of the formic acid solution is neutralised on addition of a KOH solution to it. If $K_a(\text{HCOOH}) = 2 \times 10^{-4}$ then pH of the solution is : ($\log 2 = 0.3010$)

- (1) 3.6990 (2) 10.3010
- (3) 3.85 (4) 4.3010

48. 0.05 M ammonium hydroxide solution is dissolved in 0.001 M ammonium chloride solution. What will be the OH^- ion concentration of this solution: $K_b(\text{NH}_4\text{OH}) = 1.8 \times 10^{-5}$

- (1) 3.0×10^{-3} (2) 9.0×10^{-4}
- (3) 9.0×10^{-3} (4) 3.0×10^{-4}

49. What amount of sodium propanoate should be added to one litre of an aqueous solution containing 0.02 mole of propanoic acid ($K_a = 1.34 \times 10^{-5}$ at 25°C) to obtain a buffer solution of pH 4.75 :-

- (1) 4.52×10^{-2} M (2) 3.52×10^{-2} M
- (3) 2.52×10^{-2} M (4) 1.52×10^{-2} M

50. Calculate the ratio of pH of a solution containing 1 mole of CH_3COONa + 1 mole of HCl per litre and of other solution containing 1 mole CH_3COONa + 1mole of acetic acid per litre :-

- (1) 1 : 1 (2) 2 : 1 (3) 1 : 2 (4) 2 : 3

51. 10 mL of a solution contains 0.1 M NH_4Cl + 0.01 M NH_4OH . Which addition would not change the pH of solution :-

- (1) Adding 1 mL water
- (2) Adding 5 mL of 0.1 M NH_4Cl
- (3) Adding 5 mL of 0.1 M NH_4OH
- (4) Adding 10 mL of 0.1 M NH_4Cl

ACID AND BASE

52. In the reaction $\text{NH}_3 + \text{H}_2\text{O} \rightleftharpoons \text{NH}_4^+ + \text{OH}^-$ water behaves as :-

- (1) Acid (2) Base
- (3) Neutral (4) Both acid & Base

53. The conjugated base of $(\text{CH}_3)_2\text{NH}_2^+$ is :-

- (1) CH_3NH_2 (2) $(\text{CH}_3)_2\text{N}^+$
- (3) $(\text{CH}_3)_2\text{N}$ (4) $(\text{CH}_3)_2\text{NH}$

54. Which of the following is not a Bronsted acid :-

- (1) CH_3NH_4^+ (2) CH_3COO^-
- (3) H_2O (4) HSO_4^-

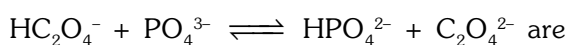
55. The conjugate base of the weak acid in the reaction $\text{HBr} + \text{H}_2\text{O} \rightleftharpoons \text{H}_3\text{O}^+ + \text{Br}^-$ is

- (1) HBr (2) H_2O (3) Br^- (4) H_3O^+

56. Mg^{2+} is ----- than Al^{3+} :-

- (1) Strong Lewis acid (2) Strong Lewis base
- (3) Weak Lewis acid (4) Weak Lewis base

57. The two Bronsted bases in the reaction

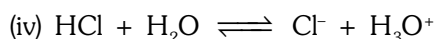
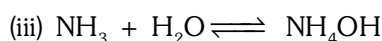
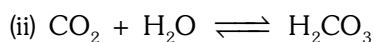
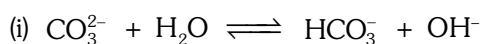


- (1) HC_2O_4^- and PO_4^{2-}
- (2) HPO_4^{2-} and $\text{C}_2\text{O}_4^{2-}$
- (3) PO_4^{3-} and $\text{C}_2\text{O}_4^{2-}$
- (4) HC_2O_4^- and HPO_4^{2-}

58. In which of the following reactions NH_3 acts as acid

- (1) $\text{NH}_3 + \text{HCl} \rightarrow \text{NH}_4\text{Cl}$
- (2) $\text{NH}_3 + \text{H}^+ \rightarrow \text{NH}_4^+$
- (3) $\text{NH}_3 + \text{Na} \rightarrow \text{NaNH}_2 + \frac{1}{2}\text{H}_2$
- (4) NH_3 cannot act as acid

