Exercise 3 (Taking It Together)

1. Which of the following reagents listed below could be added to water to make 0.10 M solution of NH_4^+?

a) NH_3 **b) NH_4Cl**

c) NH_2Cl d) CH_3CONH_2

2. Autoionisation of NH_3 is shown below

a) $NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$

b) $2NH_3 + 2Na \rightleftharpoons 2NaNH_2 + H_2$

c) $NH_3 + NH_3 \rightleftharpoons NH_2^- + NH_4^+$

d) None of the above

3. In the reaction,

$$[Al(H_2O)_6^{3+}] + H_2O \rightleftharpoons [Al(H_2O)_5(OH)^{2+}] + H_3O^+$$

a) $Al(H_2O)_6^{3+}$ is a base **b) $Al(H_2O)_6^{3+}$ is an acid**

c) Both (a) and (b) d) None of these

4. Which is true about Zwitter ion $NH_3CH_2COO^-$?

a) $NH_2CH_2COO^-$ is its conjugate base

b) H_3NCH_2COOH is its conjugate acid

c) Both (a) and (b)

d) None of the above

5. Autoionisation of liquid NH_3 is

$$2NH_3 \rightleftharpoons NH_4^+ + NH_2^-$$

with $K_{NH3} = [NH_4^+]\,[NH_2] = 10^{-30}$ at -50^0C

Number of amide ions NH_2^-. Present per mm^3 of pure liquid NH_3 is

a) 600 b) 300

c) 200 d) 100

6. BOH is a weak base. Molar concentration of BOH that provides a $[OH^-]$ of 1.5×10^{-3} M $[K_b(BOH) = 1.5 \times 10^{-5}$ M$]$ is

a) 0.15 M b) 0.1515 M

c) 0.0015 M d) 1.5×10^{-5} M

7. pH of the solution containing 50.0 mL of 0.3 M HCl and 50.0 mL of 0.4 M NH_3 is

[pK_a (NH_4^+) = 9.26]

a) 4.74 b) 9.26

c) 8.78 d) 4.63

8. Which of the following solutions will have pH of 4.74?

a) 100 mL of 1 M CH_3COOH (pK_a = 4.74) at the equivalent point using NaOH

b) 50 mL of 1 M CH_3COONa + 25 mL of 1 M HCl

c) 50 mL of 1 M of CH_3COOH + 25 mL of 1 M NaOH

d) Both (b) and (c)

9. pH at which an acid indicator with $K_a = 1 \times 10^{-5}$ changes colour when the indicator is 1×10^{-3} M, is

a) 5 b) 3

c) 8 d) 4

10. pH at which a basic indicator with $K_b = 1.0 \times 10^{-10}$ changes colour when the indicator is 10^{-2} M is

a) 10 b) 2

c) 4 d) 8

11. A weak base B, has basicity constant $K_b = 2 \times 10^{-5}$. The pH of any solution in which [B] = [BH^+] is

a) 4.7 b) 7.0

c) 9.3 d) 9.7

12. Which of the following mixtures will be a buffer solution when dissolved in 500.00 mL of water?

a) 0.200 mol of aniline and 0.200 mol of HCl

b) 0.200 mol of aniline and 0.400 mol of NaoH

c) 0.200 mol of NaCl and 0.100 mol of HCl

d) 0.200 mol of aniline and 0.100 mol of HCl

13. The correctly balanced net ionic equation for the reaction that occurs when a solution of acetic acid is mixed with a solution of sodium carbonate is

a) CH_3COOH (aq) + CO_3^{2-} (aq) ⇌ CH_3COO^-(aq) + HCO_3^-(aq)

b) H_3O^+ (aq) + CO_3^{2-}(aq) ⇌ HCO_3^-(aq) + H_2O

c) CH_3COOH(aq) + Na_2CO_3(aq) ⇌ CH_3COO^-(aq) + $NaHCO_3$(aq) + Na^+(aq)

d) CH_3COOH(aq) + OH^-(aq) ⇌ CH_3COO^-(aq) + H_2O

14. $S_2O_3^{2-}$ (aq) + $2H_3O^+$(aq) ⇌ S(s) + H_2SO_3(aq) + H_2O

Rate = k $[H_3O^+][S_2O_3^{2-}]$

Reaction is faster in

a) 0.1 M HCl b) 0.1 M CH_3COOH

c) 0.1 M NH_4OH d) 0.1 M NaOH

15. pH of 0.01 M $(NH_4)_2SO_4$ and 0.02 M NH_4OH buffer (pK_a of NH_4^+ = 9.26) is

a) 4.74 + log 2 b) 4.74 – log 2

c) 4.74 + log 1 **d) 9.26 + log 1**

16. 100 mL of pH = 6 (acidic) is diluted to 1000 mL by H_2O pH will increase approximately by

a) 9 unit b) 1 unit

c) 0.7 unit d) – 0.7 unit

17. HCOOH and CH_3COOH solution have equal pH. If K_1/K_2 (ratio of acid ionisation constants) is 4 their molar concentration ratio will be

