Class: 13th RENEET | Subject: Chemistry | DPP

IONIC EQUILIBRIUM

EXERCISE-I (Conceptual Questions) — BUILD UP YOUR UNDERSTANDING

1. If $[OH^-] = 5.0 \times 10^{-5}$ M then pH will be :-
(1) 5 - log 5 (2) 9 + log 5
(3) log 5 - 5 (4) log 5 - 9

2. Find out pH of solution having 2×10^{-3} moles of OH^- ion's in 2 litre solution :-
(1) pH = 3 (2) pH = 3 + log2
(3) pH = 3 – log2 (4) pH = 11

3. The pH of a soft drink is 3.82. The hydrogen ion concentration will be:-
(1) 1.96×10^{-2}mol L^{-1} (2) 1.6×10^{-4}mol L^{-1}
(3) 1.96×10^{-5} mol L^{-1} (4) None of them

4. Which one of the following has highest pH:-
(1) Distilled water
(2) 1 M NH_3
(3) 1 M NaOH
(4) Water saturated with chlorine

OSTWALD'S DILUTION LAW

5. Order of dissociation of 0.1 N CH_3COOH is :- (Dissociation constant = 1×10^{-5})
(1) 10^{-5} (2) 10^{-4} (3) 10^{-3} (4) 10^{-2}

6. 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 :-
(1) $\frac{\alpha(y)^{-1}}{2}$ (2) $y(\alpha)^{-1}$
(3) $\frac{y(\alpha)^{-1}}{2}$ (4) None of them

7. The degree of dissociation of acetic acid is given by the expression $\alpha = 0.1 \times C^{-1}$ (where C = concentration of the acid) What is the pH of the solution :-
(1) 1 (2) 2 (3) 3 (4) 4

8. The degree of ionisation of a compound depends upon :
(1) Size of the solute molecules
(2) Nature of the solute molecules
(3) Nature of the container taken
(4) The amount of current passed

9. Find out K_a for 10^{-2} M HCN acid, having pOH is 10 :-
(1) $K_a = 10^{-4}$ (2) $K_a = 10^{-2}$
(3) $K_a = 10^{-5}$ (4) None of them

10. Which of the following will occur if a 1.0 M solution of a weak acid is diluted to 0.01 M at constant temperature:-
(1) Percentage ionisation will increase
(2) $[H^+]$ will decrease to 0.01M
(3) K_a will increase
(4) pH will decrease by 2 units

11. The pH of 0.15 M solution of HOCl ($K_a = 9.6 \times 10^{-6}$) is:-
(1) 4.42 (2) 2.92 (3) 3.42 (4) None

12. If Ka of HCN = 4×10^{-10}, then the pH of 2.5×10^{-1} molar HCN (aq) is:-
(1) 4.2 (2) 4.7 (3) 0.47 (4) 5.0

13. The molarity of nitrous acid at which its pH becomes 2.($K_a = 4.5 \times 10^{-4}$) :-
(1) 0.3333 (2) 0.4444
(3) 0.6666 (4) 0.2222

14. Correct statement for HCN weak acid at 25^0C temperature.:-
(1) $\alpha = \frac{K_a}{[H^+]}$ (2) $\alpha = \frac{K_a \times [OH^-]}{K_w}$
(3) (1) & (2) both (4) $K_b = C\alpha^2$

15. For which, dilution law is applicable :
(1) NaCl (SASB) (2) HCl (SA)
(3) CH_3COONa(WASB) (4) None

BIODATA OF WATER

16. Ionic product of water will increase, if :-

(1) Decrease in pressure

(2) Add H^+

(3) Add OH^-

(4) Increase the temperature

17. For water at 25° C, 2×10^{-7} moles per litre is the correct answer for which one of the followoing

(1) $[H^+] + [OH^-]$ (2) $[H^+]^2$

(3) $[OH^-]^2$ (4) $[H^+] - [OH^-]$

18. The pH of 1 N H_2O is :-

(1) 7 (2) > 7 (3) < 7 (4) 0

19. At 25^0C, the dissociation constant for pure water is given by :-

(1) $(55.4 \times 10^{14})^{-1}$ (2) 1×10^{-14}

(3) $\frac{1 \times 10^{-14}}{18}$ (4) None of these

20. Ionic product of water is equal to :-

(1) Dissociation constant of water × $[H_2O]$

(2) Dissociation constant of water × $[H^+]$

(3) Product of $[H_2O]$ and $[H^+]$

(4) Product of $[OH^-]^2$ and $[H^+]$

21. Addition of H^+ and OH^- ion's concentration at 90^0C

(1) 10^{-14} (2) 10^{-12}

(3) 2×10^{-6} (4) 2×10^{-7}

22. At 90^0C, pure water has $[H_3O^+] = 10^{-6.7}$ mol L^{-1} what is the value of K_W at 90^0C:-

(1) 10^{-6} (2) 10^{-12} (3) 10^{-67} (4) $10^{-13.4}$

23. At 373 K, temp. the pH of pure H_2O can be:-

(1) < 7 (2) > 7 (3) = 7 (4) = 0

24. Choose the correct relation:-

(1) $\frac{pH + pOH}{14} = 7$ (2) pH + pOH = 14

(3) pOH = 14 + pH (4) pH = 14 + pOH

25. The common ion effect is shown by which of the following sets of solutions :-

(1) $BaCl_2 + BaNO_3$ (2) NaCl + HCl

(3) $NH_4OH + NH_4Cl$ (4) None

26. Which of the following is a true statement :

(1) The ionisation constant and ionic product of water are same.

(2) Water is a strong electrolyte.

(3) The value of ionic product of water is less than that of its ionisation constant.