59. Consider the following reactions :-



Which of the pairs of reactions proves that water is amphoteric in character :-

- (1) (i) and (ii) (2) (ii) and (iii)
- (3) (iii) and (iv) (4) (i) and (iii)

60. Aluminium chloride is :-

- (1) Bronsted Lowry acid (2) Arrhenius acid
- (3) Lewis acid (4) Lewis base

61. Water is a :-

- (1) Protogenic solvent (2) Protophilic solvent
- (3) Amphiprotic solvent (4) Aprotic solvent

62. Species which do not act both as Bronsted acid and base is :-

- (1) $(\text{HSO}_4)^{-1}$ (2) Na_2CO_3
- (3) NH_3 (4) OH^{-1}

ANSWER KEY

IONIC EQUILIBRIUM

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	2	4	1	1	1	4	3	2	3	4	1	4	1	1	2	3	2	3	4	2
Que.	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	3	4	4	4	2	2	2	3	4	1	4	3	3	4	2	4	3	3	3	2
Que.	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	4	3	3	3	2	3	1	2	4	3	1	1	4	2	2	3	3	3	3	3
Que.	61	62																		
Ans.	3	2																		

SOLUTION

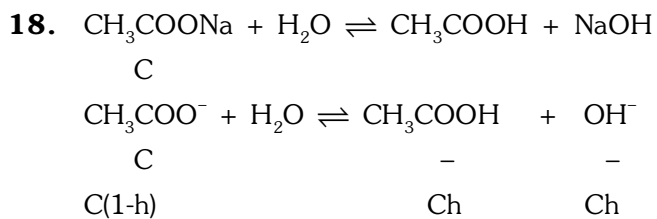
- pH = 3.31
 $-\log H^+ = 3.31$
 $[H^+] = \text{Antilog}(-3.31)$
 $= \text{Antilog}(-4 + .69)$
 $= 5 \times 10^{-4}$
- $[OH^-] = \frac{2 \times 10^{-3}}{2} = 10^{-3}$
- $[NaOH] = \frac{8/40}{1} = \frac{1}{5} = 0.2 \text{ M}$
- no. of milli equivalent of HCl = $N \times V_{ml}$
 $= 0.5 \times 100 \text{ ml}$
 $= 50$
- $[PbI_2] = 1.5 \times 10^{-3} \text{ M}$
 $[I^-] = 2 \times 1.5 \times 10^{-3} = 3 \times 10^{-3} \text{ M}$
- 0.1N $CH_3COOH = 0.1 \text{ M } CH_3COOH$
 $\frac{K_a}{C} = \frac{1 \times 10^{-5}}{.1} = 10^{-4} < 10^{-2}$
 So α neglected
 $\alpha = \sqrt{K_a/C} = \sqrt{10^{-4}}$
 $= 10^{-2}$
- Let α is dissociation if both H ionises simultaneously in diacidic Acid H_2A
 $H_2A \rightleftharpoons 2H^+ + A^{2-}$

C	-	-
$C(1-\alpha)$	$2C\alpha$	$C\alpha$

 $[H^+] = 2C\alpha = y$
 $C = \frac{y}{2} \alpha^{-1}$
- HOCl (weak Acid)
 $\frac{K_a}{C} = \frac{9.6 \times 10^{-6}}{0.15} < 10^{-5}$
 $[H^+] = \sqrt{K_a \cdot C} = \sqrt{9.6 \times 10^{-6} \times 0.15}$
-\log(9.6 \times 1.5 \times 10^{-6})^{1/2}
 $= \frac{1}{2} [6 - \log(9.6 \times 1.5)]$
 $= 2.92$
- $\alpha_{\text{weak}} \propto \sqrt{V}$ (monobasic)
- $K_w = [H^+][OH^-]$
 $T \uparrow, K_w \uparrow$
- $H_2O \rightleftharpoons H^+ + OH^-$
 $K_d = \frac{[H^+][OH^-]}{[H_2O]} = \frac{1 \times 10^{-14}}{55.55}$
 $= (55.55 \times 10^{14})^{-1}$
- $[H_3O^+] = [H^+] = 10^{-6.7}$ at 90°C
 pure H_2O
 So $[OH^-] = 10^{-6.7}$
 $K_w = [H^+][OH^-] = 10^{-13.4}$
- pH (pure H_2O) < 7 at 373 K
 At 373 K $K_w(H_2O) > 10^{-14}$
- $H_2S \rightleftharpoons 2H^+ + S^{2-}$
 weak acid
 Addition of HCl result B.D.
 $[S^{2-}]$ Decreases
 Although effective $[H^+]$ increases
 So pH decreases.
- $HCOO^- + H_2O \rightleftharpoons HCOOH + OH^-$