a) 2 b) 0.5

c) 4 **d) 0.25**

18. pH of $Ca(OH)_2$ is 12. Milliequivalents of $Ca/(OH)_2$ present in 100 mL solution will be

a) 1 b) 0.5

c) 0.05 d) 5

19. A buffer solution constants 100 mL of 0.01 M CH_3COOH and 200 mL of 0.02 M CH_3COONa. 700 mL of water is added pH before and after dilution are (pK_a = 4.74)

a) 5.04, 5.04 b) 5.04, 0.504

c) 5.04, 1.54 **d) 5.34, 5.34**

20. Which is the set of amphiprotic species?

a) H_3O^+, HPO_4^{2-}, HCO_3^- b) H_2O, HPO_3^{2-}, $H_2PO_2^-$

c) HSO_4^-, $H_2PO_4^-$, $H_2PO_3^-$ d) All of these

21. pH of a mixture containing 0.10 M X^- (base) and 0.20 M HX with $pK_b(X^-) = 4$ is

a) 4 + log 2 b) 4 - log 2

c) 10 + log 2 **d) 10 - log 2**

22. Assuming 100% ionisation which will have maximum pH?

a) 0.01 M NH_4Cl b) 0.01 M $(NH_4)_2SO_4$

c) 0.01 M $(NH_4)_3PO_4$ d) Equal

23. $H_2O + H_3PO_4 \rightleftharpoons H_3O^+ + H_2PO_4^-$, $pK_1 = 2.15$

$H_2O + H_2PO_4^- \rightleftharpoons H_3O^+ + HPO_4^{2-}$, $pK_2 = 7.20$

Hence, pH of 0.01 M NaH_2PO_4 is

a) 9.35 **b) 4.675**

c) 2.675 d) 7.350

24. To prepare a buffer of pH 8.26, amount of $(NH_4)_2SO_4$ to be added into 500 mL of 0.01 M NH_4OH solution $[pK_a(NH_4^+) = 9.26]$

a) 0.05 mol **b) 0.025 mol**

c) 0.10 mol d) 0.005 mol

25. % ionisation of a weak acid can be calculated using the formula

a) $100\sqrt{\frac{K_a}{C}}$ b) $\frac{100}{1+10^{[pK_a-pH]}}$

c) Both (a) and (b) d) None of these

26. pH of a mixture of 1 M benzoic acid ($pK_a = 4.20$) and 1 M sodium benzoate is 4.5. In 200 mL buffer. Benzoic acid is

a) 200 mL b) 150 mL

c) 100 mL d) 50 mL

27. The solubility of A_2X_3 is S mol L^{-1}. Its solubility product is

a) $6\ S^4$ b) $64\ S^4$

c) 36 S^5 **d) 108 S^6**

28. If the freezing point of 0.1 molal HA(aq) is -0.2046^0C, then pH of the solution is [$K_f(H_2O) = 1.86^0\ mol^{-1}$ kgl

a) 1 **b) 2**

c) 1.3 d) 1.7

29. If the equilibrium constant of the reaction of weak acid HA with strong base is 10^8. then pH of 0.1 M Na4 is

a) 5 **b) 9**

c) 7 d) 8

30. H_2O is Lewis acid and Lowry-Bronsted acid in

a) $H_2O + H_2O \rightleftharpoons H_3O^+ + HO$

b) $NH_3 + H_2O \rightleftharpoons NH_4^+ + OH$

c) $CaO + H_2O \rightleftharpoons Ca(OH)_2$

d) All of the above

31. pH of mixture of HA and A^- buffer is 5 K_b of $A^- = 10^{-10}$ Hence $[HA]/[A^-]$ will be

a) 1 b) 10

c) 0.1 d) 100

32. At 4^0C. $K_w = 1 \times 10^{-16}$. A solution with pH = 7.5 at 4^0C will

a) turn the litmus red

b) turn red litmus blue

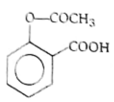
c) turn turmeric paper brown

d) be neutral to litmus

33. Maximum pH will be of

a) 0.005 M HCl b) 0.005 N H_2SO_4

c) 0.005 M CH_3COOH d) equal

34. 

(Aspirin) is a pain reliever with $pK_a = 2$. Two tablets each containing 0.09g of aspirin are dissolved in 100 mL solution. pH will be

a) 0.5 b) 1.0

c) 0.0 **d) 2.0**

35. A monoacid base is 10% ionised at 1 M. Hence, K_b is

a) 1.0×10^{-2} **b) 1.1×10^{-2}**

c) 1.0×10^{-2} d) 1.0×10^{-4}

36. At equal concentration, which base has maximum pH?

a) BOH ($K_b = 10^{-2}$) b) B^1OH ($K_b = 10^{-3}$)