(4) At 298K, the number of H^+ ions in a litre of water is 6.023×10^{16}.

27. 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 :-

(1) Decrease in S^{-2} ion concentration

(2) Concentration of S^{-2} is not affected

(3) Increase in S^{-2} ion concentration

(4) It is not possible, to add HCl in solution

28. Dissociation constant of water at 25° C is

(1) $10^{-14} \times (55.5)^{-1}$ (2) $10^{-7} \times (18)^{-1}$

(3) $10^{-14} \times (18)^{-1}$ (4) $10^{-7} \times (55.4)^{-1}$

SALTS, TYPES O F SALT & CONJUGATE THEORY

29. Which of the following is not an acidic salt :-

(1) $NaHSO_4$ (2) HCOONa

(3) NaH_2PO_3 (4) None of them

30. Which is a basic salt :–

(1) PbS (2) $PbCO_3$

(3) $PbSO_4$ (4) $2PbCO_3\,Pb(OH)_2$

31. The process of neutralisation invariably results in the production of :-

(1) H^+ ions

(2) OH^- ions

(3) Both H^+ and OH^- ions

(4) Molecules of water

HYDROLYSIS OF SALTS

32. At 90^0 C, the pH of 0.1M NaCl aqueous solution is :-

(1) < 7 (2) > 7 (3) 7 (4) 0.1

33. What will the pH of 1.0 M ammonium formate solution, If $K_a=1\times10^{-4}$ acid $K_b=1\times10^{-5}$:-

(1) 6.5 (2) 7.5 (3) 8.0 (4) 9.0

34. Which salt will not show hydrolysis :-

(1) KCl (2) Na_2SO_4 (3) NaCl (4) All

35. $HCOO^- + H_2O \rightleftharpoons HCOOH + OH^-$ is related:-

(1) $h = \sqrt{K_h}$ (2) $h = \sqrt{\frac{K_h}{C}}$

(3) $h = \sqrt{\frac{K_h}{V}}$ (4) $K_h = \sqrt{hc}$

36. The pH of aqueous solution of sodium acetate is

(1) 7 (2) Very low

(3) > 7 (4) < 7

37. If pK_b for CN^- at 25°C is 4.7. The pH of 0.5M aqueous NaCN solution is :-

(1) 12 (2) 10 (3) 11.5 (4) 11

38. The highest pH value is of :-

(1) 0.1 M NaCl (2) 0.1 M NH_4Cl

(3) 0.1 M CH_3COONa (4) 0.1 M CH_3COONH_4

39. pH of K_2S solution is:-

(1) 7 (2) Less than 7

(3) More than 7 (4) 0

40. For anionic hydrolysis, pH is given by:-

(1) $pH = \frac{1}{2}pK_W - \frac{1}{2}pK_b - \frac{1}{2}\log c$

(2) $pH = \frac{1}{2}pK_W + \frac{1}{2}pK_a - \frac{1}{2}pK_b$

(3) $pH = \frac{1}{2}pK_W + \frac{1}{2}pK_a + \frac{1}{2}\log c$

(4) None of above

41. A weak acid react with strong base, ionisation constant of weak acid is 10^{-4}. Find out equilibrium constant for this reaction :-

(1) 10^{-10} (2) 10^{10} (3) 10^{-9} (4) 10^{9}

42. Hydroxyl ion concentration $[OH^-]$ 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) $[OH^-] = (CK_w.\ K_a)^{1/2}$

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

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

(4) $[OH^-] = C.\ K_a.\ K_w.$

43. Consider :-

(a) $FeCl_3$ in water - Basic

(b) NH_4Cl in water - Acidic

(c) Ammonium acetate in water - Acidic

(d) Na_2CO_3 in water - Basic

Which is/are not correctly matched:-

(1) b and d (2) b only

(3) a and c (4) d only

44. Which of the following salts undergoes hydrolysis in water:-

(1) Na_3PO_4 (2) CH_3COONa

(3) $NaNO_3$ (4) Both of (1) and (2)

45. 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}

46. Degree of Hydrolysis of $\frac{N}{100}$ solution of KCN is (Given Ka = 1.4×10^{-9})

(1) 2.7×10^{-3} (2) 2.7×10^{-2}

(3) 2.7×10^{-4} (4) 2.7×10^{-5}

SOLUBILITY & SOLUBILITY PRODUCT (K_{sp})

47. The solubility product of sparingly soluble univalent salt is defined as the product of ionic concentration in a:-

(1) 1 M solution

(2) Concentration solution

(3) Very dilute solution

(4) Saturated solution

48. In solubility of salts M_2X, QY_2 and PZ_2 equal, then the relation between their K_{sp} will be :-

(1) $K_{sp}(M_2X) > K_{sp}(QY_2) > K_{sp}(PZ_2)$

(2) $K_{sp}(M_2X) = K_{sp}(QY_2) < K_{sp}(PZ_2)$

(3) $K_{sp}(M_2X) > K_{sp}(QY_2) = K_{sp}(PZ_2)$

(4) $K_{sp}(M_2X) = K_{sp}(QY_2) = K_{sp}(PZ_2)$

49. The expression of solubility product of mercurous iodide is :-

(1) $[2\ Hg^{+}]^2 \times 2\ [I^{-}]^2$ (2) $[Hg^{++}]^2 \times [\ 2I^{-}]^2$

(3) $[Hg_2^{2+}] \times [I^{-}]^2$ (4) $[Hg^{2+}]^2 \times [I^{-}]^2$

50. At 25⁰C, 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) $18 \times 10^{+10}$

51. At 25⁰C, required volume of water, to dissolve 1g $BaSO_4$ ($K_{sp} = 1.1 \times 10^{-10}$) will be:-

(1) 820 L. (2) 1 L.