C	0	0
$C(1-h)$	Ch	Ch

 $K_h = \frac{Ch^2}{1-h} (1-h \approx 1)$
 $K_h = Ch^2$
 $h = \sqrt{\frac{K_h}{C}}$
- CH_3COONa (Salt = wA + S.B)
 So pH will be High
- $HX + NaOH \rightleftharpoons NaX + H_2O$ (Let)
 W.A S.B
 $K_c = \frac{1}{K_h(X^-)}$
 $NaX + H_2O \rightleftharpoons Hx + NaOH$
 $X^- + H_2O \rightleftharpoons HX + OH^-$
 So $K_c = \frac{1}{K_h(X^-)} = \frac{1}{K_b(X^-)}$
 $= \frac{1}{\frac{K_w}{K_a(HX)}} = \frac{K_a(HX)}{K_w}$
 $= \frac{10^{-4}}{10^{-14}} = 10^{10}$



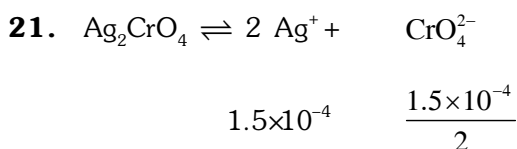
$$h = \sqrt{\frac{k_h}{c}} \quad \left(k_h = \frac{k_w}{k_a} \right)$$

$$[\text{OH}^-] = \text{Ch} = \sqrt{k_h C}$$

$$[\text{OH}^-] = \sqrt{\frac{k_w}{k_a} \cdot C}$$

19. $h = \sqrt{\frac{k_w}{k_a} \cdot C}$
 $= \sqrt{\frac{10^{-14} \times 0.05}{3.5 \times 10^{-3}}}$
 $= 7.559 \times 10^{-6}$

20. K_{sp} value does not change on changing concentration of ions.

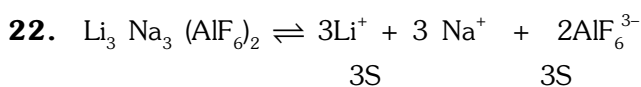


Saturated solution

$$K_{sp} = [\text{Ag}^+]^2 [\text{CrO}_4^{2-}]$$

$$= (1.5 \times 10^{-4})^2 \left(\frac{1.5 \times 10^{-4}}{2} \right)$$

$$= 1.68 \times 10^{-12}$$



$$K_{sp} = 2916 \text{S}^8$$

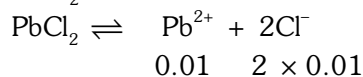
23. $K_{sp} (\text{CuS}) = \text{S}_1^2 = 10^{-37}$

$$K_{sp} (\text{Ag}_2\text{S}) = 4\text{S}_2^3 = 10^{-44}$$

$$K_{sp} (\text{HgS}) = \text{S}_3^2 = 10^{-54}$$

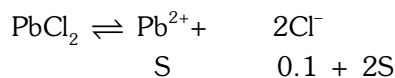
$$\text{So } \text{S}_2 > \text{S}_1 > \text{S}_3$$

24. In H_2O



$$K_{sp} = (0.01)(2 \times 0.01)^2 = 4 \times 10^{-6}$$

In 0.1 M NaCl



$$K_{sp} = (\text{S})(0.1 + 2\text{S})^2$$

$$4 \times 10^{-6} = \text{S} \cdot (0.1)^2$$

$$\text{S} = 4 \times 10^{-4} \text{ M}$$

25. Solubility of AgCl is maximum in H_2O among given option because in other case due to common ion effect solubility decreases.