c) $B^{11}OH$ ($K_b = 10^{-5}$) d) Equal

37. Conjugate acid of HF_2^- is

a) HF **b) H_2F_2**

c) F_2^- d) H^+

38. $2H_2O \rightleftharpoons H_3O^+ + OH^-$

$K_w = 1 \times 10^{-14}$ at 25^0C. Hence, K_a is

a) 1×10^{-14} b) 5.55×10^{-13}

c) 18×10^{-17} d) 1.00×10^{-7}

39. Number of $(OH)^-$ in 1 mL solution of pH = 13 is

a) 1×10^{-13} b) 6.00×10^{7}

c) 6.00×10^{13} **d) 6.02×10^{19}**

40. 1 M NH_4OH and 1 M HCl are mixed to make total volume of 300 mL. If pH of the mixture is 9.26 and $pK_a(NH_4^+)$ = 9.26 then volume ratio of NH_4OH and HCl will be

a) 1 : 1 b) 1 : 2

c) 2 : 1 d) 3 : 1

41. pK_a (CH_3COOH) is 4.74. x moles of lead acetate and 0.1 mole of acetic acid in 1 L solution make a solution of pH = 5.04. Hence, x is

a) 0.2 b) 0.05

c) 0.1 d) 0.02

42. 100 mL of 2 M of monobasic acid (pK_a = 5) is noutralised by NaOH, at the equivalence point pH is

a) 7 b) 6

c) 95 d) 45

43. pH of a saturated solution of $Ba(OH)_2$ is 12 Hence k_{sp} of $Ba(OH)_2$ is

a) 5×10^7 M^3 b) 5×10^4 M^2

c) 1×10^6 M^3 d) 4×10^6 M^4

44. K_{sp} of $CaSO_4$ is 4×10^{-12} $CaSO_4$ is precipitated on mixing equal volumes of the following solution.

a) 3×10^6 M $CaCl_2$ and 3×10^6 M $(NH_4)_2SO_4$

b) 4×10^6 M $CaCl_2$ and 3×10^6 M $(NH_4)_2SO_4$

c) 6×10^6 M $CaCl_2$ and 3×10^6 M $(NH_4)_2SO_4$

d) in all the above cases

45. A solution is a mixture of 0.05 M NaCl and 0.05 M NaI. The concentration of iodide ion in the solution when AgCl just starts precipitating is equal to

a) 4×10^6 M b) 2×10^8 M

c) 2×10^{-7} M d) 8×10^{16} M

46. The pK_a of acetylsalicylic acid (aspirin) is 3.5. The pH of gastric juice in human stomach is about 2.3 and the pH in the small intestine is about 8 Aspirin will be

a) unionised in the small intestine and in the stomach

b) completely ionised in the small intestine and in the stomach

c) ionised in the stomach and almost unionised in the small intestine

d) ionised in the small intestine and almost unionised in the stomach

47. The following reaction occurs in the body

$$CO_2 + H_2O \rightleftharpoons H_2CO_3 \rightleftharpoons H^+ + HCO_3$$

If CO_2 escapes from the system

a) pH will decrease

b) hydrogen ion concentration will decrease

c) H_2CO_3 concentration remains unaltered

d) forward reaction will be promoted

48. The compound whose 0.1 M solution is basic, is

a) ammonium acetate b) ammonium chloride

c) ammonium sulphate **d) sodium acetate**

49. Which compound will liberate CO_2 from $NaHCO_3$?

a) CH_3OH b) CH_3NH_2

c) $(CH_3)_4N^+OH$ **d) CH_3NH_3Cl**

50. The following equilibrium is established when hydrogen chloride is dissolved in acetic acid

$$HCl + CH_3COOH \rightleftharpoons Cl + CH_3COOH_2^+$$

The set that characterises the conjugate acid-base pair is

a) (HCl, CH_3COOH) and ($CH_3COOH_2^1$, Cl)

b) (HCl, $CH_3COOH_2^+$) and (CH_3COOH, Cl^-)

c) ($CH_3COOH_2^+$, HCl) and (Cl^-, CH_3COOH)

d) (HCl, Cl^-) and ($CH_3COOH_2^+$, CH_3COOH)

51. $H_3PO_4 + H_2O \rightleftharpoons H_3O^4 + H_2PO_4^-$; K_{a1}

$H_2PO_4 + H_2O \rightleftharpoons H_3O^4 + HPO_4^{2-}$; K_{a2}

$HPO_4^{2-} + H_2O \rightleftharpoons H_3O^4 + PO_4^{3-}$; K_{a3}

Which is the correct order of K_a values?

a) $K_{a1} > K_{a2} < K_{a3}$ b) $K_{a1} < K_{a2} < K_{a3}$

c) $K_{a1} > K_{a2} > K_{a3}$ d) $K_{a1} < K_{a2} > K_{a3}$

52. Some chemists at ISRO wished to prepare a saturated solution of a silver compound and they wanted it to have the highest concentration of silver ion possible. Which of the following compounds would they use?