(3) 205 L. (4) 430 L.

52. Concentration of Ag^+ ions in saturated solution of Ag_2CrO_4 at 20⁰C is 1.5×10^{-4} mol L^{-1}. At 20⁰C, 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}

53. How many grams of CaC_2O_4 will dissolve in distilled water to make one litre saturated solution? solubility product of CaC_2O_4 is 2.5×10^{-9} mol² L^{-2} and its molecular weight is 128.

(1) 0.0064 g (2) 0.0128 g

(3) 0.0032 g (4) 0.0640 g

54. If the concentration of CrO_4^{2-} ion in a saturated solution of silver chromate will be 2×10^{-4} M, solubility product of silver chromate will be -

(1) 4×10^{-8} (2) 8×10^{-12}

(3) 32×10^{-12} (4) 6×10^{-12}

55. If the solubility of AgCl (formula mass=143) in water at 25°C is 1.43×10^{-4} g/100 mL of solution then the value of K_{sp} will be :–

(1) 1×10^{-5} (2) 2×10^{-5}

(3) 1×10^{-10} (4) 2×10^{-10}

56. The solubility product of As_2S_3 is given by the expression :-

(1) $K_{sp} = [As^{3+}] \times [S^{-2}]$

(2) $K_{sp} = [As^{3+}]^1\ [S^{-2}]^1$

(3) $K_{sp} = [As^{3+}]^3\ [S^{-2}]^2$

(4) $K_{sp} = [As^{3+}]^2\ [S^{-2}]^3$

57. If the solubility of lithium sodium hexeafluoro aluminate $Li_3Na_3(AlF_6)_2$ is 'S' mol L^{-1}. Its solubility product is equal to :-

(1) S^8 (2) $12\ S^3$

(3) $18S^3$ (4) $2916\ S^8$

58. One litre of saturated solution of $CaCO_3$ is evaporated to dryness, when 7.0 g of residue is left. The solubility product for $CaCO_3$ is:-

(1) 4.9×10^{-3} (2) 4.9×10^{-5}

(3) 4.9×10^{-9} (4) 4.9×10^{-7}

59. If solubility product of the base $M(OH)_3$ is 2.7×10^{-11}, the concentration of OH^{-1} will be

(1) 3×10^{-3} (2) 3×10^{-4}
(3) 10^{-3} (4) 10^{-11}

60. Solubility products of $M(OH)_3$ and $M(OH)_2$ are 10^{-23} and 10^{-14} respectively. Which will be precipitated first on adding NH_4OH, if M^{+2} and M^{+3} both the ions are in solution ?

(1) M^{+2}
(2) M^{+3}
(3) Both M^{+2} and M^{+3} together
(4) Precipitation will not take place.

APPLICATION OF SOLUBILITY PRODUCT (K_{sp})

61. At 30ºC, In which of the one litre solution, the solubility of Ag_2CO_3 (solubility product = 8×10^{-12}) will be maximum :-

(1) 0.05 M Na_2CO_3 (2) Pure water
(3) 0.05 M $AgNO_3$ (4) 0.05 M NH_3

62. Solubility of AgBr will be minimum in :-

(1) Pure water (2) 0.1 M $CaBr_2$
(3) 0.1 M NaBr (4) 0.1 M $AgNO_3$

63. In which of the following, the solution of AgSCN will be unsaturated :-

(1) $[Ag^+]\ [SCN^-] = K_{sp}$
(2) $[Ag^+] \times [SCN^-] < K_{sp}$
(3) $[Ag^+] \times [SCN^-] > K_{sp}$
(4) $[Ag^+]\ [SCN^-]^2 < K_{sp}$

64. If 's' and 'S' are respectively solubility and solubility product of a sparingly soluble binary electrolyte then :–

(1) $s = S$ (2) $s = S^2$
(3) $s = S^{1/2}$ (4) $s = \frac{1}{2}S$

65. 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) HgS > Ag_2S > CuS (2) Ag_2S > HgS > CuS
(3) CuS > Ag_2S > HgS (4) Ag_2S > CuS > HgS

66. 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) 4×10^{-3} M (2) 0.4×10^{-4} M
(3) 4×10^{-2} M (4) 4×10^{-4} M

67. M_2SO_4 (M^+ is a monovalent metal ion) has a K_{sp} of 1.2×10^{-5} at 298 K. The maximum concentration of M^+ ion that could be attained in a saturated solution of this solid at 298 K is:-

(1) 3.46×10^{-3} M (2) 2.89×10^{-2} M
(3) 2.8×10^{-3} M (4) 7.0×10^{-3} M

68. Which of the following has maximum solubility (K_{sp} value is given in brackets) :-

(1) HgS (1.6×10^{-54}) (2) $PbSO_4$ (1.3×10^{-8})
(3) ZnS (7.0×10^{-26}) (4) AgCl (1.7×10^{-10})

69. 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

70. The solubility product of three sparingly soluble salts are given below :

No.	Formula	Solubility product
1	PQ	4.0×10^{-20}
2	PQ_2	3.2×10^{-14}
3	PQ_3	2.7×10^{-35}

The correct order of decreasing molar solublity is:-

(1) 1, 2, 3 (2) 2, 1, 3
(3) 3, 2, 1 (4) 2, 3, 1

71. K_{sp} value is more for :-

(1) CuS (2) NiS
(3) PbS (4) CdS

72. The K_{sp} value for $Gd(OH)_3$ is 2.8×10^{-23}, the pH at which $Gd(OH)_3$ begins to precipitate is:-

(1) 6.08 (2) 5.08 (3) 8.47 (4) 4.08

73. If the solubility product of $AgBrO_3$ and Ag_2SO_4 are 5.5×10^{-5} and 2×10^{-5} respectively, the relationship between the solubilities of these can be correctly represented as:-