26. Ions ppt by passing H_2S gas in presence of HCl are Cd^{2+} , Hg^{2+} , Cu^{2+}

27. IP ($\text{Mg}(\text{OH})_2$) at pH = 9
 $= (\text{Mg}^{2+})(\text{OH}^-)^2$; [pOH = 6]
 $= (0.001)(10^{-6})^2$

$$\text{IP} = 10^{-15} < K_{sp} (8.9 \times 10^{-12})$$

So no ppt will take place

28. As^{3+} get ppt but not Zn^{2+} by passing H_2S in Acidic medium because $K_{sp} (\text{As}_2\text{S}_3) < K_{sp} (\text{ZnS})$

29. H_2S gas ppt IIA & IIB groups ions in HCl medium.

30. Hydroxide having low K_{sp} will ppt 1st

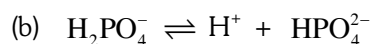
31. generally salt Y having high pH (=13) value is composed of weak Acid and strong base.

32. $[\text{H}^+]_R = \frac{N_1 V_1 + N_2 V_2 + N_3 V_3}{V_1 + V_2 + V_3}$

$$\text{pH} = -\log[\text{H}^+]_R$$

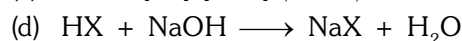
33. $\text{pH}_1 = 3$ to $\text{pH}_2 = 6$
 $[\text{H}^+]_1 = 10^{-3}$ to $[\text{H}^+]_2 = 10^{-6}$
 $[\text{H}^+]$ Reduced by 1000 times

34. (a) pH of 10^{-8}M HCl is less than 7



Acid $\qquad \qquad \qquad$ C.B

(c) $K_w = [\text{H}^+][\text{OH}^-]$; $T \uparrow$, $K_w \uparrow$



WA S.B

$$\text{C}_0 \qquad \text{C}_0/2 \qquad \qquad - \qquad -$$

$$\frac{\text{C}_0}{2} \qquad 0 \qquad \qquad \frac{\text{C}_0}{2}$$

Acidic buffer form at half neutralization point

$$\text{So } \text{pH} = \text{pKa} + \log \left(\frac{\text{Salt}}{\text{Acid}} \right)$$

$$\text{pH} = \text{pKa} \qquad ([\text{Salt}] = [\text{Acid}])$$

35. $[H^+] = 6 \times 10^{-4}$

$pH = 4 - \log 6 = 3.22$

36. $pOH = 10$; $pH = 4$; $[H^+] = 10^{-4}$

37. In each given solution

$[KOH] = 0.1M$; After mixing

$[OH^-]_R = 0.1$; $pOH = 1$

$pH = 13$

38. $pH = 2$ means 10^{-2} moles per lit

$pH = 3$ means 10^{-3} moles per lit

So $n_{HCl}(\text{removed}) = 10^{-2} - 10^{-3} = 0.009$ moles

39. $pH = 13$; $pOH = 1$; $[OH^-] = 10^{-1}$
or $[NaOH] = 0.1 M$

$$[NaOH] = \frac{n_{NaOH}}{V_{lit}}$$

$$0.1 = \frac{n}{250/1000}$$

$$n = \frac{0.1}{4}$$

$$w(NaOH) = \frac{0.1 \times 40}{4} = 1 \text{ gm}$$

40. buffer of NH_4Cl & NH_4OH is basic buffer

$$\text{Initially } pOH = p^{k_b} + \log\left(\frac{1}{1}\right)$$

$$\text{finally } pOH = p^{k_b} + \log\left(\frac{2}{1}\right)$$

Now pOH increases so
 pH decreases.

41. Phenolphthalin indicator is suitable for titration of HCl with $S.B.$

42. Phenolphthalein is suitable for titration of $SA+SB$ and $WA+SB$

43. Buffer may be solution of

(a) Salt ($WA + WB$)

(b) WA + its salt with $S.B$

(c) WB + its salt with $S.A$

44. Methyl orange is best indicator for titration of ($SA + SB$) and ($SA + W.B$) among given

45. pH of Blood is maintain by CO_2 and H_2CO_3 by making Buffer

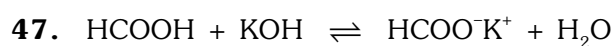
46. Buffer may be

(a) Salt ($WA + WB$)