$K_{sp}(AgCl) = 1.8 \times 10^{-10}$, $K_{sp}(AgBr) = 5.0 \times 10^{-13}$,

$K_{sp}(Ag_2CrO_4) = 2.4 \times 10^{-12}$

a) AgCl b) AgBr

c) Ag_2CrO_4 d) Any of them

53. "Ostwald dilution law" constitutes one of the postulates of the "Arrhenius theory" of "electrolytic dissociation" It ("Ostwald dilution law") is valid for

a) strong electrolyte

b) weak electrolyte

c) both strong and weak electrolytes

d) None of the above

54. The pH of 10^{-8} N HCl is approximately

a) 8 b) 7.02

c) 7 **d) 6.96**

55. NH_4OH is blue towards litmus. HCl is red towards litmus, hence, NH_4Cl will be... towards it.

a) red b) blue

c) green d) colourless

56. pH of 0.01 M HS^- will be

a) pH = 7 + $\frac{pK_a}{2} + \frac{\log C}{2}$ b) pH = 7 - $\frac{pK_b}{2} + \frac{\log C}{2}$

c) pH = $\frac{pK_1+pK_2}{2}$ d) pH = 7 + $\left(\frac{pK_a-pK_b}{2}\right)$

57. Solution of aniline hydrochloride is X due to hydrolysis of Y. X and Y are

a) basis $C_6H_5NH_3^+$ **b) acidic $C_6H_5NH_3^+$**

c) basis Cl^- d) acidic Cl^-

58. Which is a part of blood buffer?

a) HCO_3^-, H_2CO_3 b) CO_3^{2-}, HCO_3^-

c) CH_3COOH, CH_3COO^- d) SO_4^{2-}, HSO_4^-

59. Which is not amphoteric?

a) HSO_4^- **b) $H_2PO_2^-$**

c) H_2O d) NH_3

60. pH of the solution after NaCl solution is electrolysed will

a) remain constant **b) increase**

c) decrease d) Can't be determined

61. $FeCl_3$ solution is acidic due to hydrolysis of

a) $FeCl_3$ **b) Fe^{3+}**

c) Cl^- d) None of these

62. Dissociation constant of a weak acid is decreased by

a) addition of a strong acid

b) addition of a salt of the above weak acid

c) decreasing temperature

d) diluting the solution

63. Silver iodide is used in cloud seeding to produce rain

$AgI \rightleftharpoons Ag^{+}(aq) + I^{-}(aq)$: $K_{sp} = 8.5 \times 10^{-7}$

$AgNO_3$ and KI are mixed to give $[Ag^{+}] = 0.010$ M; $[I^{-}] = 0.015$ M. Will AgI precipitate?

a) Yes

b) No

c) Can't say

d) This depends on $[NO_3^-]$ and $[K^+]$

64. Slaked lime, $Ca(OH)_2$ is used extensively in sewage treatment. What is the maximum pH that can be established in $Ca(OH)_2(aq)$?

$Ca(OH)_2(s) \rightleftharpoons Ca^{2+}(aq) + 2OH^{-}(aq)$, $K_{sp} = 5.5 \times 10^{-6}$

a) 1.66 **b) 12.35**

c) 7 d) 14

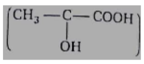
65. There is no effect of dilution on pH of the following

a) 0.01 M CH_3COONa + 0.01 M CH_3COOH buffer

b) 0.01 M CH_3COONH_4

c) 0.01 M NaH_2PO_4

d) in all the above cases

66. pK_a of lactic acid  is 5. pH of 0.005 M calcium lactate solution is

a) 10.5 **b) 8.5**

c) 5.0 d) 9.7

67. K_{sp} of $Mg(OH)_2$ is 1×10^{-12}. 0.01 M $MgCl_2$ will be precipitating at the limiting pH

a) 8 **b) 9**

c) 10 d) 12

68. $M(OH)_x$ has $K_{sp} = 4 \times 10^{-12}$ and solubility 10^{-4} M. Hence, x is

a) 1 **b) 2**

c) 3 d) 4

69. 10 mL of 10^{-6} M HCl solution is mixed with 90 mL H_2O pH will change approximately

a) by 1 unit b) by 0.3 unit

c) by 0.7 unit d) by 0.1 unit

70. pK_b of CH_3COO^- has is 9.26. pH of solution when 0.01 M CH_3COOH is neutralised 50% and at equivalence point using 0.01 M NaoH are respectively

a) 4.63, 8.22 **b) 4.74, 8.22**

c) 2.37, 4.11 d) 4.74, 8.37

71. Ionisation constant of water at 298 K ($K_w = 1 \times 10^{-14}$) is

a) 1×10^{-14} b) 1×10^{-7}

c) 1.8×10^{-16} d) 1.8×10^{-5}

72. pOH of the mixture containing 100 mL of 0.01 M NH_4OH and 100 ML of 0.01 M $(NH_4)_2SO_4$ is [$pK_a(NH_4^+)$ = 9.26]

a) 4.74 b) 9.26

c) 5.04 d) 9.56

73. Lemon juice normally has a pH of 2. If all the acid in the lemon juice is citric acid and the there are no citrate salts present, then what will be the citric acid concentration [HCit] in the lemon juice ? (Assume that only the first hydrogen of citric acid is important)