(1) $sAgBrO_3 > sAg_2SO_4$

(2) $sAgBrO_3 = sAg_2SO_4$

(3) $sAgBrO_3 < sAg_2SO_4$

(4) $sAgBrO_3 = sAgSO_4$

74. Solubility product of $Mg(OH)_2$ is 1×10^{-11}. At what pH, precipitation of $Mg(OH)_2$ will begin from 0.1 M Mg^{2+} solution :-

(1) 9 (2) 5 (3) 3 (4) 7

75. In the qualitative analysis of group III, $Fe(OH)_2$ is not precipitated because :-

(1) The K_{sp} for $Fe(OH)_2$ is higher

(2) To precipitate $Fe(OH)_2$, only small $[OH^-]$ is needed

(3) $Fe(OH)_2$ is a weak electrolyte

(4) The oxidation state of Fe in $Fe(OH)_2$ is +2

76. A solution, containing 0.01 M Zn^{+2} and 0.01 M Cu^{2+} is saturated by passing H_2S gas. The S^{2-} concentration is 8.1×10^{-21} M, Ksp for ZnS and CuS are 3.0×10^{-22} and 8.0×10^{-36} respectively. Which of the following will occur in the solution:-

(1) ZnS will precipitate

(2) CuS will precipitate

(3) Both ZnS and CuS will precipitate

(4) Both Zn^{2+} and Cu^{2+} will remain in the solution

77. Consider (1) $Zn(OH)_2$ (2) $Cr(OH)_3$ (3) $Mg(OH)_2$ (4) $Al(OH)_3$ which hydroxide is precipitated by NH_4OH containing NH_4Cl :-

(1) 1, 2 (2) 2, 4

(3) Only 4 (4) 1, 2, 3 and 4

78. What will happen if the pH of the solution of 0.001 M $Mg(NO_3)_2$ solution is adjusted to pH = 9

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

(1) ppt will take place

(2) ppt will not take place

(3) Solution will be saturated

(4) None of these

79. The solubility product constant Ksp of $Mg(OH)_2$ is 9.0×10^{-12}. If a solution is 0.010 M with respect to Mg^{2+} ion, what is the maximum hydroxide ion concentration which could be present without causing the precipitation of $Mg(OH)_2$:-

(1) 1.5×10^{-7} M (2) 3.0×10^{-7} M

(3) 1.5×10^{-5} M (4) 3.0×10^{-5} M

80. When HCl gas is passed through a saturated solution of common salt, pure NaCl is precipitated because:-

(1) The impurities dissolve in HCl

(2) HCl is slightly soluble in water

(3) The ionic product $[Na^+] \times [Cl^-]$ exceeds the solubility product of NaCl

(4) The solubility product of NaCl is lowered by Cl^- from aq. HCl

81. A solution is a mixture of 0.06 M KCl and 0.06 M KI. $AgNO_3$ solution is being added drop by drop till AgCl starts precipitating (K_{sp} AgCl = 1×10^{-10} and K_{sp} AgI = 4×10^{-16}). The concentration of Iodide ion at this stage will be nearly equal to :-

(1) 4.0×10^{-5} M (2) 2.4×10^{-7} M

(3) 2.0×10^{-8} M (4) 4×10^{-8} M

82. To have more sulphide ion concentration, H_2S should be passed through :-

(1) 1 N HCl solution

(2) 0.1 M HCl solution

(3) A neutral solution such as water

(4) An ammonical solution

83. When excess oxalic acid is added to $CaCl_2$, CaC_2O_4 is precipitated and the solution still contains some unprecipitated Ca^{2+} for the reason:-

(1) CaC_2O_4 is a soluble salt

(2) Oxalic acid does not ionise at all

(3) When $H_2C_2O_4$ is added to $CaCl_2$, HCl is formed which is fully ionised and thus increases the H^+ ion concentration so supresses the ionisations of $H_2C_2O_4$ and hense the ionic product of CaC_2O_4 is not exceeded to the solubility product

(4) None of the above

84. The solubility product of hydroxides of Mg^{+2}, Zn^{+2}, and Fe^{+3} decreases as $K_{sp}\ Mg(OH)_2 > K_{sp}\ Zn(OH)_2 > K_{sp}\ Fe(OH)_3$ The order of precipitation of hydroxides is:-

(1) $Fe(OH)_3$, $Zn(OH)_2$, $Mg(OH)_2$
(2) $Mg(OH)_2$, $Zn(OH)_2$, $Fe(OH)_3$
(3) $Zn(OH)_2$, $Fe(OH)_3$, $Mg(OH)_2$
(4) $Zn(OH)_2$, $Mg(OH)_2$, $Fe(OH)_3$

FEW IMPORTANT POINTS

85. Two monobasic weak acids have the same concentration of H^+ ions. What is the relationship between dissociation constant and dilution:-

(1) $Ka_1V_1 = Ka_2V_2$ (2) $Ka_1V_2 = Ka_2V_1$
(3) $[Ka_1V_1]^{\frac{1}{2}} = Ka_2V_2$ (4) $Ka_1V_1 = [Ka_2V_2]^{\frac{1}{2}}$

86. What is the molar concentration of chloride ion for the solution obtained by mixing 300 mL of 3.0M NaCl and 200 mL of 4.0 M solution of $BaCl_2$:-

(1) 5.0 M (2) 1.8 M
(3) 1.6 M (4) None of these

pH

87. The pH of a 0.1 M formic acid 0.1% dissociated is equal to 4. What will be the pH of another weak acid (same concentration) which is 1% dissociated