(b) WA . + its salt with $S.B$

(c) WB + its salt with $S.A$

So $NH_4Cl + HCl$ is not buffer



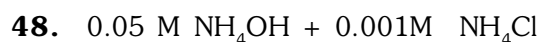
$$C_0 \quad \frac{C_0}{2} \quad - \quad -$$

$$\frac{C_0}{2} \quad 0 \quad \frac{C_0}{2} \quad -$$

$$pH = pK_a + \log\left(\frac{C_0/2}{C_0/2}\right)$$

$$pH = pK_a = 4 - \log 2$$

$$pH = 3.699$$



Basic Buffer

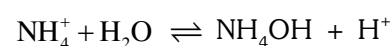
$$pOH = p^{k_b} + \log\left(\frac{NH_4^+}{NH_4OH}\right)$$

$$= 4.74 + \log\left(\frac{0.001}{.05}\right) = 4.74 + \log\left(\frac{1}{50}\right)$$

$$pOH = 3.14$$

$$[OH^-] = 9 \times 10^{-4}$$

2nd methode



$$K_h(NH_4^+) = K_a(NH_4^+) = \frac{kw}{K_b(NH_4OH)}$$

$$K_h(NH_4^+) = \frac{[NH_4OH][H^+]}{[NH_4^+]}$$

$$\frac{kw}{1.8 \times 10^{-5}} = \frac{0.05}{0.001} [H^+]$$

$$\frac{[H^+][OH^-]}{1.8 \times 10^{-5}} = 50 [H^+]$$

$$[OH^-] = 9 \times 10^{-4}$$

- 49.** 0.02 mole C_2H_5COOH + a_0 mole C_2H_5COONa in one litre

So Acidic Buffer

$$pH = pK_a + \log_{10} \left(\frac{\text{Salt}}{\text{Acid}} \right)$$

$$4.75 = 5 - \log 1.34 + \log_{10} \left(\frac{a_0}{0.02} \right)$$

$$a_0 = 1.52 \times 10^{-2} \text{ M (in 1 liter solution)}$$

- 50.** 1 mole CH_3COONa + 1 mole HCl in 1 liter means effectively 1M CH_3COOH

$$pH_1 = \frac{1}{2} [pK_a + \log C]$$

$$= \frac{1}{2} [pK_a + \log 1]$$

$$= \frac{1}{2} pK_a$$

1 mole CH_3COONa + 1 mole CH_3COOH in 1 litre

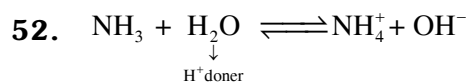
$$pH_2 = pK_a + \log_{10} \left(\frac{\text{Salt}}{\text{Acid}} \right)$$

$$= pK_a + \log_{10} \left(\frac{1M}{1M} \right)$$

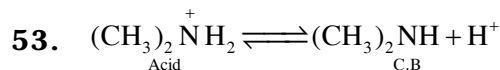
$$= pK_a$$

$$\text{So } pH_1 : pH_2 = \frac{1}{2} : 1 = 1 : 2$$

- 51.** 10 ml of 0.1 M NH_4Cl + 0.01 M NH_4OH
pH of Solution does not change by adding small amount of H_2O

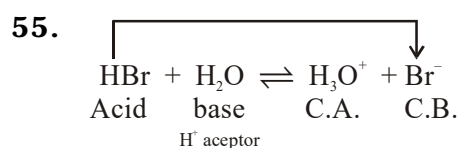


H_2O act as acid



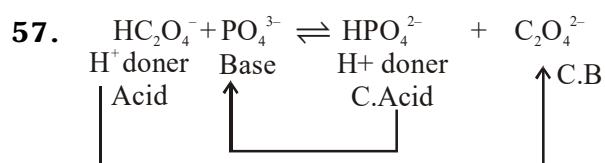
- 54.** Bronsted acid : H^+ doner

CH_3COO^- is not Bronsted acid

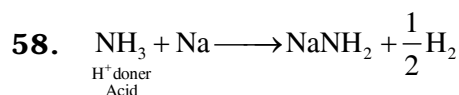


C.B. of weak Acid (H_3O^+) is H_2O

- 56.** Mg^{2+} is weaker lewis acid than Al^{3+}



So Bronsted base are $PO_4^{3-}, C_2O_4^{2-}$



- 59.** Amphoteric : H^+ doner as well as H^+ acceptor

- 60.** $AlCl_3$ is lone pair acceptor so it is lewis acid

- 61.** H_2O can act as acid as well as base

- 62.** Na_2CO_3 is neither Bronsted acid nor bronsted base