$$HCit \rightleftharpoons H^+ + Cit^-, \quad K_a = 8.4 \times 10^{-4} \text{ mol L}^{-1}$$

a) 8.4×10^{-4} M b) 4.2×10^{-4} M

c) 16.8×10^{-4} M **d) 12.0×10^{-2} M**

74. The solubility products of MA, MB, MC and MD are 1.8×10^{-10}, 4×10^{-3}, 4×10^{-8} and 6×10^{-5} respectively. If a 0.01 M solution of MX is added dropwise to a mixture containing A, B, C and D ions then the one to be precipitated first will be

a) MA b) MB

c) MC d) MD

75. Atmospheric behaviour is shown by

a) H_2CO_3 and Al_2O_2 **b) HCO_3^- and H_2O**

c) HCO_3^- and H_3O^+ c) H_2CO_3 and H_2O

76. Which of the following will not function as buffer solution?

a) NaCl + NaOH b) Borax + Boric acid

c) Na H_2PO_4 + Na_2HPO_4 d) NH_4 Cl + NH_4OH

77. An acid –base indicator has a $K_p$of 3.0 x 10^{-5}. The acid form of the indicator is red and the basic form is blue. Then

a) pH is 4.05 when indicator is 75% red

b) pH is 5.00 when indicator is 75% blue

c) Both (a) and (b) are correct

d) None of the above is correct

78. The pH of a solution of 0.10 M CH_3COOH increases, when which of the following substance is added?

a) Na HSO_4 b) $HClO_4$

c) NH_4 NO_2 **d) K_2CO_3**

79. A 50.00 mL sample of 0.0100 M Ba $(OH)_2$ is titrated with 0.0100 M HCl. The solution at the equivalence point is

a) 3.33 x10^{-3} $M\ Ba\ Cl_2$ b) 5.00 x 10^{-3} $M\ Ba\ Cl_2$

c) 2.50 x x10^{-3} $M\ Ba\ Cl_2$ d) 1.00 x x10^{-2} $M\ Ba\ Cl_2$

80. A flask contains 100.00 mL of 0.100 M HO Ac. To prepare a buffer with pH =pK which of the following samples of barium acetate solution should be added to the flask?

a) 50.00 mL of 0.400 $M\ Ba\ (OAc)_2$

b) 25.00 mL of 0.200 $M\ Ba\ (OAc)_2$

c) 50.00 mL of 0.0200 $M\ Ba\ (OAc)_2$

d) 100.00 mL of 0.100 $M\ Ba\ (OAc)_2$

81. A50.00 ml sample of acetic acid was titrated with 0.1200 M KOH and 38.62 ml of base were required to reach the equivalence point. What was the pH of the titration mixture. When 19.31 ml of base has been added? (pK_a(acetic acid)=4.74)

a) 2.94 b) 3.54

c) 4.74 d) 5.74

82. In the following reaction,

[Cu $(H_2O)_3$ $(OH)^+$]+[Al$(H_2O)_6^{3+}$]→[Cu$(H_2O)_4^{2+}$] + [A$(H_2O)_5(OH)^{+2}$]

(A) (B) (C) (D)

a) (A) is a base and (B) the acid

b) (C) is the conjugate acid of (A) and (D) is the conjugate base of (B)

c) Both (a) and (b) are correct

d) None of the above is correct

83. Which reacts with Na OH or which is an acid salt?

a) NaH_2PO_2 b) Na_2HPO_3

c) Both a) and b) **d) None of these**

84. pH of the following solution is not affected by dilution

a) 0.01 M NaHC O_3

b) buffer of 0.01 M CH_3COONa and 0.01 M CH_3COOH

c) 0.01 M CH_3COONH_4

d) All of the above

85. Which of the hydrated species can exist?

I: $H_5O_2^+$ II: H_3O^+ III: $H_3O_2^+$ IV: $H_5O_3^-$

Select the correct alternate.

a) II only b) I and II

c) I,II and III **d) I,II,III and IV**

86. For a polybasic acid stepwise ionisation constant are $K_{eq}.K_{eq.}$ … ..Their values are

a) $K_{eq} < K_{eq.} < K_{eq.}$ **b)** $\boldsymbol{K_{eq} > K_{eq.} > K_{eq.}}$

c) $K_{eq} > K_{eq.} > K_{eq.}$ d) $K_{eq} > K_{eq.} = K_{eq.}$

87. What is [NH_4^+] in a solution that is 0.02 M NH_3 and 0.01 M NH_3 and 0.01 M KOH? [$K_s(NH_3)=1.8 \times 10^{-3}$]

a) $3.6 \times 10^{-5}\ M$ b) $1.8 \times 10^{-8}\ M$

c) $0.9 \times 10^{-5}\ M$ d) $7.2 \times 10^{-5}\ M$

88. Consider the following examples

I: blood II: Saline solution III: benzoic acid + sodium benzoate

Solution (s) with n buffer capacity is/are

a) I, II **b) II**

c) II,III d) I, III

89. Buffer index of a buffer of 0.1 M NH_4OH and 0.1 m NH_4 Cl is

a) 0.052 **b) 0.115**

c) 0.025 d) 0.230

90. p$K_s$of a weak acid HA is 4.0. Effective range of a buffer of HA and $A^-$is about pH