(1) 2 (2) 3 (3) 1 (4) 4

88. 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

89. Find out (OH^-) concentration in pH = 3.28 solution

(1) 5.3×10^{-4} (2) 5.3×10^{-10}
(3) 1.8×10^{-10} (4) 1.8×10^{-11}

90. 0.001 N KOH solution has the pH :-

(1) 10^{-1} (2) 3
(3) 11 (4) 2

91. Given :-

(a) 0.005 M H_2SO_4 (b) 0.1 M Na_2SO_4
(c) 10^{-2} M NaOH (d) 0.01 M HCl

Choose the correct code having same pH :-

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

92. What is H^+ ion concentration of 5×10^{-3} M H_2CO_3 solution having a 10% dissociation:-

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

93. A metal hydroxide of molecular formula $M(OH)_4$ is 50% ionised. Its 0.0025M solution will have the pH :-

(1) 12 (2) 2 (3) 4 (4) 11.7

94. In the following solutions, the conc. of different acids are given, which mixture of the acid has highest pH :-

(1) $\frac{M}{10} H_2SO_4$, $\frac{M}{20} HNO_3$, $\frac{M}{10} HClO_4$

(2) $\frac{M}{20} H_2SO_4$, $\frac{M}{10} HNO_3$, $\frac{M}{20} HClO_4$

(3) $\frac{M}{20} H_2SO_4$, $\frac{M}{10} HNO_3$, $\frac{M}{40} HClO_4$

(4) $\frac{M}{20} H_2SO_4$, $\frac{M}{5} HNO_3$, $\frac{M}{5} HClO_4$

95. If 100 mL of pH = 3 and 400 mL of pH = 3 is mixed, what will be the pH of the mixture

(1) 3.2 (2) 3.0 (3) 3.5 (4) 2.8

96. 10^{-6} M HCl is diluted to 100 times. Its pH is :-

(1) 6.0 (2) 8.0 (3) 6.95 (4) 9.5

97. At 90°C, the pH of 0.001M KOH solution will be

(1) 3 (2) 11 (3) 5 (4) 9

98. 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

99. Which expression is correct for pH :-

(1) $pH = -\log[H_3O^+]$ (2) $pH = \log\frac{1}{[H_3O^+]}$

(3) $[H^+] = 10^{-pH}$ (4) All

100. The pH of the solution containing 10 mL of a 0.1M NaOH and 10 mL of 0.05M H_2SO_4 would be

(1) Zero (2) 1 (3) >7 (4) 7

101. In a solution of pH = 5, more acid is added in order to reduce the pH = 2. The increase in hydrogen ion concentration is:-

(1) 100 times (2) 1000 times

(3) 3 times (4) 5 times

102. Calculate the pH of 4×10^{-3} M, $Y(OH)_2$ solution assuming the first dissociation to be 100% second dissociation to be 50%:-

(1) 11.78 (2) 9.9

(3) 2.5 (4) 2.22

103. The pOH of beer is 10.0. The hydrogen ion concentration will be :–

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

(1) a, d (2) b, c

(3) a, b, c (4) None

104. An aqueous solution whose pH = 0 is :-

(1) Basic (2) Acidic

(3) Neutral (4) Amphoteric

105. The pH of a 10^{-10} M NaOH solution is nearest to :-

(1) 10 (2) 7 (3) 4 (4) –10

106. The pH of the solution produced when an aqueous solution of strong acid pH 5 is mixed with equal volume of an aqueous solution of strong acid of pH 3 is :-

(1) 3.3 (2) 3.5

(3) 4.5 (4) 4.0

107. Following five solution of KOH were prepare as–

First → 0.1 moles in 1 L

Second → 0.2 moles in 2 L

Third → 0.3 moles in 3 L

Fourth → 0.4 moles in 4 L

Fifth → 0.5 moles in 5 L

The pH of resultant solution is :–

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

108. Which would decrease the pH of 25 cm^3 of a 0.01 M solution of hydrochloric acid:-

(1) The addition of 25 cm^3, 0.005 M hydrochloric acid

(2) The addition of 25 cm^3, 0.02 M hydrochloric acid

(3) The addition of magnesium metal

(4) None

109. The pH of a 0.02 M ammonia solution which is 5% ionised will be :-

(1) 2 (2) 11 (3) 5 (4) 7

110. Pure water is kept in a vessel and it remains exposed to atmospheric CO_2 which is absorbed. Then the pH will be :-

(1) Greater than 7

(2) Less than 7

(3) 7

(4) Depends on ionic product of water

111. pH of 10^{-1} M formic acid is:-

(1) 1 (2) > 1 (3) < 1 (4) 13

112. For $\frac{N}{10}$ H_2SO_4, pH value is :-

(1) 1 (2) 0.586

(3) 0.856 (4) None

113. H_2X is a dibasic acid which dissociates completely in water. Which one of the following is the molarity of an aqueous solution of this acid which has a pH of 1 :-

(1) 0.1 (2) 0.05 (3) 0.2 (4) 0.5

114. The pH of blood is :–

(1) Less than 6

(2) Greater than 7 and less than 8

(3) Greater than 8 and less than 9

(4) Greater than 10

115. 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

116. 8 g NaOH and 4.9 g H_2SO_4 are present in one litre of the solution. What is its pH

(1) 1 (2) 13 (3) 12 (4) 2

117. Calculate pH of a solution whose 100 mL contains 0.2 g NaOH dissolved in it :-

(1) 10.699 (2) 11.699

(3) 12.699 (4) 13.699

118. One litre solution contains 1M HOCl [$K_a = 10^{-8}$] and 1 M NaOH. What is the pH of the solution:-

(1) 8 (2) 11 (3) 5 (4) 2

119. 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

120. 0.001 mol of the strong electrolyte $M(OH)_2$ has been dissolved to make a 20 mL of its saturated solution. Its pH will be : - [$K_w = 1 \times 10^{-14}$]

(1) 13 (2) 3.3 (3) 11 (4) 9.8

121. Choose the wrong statement :-

(1) For a neutral solution : $[H^+] = [OH^-] = \sqrt{K_w}$

(2) For an acidic solution : $[H^+] > \sqrt{K_w}$ and $[OH^-] < \sqrt{K_w}$

(3) For a basic solution : $[H^+] < \sqrt{K_w}$ and $[OH^-] > \sqrt{K_w}$

(4) For a neutral solution at all temperatures : $[H^+] = [OH^-] = 10^{-7}$ M

122. The pH of 0.1 M solution of the following salts increases in order :-

(1) NaCl < NH_4Cl < NaCN < HCl

(2) NaCN < NH_4Cl < NaCl < HCl

(3) HCl < NaCl < NaCN < NH_4Cl

(4) HCl < NH_4Cl < NaCl < NaCN

123. pH values of two acids A and B are 4 and 5. The strengths of these two acids are related as :-

(1) The strengths of the two acids cannot be compared.

(2) Acid B is 10 times stronger than acid A.

(3) Strength of acid A : Strength of acid B = 4 : 5

(4) Acid A is 10 times stronger than acid B.

124. What is the pH of 1 M CH_3COONa solution? Ka of acetic acid = 1.8×10^{-5}, $K_w = 10^{-14}$ mol^2 L^{-2}

(1) 2.4 (2) 3.6

(3) 4.8 (4) 9.4

BUFFER SOLUTION & INDICATORS

125. What will be the pH of the solution, if 0.01 moles of HCl is dissolved in a buffer solution containing 0.02 moles of propanoic acid ($K_a = 1.34 \times 10^{-5}$) and 0.0152 moles of salt, at 25°C :

[log(0.173) = –0.76]

(1) 3.11 (2) 4.11 (3) 5.11 (4) 6.11

126. $\frac{N}{10}$ acetic acid was titrated with $\frac{N}{10}$ NaOH. When 25%, 50% and 75% of titration is over then the pH of the solution will be :- [$K_a = 10^{-5}$]

(1) 5 + log 1/3, 5, 5 + log 3

(2) 5 + log 3, 4, 5 + log 1/3

(3) 5 – log 1/3, 5, 5 – log 3

(4) 5 – log 1/3, 4, 5 + log 1/3

127. 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.

128. To a 50 mL of 0.05M formic acid how much volume of 0.10M sodium formate must be added to get a buffer solution of pH = 4.0 ? (pK_a of the acid is 3.8)

(1) 50 mL (2) 4 mL
(3) 39.6 mL (4) 100 mL

129. In a mixture of weak acid and its salt, the ratio of concentration of acid to salt is increased ten-fold. The pH of the solution :-

(1) Decreases by one
(2) Increases by one-tenth
(3) Increases by one
(4) Increases ten-fold

130. pK_b for NH_4OH at certain temperature is 4.74. The pH of basic buffer containing equimolar concentration of NH_4OH and NH_4Cl will be:-

(1) 7.74 (2) 4.74
(3) 2.37 (4) 9.26

131. Which can act as buffer :-

(1) NH_4OH + NaOH
(2) HCOOH + CH_3COONa
(3) 40 mL 0.1 M NaCN + 20 mL of 0.1 M HCl
(4) None of them

132. The buffer solution play an important role in :-

(1) Increasing the pH value
(2) Decreasing the pH value
(3) Keeping the pH constant
(4) Solution will be neutral

133. Ka for HCN is 5×10^{-10} at 25^0C. For maintaining a constant pH of 9, the volume of 5M KCN solution required to be added to 10mL of 2M HCN solution is-

(1) 4 mL (2) 7.95 mL
(3) 2 mL (4) 9.3 mL

134. Buffering action of a mixture of CH_3COOH and CH_3COONa is maximum when the ratio of salt to acid is equal to -

(1) 1.0 (2) 100.0 (3) 10.0 (4) 0.1

135. The pink colour of phenolphthalein in alkaline medium is due to -

(1) Negative ion (2) Positive ion
(3) OH^- ions (4) Neutral form

136. Which indicator works in the pH range 8 – 9.8

(1) Phenolphthalein (2) Methyl orange
(3) Methyl red (4) Litmus

137. A basic - buffer will obey the equation pOH - pK_b = 1 only under condition:-

(1) [Conjugate acid] : [base] = 1 : 10
(2) [Conjugate acid] = [base]
(3) [Conjugate acid] : [base] = 10 : 1
(4) N.O.T

138. For weak acid strong base titration, the indicator used is :-

(1) Potassium di-chromate
(2) Methyl orange
(3) Litmus
(4) Phenolphthalein

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

(1) CH_3COOH + NaOH (2) $H_2C_2O_4$ + NaOH
(3) HCl + NaOH (4) $CH_3COOH + NH_4OH$

140. The total number of different kind of buffers obtained during the titration of H_3PO_4 with NaOH are :-

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

141. The H^+ ion concentration in 0.001 M acetic acid is 1.34×10^{-4} g ion L^{-1}. The H^+ ion concentration of 0.164 g of CH_3COONa is added to a litre of 0.001 M CH_3COOH will be :-

(1) 9×10^{-6} (2) 18×10^{-6}
(3) 4.5×10^{-6} (4) 5×10^{-6}

142. A certain acidic buffer solution contains equal concentration of X^- and HX. The K_b for X^- is 10^{-10}. The pH of the buffer is :-