a) 3 to 4 b) 3 to 6

c) 3 to 5 d) 4 to 5

91. pK_s of BH^+ is 8.0. A buffer of B and BH^+ has effective range of about pH

a) 5 to 7 b) 6 to 8

c) 6 to 7 **d) 7 to 9**

92. K_a of HCOOH is 1.8x10^{-4}. [$HCOO^-$] in a solution that is both 0.015 M HCOOH and 0.020 M HCl is

a) 3.5x $10^{-2}M$ b) 1.5 x $10^{-2}M$

c) 1.6 x $10^{-3}M$ **d) 1.3.5 x $10^{-4}M$**

93. 0.2 M AcOH is ....% dissociation in 0.1 M HCl (K_a of AcOH=1.8 x 10^{-5}).

a) 0.018% b) 0.036%

c) 1.8% d) 3.6%

94. The pH of a solution resulting when 50 mL of 0.2 M HCl is mixed with 50 mL of 0.20 M AcOH (K_a=1.8x10^{-5}) is

a) 0.70 b) 0.30

c) 1.00 d) 4.51

96. The acid ionisation (hydrolysis) constant of Zn^{2+} is 1.0 x10^{-9}. Hence, pH of 0.001 M solution of $ZnCl_2$ is

a) 9.0 b) 3.0

c) 6.0 d) 7.0

97. Conjugate base of Zn^{2+}

a) $Zn(OH)^{+}$ b) $Zn(OH)_2$

c) ZnO d) $Zn(H_2O)^{2+}$

98. Basic dissociation constant of $Zn(OH)^{+}$ is.. if acid ionisation constant of Zn^{2+} is 1.0 x 10^{-9}.

a) 1 x10^{-9} b) 1 x10^{9}

c) 1 x10^{5} **d) 1 x10^{-5}**

99. At what pH will a 1.0 x10^{-3} M solution of an indicator with $K_b = 1.0\text{x}10^{-10}$ change colour

a) 3.0 **b) 4.0**

c) 10.0 d) 7.0

100. An acid Indicator is ...% in its basic form at a pH of 5 [$K_a = 1 \times 10^{-5}$.

a) 20% b) 40%

c) 50% d) 100%

101. Which one of the following is most soluble?

a) Cus ($K_{eq} = B \times 10^{17}$) **b) MnS ($K_{sp} = 7 \times 10^{-16}$)**

c) Bi_2S_3($K_{eq} = 7 \times 10^{20}$) d) Ag_2S($K_{sp} = 7 \times 10^{-51}$)

102. At 80°C. distilled water has [H_3O^{+}] concentration equal to 1x10^{-6}mol/L The value of K_W at this temperature will be

a) 1x10^{-6} b) 1× 10^{-9}

c) 1× 10^{-13} d) 1× 10^{-15}

103. The solubility of AgCl will be minimum in

a) 0.001 M Ag NO_3 b) 0.01 M Na Cl

c) 0.01 M $CaCl_2$ d) pure water

104. The pH value of a 10 M solution of HCl is

a) less than 0 b) equal to 0

c) equal to 1 d) equal to 2

105. A physician wishes to prepare a buffer solution of pH =3.85 that efficiently resists changes in pH yet contains only small concentration of the buffering agents. Which one of the following weak acids together with its sodium salt would be best to use?

a) m-chlorobenzoic acid ($pK_a = 3.98$)

b) p-chlorocinnamic acid($pK_a = 4.41$)

c) 2, 5-dthydroxy benzoic acid($pK_a = 2.97$)

d) acetoacetic acid ($pK_a = 3.58$)

106. The solubility product of CuS, CdS and HgS are 10^{-31},10^{-44},10^{-64}, respectively. The solubility of these sulphides are in the order

a) CdS > HgS > CuS b) HgS > CdS > CuS

c) CdS > CuS > HgS **d) CuS > CdS > HgS**

107. The concentration of [H^+] and concentration of [OH^-] of a 0.1 M aqueous solution of 2% ionised weak monobasic acid is [Ionic product of water =1 x 10^{-14}]