(1) 4 (2) 7 (3) 10 (4) 14

143. When 1.0 mL of dil. HCl acid is added to 100 mL of a buffer solution of pH 4.0. The pH of the solution

(1) Becomes 7 (2) Does not change

(3) Becomes 2 (4) Becomes 10

144. Which of the following solutions does not act as buffer :–

(1) $H_3PO_4 + NaH_2PO_4$

(2) $NaHCO_3 + H_2CO_3$

(3) $NH_4Cl + HCl$

(4) $CH_3COOH + CH_3COONa$

145. 50 mL of 2N acetic acid mixed with 10 mL of 1N sodium acetate solution will have an approximate pH of ($K_a = 10^{-5}$) :–

(1) 4 (2) 5 (3) 6 (4) 7

146. On addition of NaOH to CH_3COOH solution, 60% of the acid is neutralised. If pK_a of CH_3COOH is 4.7 then the pH of the resulting solution is :-

(1) More than 4.7 but less than 5.0

(2) Less than 4.7 but more than 4.0

(3) More than 5.0

(4) Remains unchanged

147. 500 mL of 0.2 M acetic acid are added to 500 mL of 0.30 M sodium acetate solution. If the dissociation constant of acetic acid is 1.5×10^{-5} then pH of the resulting solution is :-

(1) 5.0 (2) 9.0 (3) 3.0 (4) 4.0

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

(1) 3.6990 (2) 10.3010

(3) 3.85 (4) 4.3010

149. A solution contains 0.2M NH_4OH and 0.2M NH_4Cl. If 1.0 mL of 0.001 M HCl is added to it. What will be the [OH^-] of the resulting solution [$K_b = 2 \times 10^{-5}$] :-

(1) 2×10^{-5} (2) 5×10^{-10}

(3) 2×10^{-3} (4) None of these

150. Hunderson equation $pH - pK_a = 1$ will be applicable to an acidic buffer when :-

(1) [Acid] = [Conjugate base]

(2) [Acid] × 10 = [Conjugate base]

(3) [Acid] = [Conjugate base] × 10

(4) None of these

151. 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 : $K_b(NH_4OH) = 1.8 \times 10^{-5}$

(1) 3.0×10^{-3} (2) 9.0×10^{-4}

(3) 9.0×10^{-3} (4) 3.0×10^{-4}

152. When 0.02 moles of NaOH are added to a litre of buffer solution, its pH changes from 5.75 to 5.80. What is its buffer capacity :-

(1) 0.4 (2) 0.05

(3) – 0.05 (4) 2.5

153. Calculate the pH of a buffer prepared by mixing 300 cc of 0.3 M NH_3 and 500 cc of 0.5 M NH_4Cl. K_b for $NH_3 = 1.8 \times 10^{-5}$:-

(1) 8.1187 (2) 9.8117

(3) 8.8117 (4) None of these

154. What amount of sodium propanoate should be added to one litre of an aqueous solution containing 0.02 mole of propanoic acid (Ka = 1.34×10^{-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

155. 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

156. When 20 mL of $\frac{M}{20}$ NaOH are added to 10 mL of $\frac{M}{10}$ HCl, the resulting solution will:-

(1) Turn blue litmus red

(2) Turn phenolphthalein solution

(3) Turn methyl orange red

(4) Will have no effect on either red or blue litmus

157. 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

158. What is the suitable indicator for titration of NaOH and oxalic acid:-

(1) Methyl orange (2) Methyl red

(3) Phenolphthalein (4) Starch solution

159. 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) $Ba(OH)_2$ and HCl

ACID AND BASE

160. The conjugated acid of O^{-2} ion's is :-

(1) O_2^+ (2) H^+

(3) H_3O^+ (4) OH^-

161. Amphoteric oxide is:-

(1) NO_2 (2) CO_2

(3) Al_2O_3 (4) (1) & (3) both

162. Ionization constant of AOH and BOH base one K_{b_1} and K_{b_2}. Their relation is $pK_{b_1} < pK_{b_2}$. Conjugate of following base, does not show maximum pH :