a) 0.02x10^{-3} M and 5 x10^{-11} M

b) 1x10^{-3} M and 3 x10^{-11} M

c) 2x10^{-3} M and 5 x10^{-12} M

d) 3x10^{-2} M and 5 x10^{-13} M

108. The solubility of a saturated solution of calcium fluoride is 2 x10^{-4} mol L^{-1}. Its solubility product is

a) 12 x10^{-2} b) 14x10^{-4}

c) 22 x10^{-11} **d) 32 x10^{-12}**

109. The ionisation constant of phenol is higher than that of ethanol because

a) phenoxide ion is bulkier than ethoxide

b) phenoxide ion is stronger base than ethoxide

c) phenoxide ion is stabilized through delocalisation

d) phenoxide ion is less stable than ethoxide

110. A solution having pH=13 contained H^+ ions in 1 ml of solution which is

a) 6.02x10^7 b) 4.45x10^5

c) 8.42x10^8 d) 6.15x10^7

111. How many times a solution of pH=2 has higher acidity than the solution of pH=6?

a) 400 b) 800

c) 1200 **d) 10000**

112. The K_a for formic acid is 2.0x10^{-4} mol L^{-1}, then K_h for $HCOO^-$ is

a) 2x10^{-5}mol L^{-1} b) 4x10^{-7}mol L^{-1}

c) 5x10^{-11}mol L^{-1} d) 5x10^{-5}mol L^{-1}

113. A solution having hydronium ion concentration is 6.2x10^{-9}mol/L, it pH is

a) 6.42 b) 7.34

c) 8.21 d) 8.94

114. Which chemical decreases the H^+ ion concentration of an acetic acid solution?

a) $AgNO_3$ **b) CH_3COONa**

c) $Al_2(SO_4)_3$ d) NH_4Cl

115. The pH of a 10^{-10} molar solution of Hcl in water is about

a) 6.0 **b) 7.0**

c) 10 d) 14

116. An acid solution of 0.005 M has a pH of 5. The degree of ionisation of acid is

a) 0.1x10^{-2} **b) 0.2x10^{-2}**

c) 0.5x10^{-4} d) 0.6x10^{-6}

117. The solubility product of $BaCl_2$ is 4x10^{-9}. Its solubility in mol L^{-1} is

a) 4x10^{-3} b) 4x10^{-9}

c) 1x10^{-3} d) 1x10^{-9}

118. On dissolving CO_2 in water the following equilibrium is established

$$CO_2 + 2H_2O \rightleftharpoons H_3O^+ + HCO_3^-$$

For which the value of equilibrium constant is 3.8x10^{-7} and pH =6.0. The $\frac{[HCO_3^-]}{[Co_2]}$ ratio is

a) 3.8 **b) 0.38**

c) 13.8 d) 1.38

119. The dissociation constant of a weak acid is 4.9x10^{-8} , its percentage ionisation at 0.1 M is

a) 0.07% b) 0.007%

c) 0.7% d) 0.0007%

120. Ionisation constant of acetic acid is $1.8x10^{-5}$. The concentration of H^+ ions in 0.1 M solution is

a) $1.8x10^{-3}$ M b) 1.8x $x10^{-5}$ M

c) 1.3 $x10^{-3}$ M **d) 1.34 $x10^{-3}$ M**

121. The solubility product of $PbBr_2$ is $10.8x10^{-5}$. It is 70% dissociated in saturated solution. The solubility of salt is

a) $4.285x10^{-2}$ b) $6.756x10^{-3}$

c) $3.399x10^{-4}$ d) $5.435x10^{-2}$

122. A solution which is 10^{-3} M each in Mn^{2+}, Fe^{2+},Zn^{2+} and H^{2+} is treated with 10^{-16} M sulphide ion. If K_{sp} of MnS, FeS, ZnS and HgS are 10^{-15}, 10^{-23}, 10^{-20} and 10^{-54} respectively, which one will precipitate first?

a) FeS b) MgS

c) HgS d) ZnS

123. HX is a weak acid (K_a $=10^{-5}$). It forms asalt NaX on reacting with caustic soda. The degree of hydrolysis of 0.1 M NaX is

a) 0.01% b) 0.0001%

c) 0.1% d) 0.5%

124. 0.1 mol of CH_3 NH_2 (K_a $=10^{-4}$) is mixed with 0.08 mol of HCl and diluted to 1 L. What will be the H^+ Concentration in the solution?

a) $8x10^{-2}$ M **b) 8 $x10^{-11}$ M**

c) 1.6 $x10^{-11}$ M d) 8 $x10^{-5}$ M

125. $Ag^+ + NH_3 \rightleftharpoons [Ag(NH_3)]^+$. $k_1 = 3.5 \times 10^{-3}$

$[Ag(NH_3)]^+ + NH_3 \rightleftharpoons [Ag(NH_3)_2]^+$. $K_2 = 1.7 \times 10^{-3}$

then the formation constant of $[Ag(NH_3)_2]^+$ is

a) 6.00 x 10^{-6} b) 6.00 x 10^{6}

c) 6.00 x 10^{9} d) None of these

126. The silver ion in a solution is precipitated by addition of chloride ion. The final volume of solution is 500 ml. What 0.10 mg of Ag^+ ion ion remains unprecipitated?