(1) AOH (2) BOH

(3) Both of them (4) NOT

163. Select the species which can function as - Lewis base, bronsted acid and bronsted base:-

(a) H_2O (b) NH_4^+ (c) N^{-3}

Correct code is :-

(1) Only a (2) a, b

(3) a, c (4) b, c

164. An example of Lewis acid is:-

(1) CaO (2) CH_3NH_2

(3) SO_3 (4) None of these

165. In the reaction $NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$ water behaves as :-

(1) Acid (2) Base

(3) Neutral (4) Both acid & Base

166. Which acts as Lewis base in the reaction

$BCl_3 + :PH_3 \rightarrow Cl_3B \leftarrow PH_3$

(1) PH_3 (2) BCl_3

(3) Both 1 & 2 (4) None

167. In the dissociation , $H_2A \overset{K_1}{\rightleftharpoons} H^+ + HA^-$

$HA^- \overset{K_2}{\rightleftharpoons} H^+ + A^{-2}$

(1) K_1 is equal to K_2

(2) K_1 is smaller than K_2

(3) K_1 is greater than K_2

(4) K_1 is negligible

168. Which is the strongest Lewis base :–

(1) SbH_3 (2) AsH_3

(3) PH_3 (4) NH_3

169. Conjugate base of hydrazoic acid is :-

(1) HN_3^- (2) N_3^- (3) N^{3-} (4) N_2^-

170. NH_3 gas dissolves in water to give NH_4OH, in this reaction, water acts as :-

(1) An acid (2) A base

(3) A salt (4) A conjugate base

171. When ammonia is added to water it decreases the concentration of which of the following ion

(1) OH^- (2) H_3O^+

(3) NH_4^+ (4) None

172. The strongest acid among the following is -

(1) $ClO_3(OH)$ (2) $ClO_2(OH)$

(3) $SO(OH)_2$ (4) $SO_2(OH)_2$

173. The mixed salt among the following is :-

(1) $\begin{array}{l} CH(OH)COONa \\ | \\ CH(OH)COONa \end{array}$ (2) $NaKSO_4$

(3) $CaCl_2$ (4) All

174. For two acids A and B, $pKa_1 = 1.2$, $pKa_2 = 2.8$ respectively in value, then which is true:-

(1) A & B both are equally acidic

(2) A is stronger than B

(3) B is stronger than A

(4) None of these

175. Which of the following example behave as a Lewis acid BF_3 , $SnCl_2$, $SnCl_4$:-

(1) Stanus chloride , stanic chloride

(2) BF_3 , Stanus chloride

(3) Only BF_3

(4) BF_3 , stanus chloride, stanic chloride

176. In the reaction

$HNO_3 + H_2O \rightleftharpoons H_3O^+ + NO_3^-$, the conjugate base of HNO_3 is :-

(1) H_2O (2) H_3O^+

(3) NO_3^- (4) H_3O^+ and NO_3^-

177. The two Bronsted bases in the reaction

$HC_2O_4^- + PO_4^{3-} \rightleftharpoons HPO_4^{2-} + C_2O_4^{2-}$ are

(1) $HC_2O_4^-$ and PO_4^{2-}

(2) HPO_4^{2-} and $C_2O_4^{2-}$

(3) PO_4^{3-} and $C_2O_4^{-2}$

(4) $HC_2O_4^-$ and HPO_4^{2-}

178. Which one of the following is the weakest base:-

(1) NaOH (2) NH_4OH

(3) $Ca(OH)_2$ (4) $Ba(OH)_2$

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

(1) $NH_3 + HCl \rightarrow NH_4Cl$

(2) $NH_3 + H^+ \rightarrow NH_4^+$

(3) $NH_3 + Na \rightarrow NaNH_2 + \frac{1}{2}H_2$

(4) NH_3 cannot act as acid

180. Consider the following reactions :-

(i) $CO_3^{2-} + H_2O \rightleftharpoons HCO_3^- + OH^-$

(ii) $CO_2 + H_2O \rightleftharpoons H_2CO_3$

(iii) $NH_3 + H_2O \rightleftharpoons NH_4OH$

(iv) $HCl + H_2O \rightleftharpoons Cl^- + H_3O^+$

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)

181. CH_3COO^- ion is a :-

(1) Weak conjugate base

(2) Strong conjugate base

(3) Weak conjugate acid

(4) Strong conjugate acid

182. Which of the following is strongest conjugate base

(1) ClO_4^- (2) HCO_3^-

(3) F^- (4) HSO_4^-

183. Which of the following is not a Lewis base :-

(1) CN^- (2) ROH

(3) NH_3 (4) $AlCl_3$

184. Which of the following is acid :-

(1) NH_4Cl (2) $MgCl_2$

(3) CO_2 (4) H_2O

185. Aluminium chloride is :-

(1) Bronsted Lowry acid (2) Arrhenius acid

(3) Lewis acid (4) Lewis base

186. Water is a :-

(1) Protogenic solvent

(2) Protophilic solvent

(3) Amphiprotic solvent

(4) Aprotic solvent

187. Ammonium ion is :-

(1) A conjugate acid

(2) A conjugate base

(3) Neither an acid nor a basic

(4) Both an acid and a base

188. Which of the following is not a correct statement

(1) Arrhenius theory of acids-bases is capable of explaining the acidic or basic nature of the substances in the solvents other than water

(2) Arrhenius theory does not explain acidic nature of $AlCl_3$

(3) The aqueous solution of Na_2CO_3 is alkaline although it does not contain OH^- ions

(4) Aqueous solution of CO_2 is acidic although it does not contain H^+ ions

189. For the reaction $NH_4^+ + S^{-2} \rightleftharpoons NH_3 + HS^-$, NH_3 and S^{-2} are a group of :-

(1) Acids

(2) Bases

(3) Acid-base pair

(4) None of these

ANSWER KEY [EXERCISE-I]

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	2	4	2	3	4	3	1	2	4	1	2	4	4	3	4
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	4	1	1	1	1	3	4	1	2	3	4	1	1	2	4
Que.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans.	4	1	1	4	2	3	3	3	3	3	2	3	3	4	4
Que.	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	2	4	4	3	2	4	3	1	3	3	4	4	1	1	2
Que.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Ans.	4	2	2	3	4	4	2	2	2	4	2	3	3	1	1
Que.	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Ans.	2	2	2	4	3	2	4	3	1	2	1	2	4	4	3
Que.	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
Ans.	3	1	4	3	2	3	4	3	4	4	2	1	4	2	2
Que.	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
Ans.	1	3	2	2	2	2	1	2	2	3	2	3	2	3	1
Que.	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135
Ans.	4	4	4	4	2	1	2	3	1	4	3	3	3	1	1
Que.	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150
Ans.	1	3	4	3	1	1	1	2	3	1	1	1	1	1	2
Que.	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165
Ans.	2	1	3	4	3	4	1	3	3	4	3	2	1	3	1
Que.	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
Ans.	1	3	4	2	1	2	1	2	2	4	3	3	2	3	3
Que.	181	182	183	184	185	186	187	188	189						
Ans.	2	2	4	3	3	3	1	1	2						