(K_{sp}(AgCl) = 1.0 x 10^{-10})

a) 5.4 x 10^{-6} M b) 1.9 x 10^{-6} M

c) 5.4×10^{-4} M d) 1.9×10^{-7} M

127. For the reaction.

$$Hg^{2+} + 2Cl^- \rightleftharpoons HgCl_2 \qquad K = 1.65 \times 10^{13}$$

concentration of Hg^{2+} at the equivalence point in the titration of 2.0 mmol of Hg^{2+} with Cl^- when final volume is 100 mL., is

a) 8.25×10^{14} M b) 1.65×10^{13} M

c) 2.87×10^{6} M **d) 6.72×10^{-6} M**

128. It is desired to prepare 100 mL of a buffer of pH 5.00. Acetic (pK_a = 4.74). benzoic (p K_a = 4.18) and formic acids (pK_a = 3.68) and their salts are available for use. Which acid should be used for maximum effectiveness against increase or decrease in pH?

a) Acetic acid b) Benzoic acid

c) Formic acid d) Any one of these

129. K_{sp} of AgCl = 1.0×10^{-10}. Select the incorrect statement(s)

a) $P_{Ag} + P_{Cl} = 10$

b) $P_{Cl} = 8$ in 0.01 M Ag^+

c) $P_{Ag} + P_{Cl} < 10$ in presence of Ag^+

d) $P_{Ag} = P_{Cl} = 5$ in saturated AgCl solution

130. At the equilibrium point in the titration of CrO_4^{2-} with Ag^+

$$2Ag^+ + CrO_4^{2-} \rightleftharpoons Ag_2CrO_4(s)$$

a) $p_{Ag} + 2p_{cro4} = pK_{sp}$ **b) $3p_{cro4} = pK_{sp} + 2 \log 2$**

c) $3\ p_{Ag} + 2 \log 2 = pK_{sp}$ d) All of these

131. Internal proton transfer can take plae in one or more of the following acids

I : Glycine II : Anthranilic acids

III : Sulphanilic acid IV : Salicylic acids

Select such acids

a) I, II, III b) I, III, IV

c) II, III, IV d) All of these

132. Select the correct statement(s)

a) When we add NH_4Cl to water, solution becomes acidic due to weak acid NH_4^+

b) When we add CH_3COONa, solution becomes basic due to Na^+

c) At 100^0C, pH = 6 in water thus, it is basic solution

d) pH of 1 x 10^{-7} M HCl is 7

133. pK_{tn} of bromocresol green is 4 : 7. Thus, ratio of its yellow and blue forms at pH 3 : 7 is

a) 1 : 10 **b) 10 : 1**

c) 1 : 1 d) 1 : 3

134. pK_{tn} of bromocresol green is 4 : 7. Thus, ratio of its yellow and blue forms at pH 4 : 7 is

a) 1 : 10 b) 10 : 1

c) 1 : 1 d) 1 : 3

135. Fraction of the acid deprotonated is given by

a) f = $\frac{[conjugate\ base]_{equilibrium}}{[acid]_{actual}}$

b) f = $\frac{[acid]_{actual}}{[conjugate\ base]_{equilibrium}}$

c) f = $\frac{[conjugate\ acid]_{equilibrium}}{[conjugte\ base]_{actual}}$

d) f = $\frac{[conjugate\ base]_{equilibrium}}{[conjugate\ acid]_{equilibrium}}$

136. Select the correct statement(s)

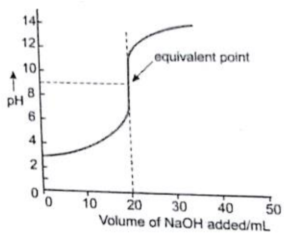
a) When pH of blood rises above about 7.45, alkalosis occurs.

b) When pH of blood falls below about 7.35, acidosis occurs

c) Respiratory alkalosis is caused by hyperventilation, or excessive respiration

d) All of the above

137. Following is the titration curve of CH_3COOH against NaOH added with phenolphthalein as the indicator



K_{in} value of phenolphthalein is 4.0 x 10^{-10}. Thus, incorrect statement is

a) it begins to change colour from the pH 9.4

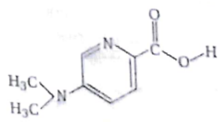
b) it begins to change colour from acid colourless at pH 8.4 to the base form (reddish pink) at pH 10.4

c) phenolphthalein is suitable indicator for CH_3COOH — NaOH titration

d) phenolphthalein is a weak acid

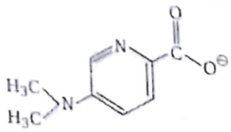
138. Select the correct statement(s).

a) Red colour of methyl red is due to the structure



(I)

b) Yellow colour of methyl red is due to the structure



(II)

c) pH = pK_{in} when I and II have equal concentrations

d) All the above are correct statements

139. For an indicator HIn

$$\underset{A}{HIn} \rightleftharpoons H^{\oplus} + \underset{B}{In^{\ominus}}$$

as the pH changes from $pK_{in} - 1$ to $pK_{in} + 1$, [B]/[A]

a) will vary from 0.1 to 10

b) will vary from 10 to 0.1

c) will vary from 1 to 10

d) will vary from 10 to 1

140. Adding 0.25 ml of a strong monoprotic acid solution to 500 mL of water produced a pH of 2.00. Thus, concentration of the strong acid is

a) 10 M **b) 20 M**

c) 5 N d) 2 M