TOPIC : IONIC EQUILIBRIUM

1.Which of the following expressions is/are not true ?

(A) $[H^+] = [OH^-] = \sqrt{K_w}$ for a neutral solution at all temperatures.

(B) $[H^+] > \sqrt{K_w}$ & $[OH^-] < \sqrt{K_w}$ for an acidic solution

(C) $[H^+] < \sqrt{K_w}$ & $[OH^-] > \sqrt{K_w}$ for an alkaline solution

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

2 . Addition of HCl will not suppress the ionization of-

(A) acetic acid (B) Benzoic acid (C) H_2S (D) Sulphuric acid

3 . An acid solution of pH 6 is diluted thousand times. The pH of solution becomes approx-

(A) 6.96 (B) 6 (C) 4 (D) 9

4 . pOH of H_2O is 7.0 at 298 K. If water is heated at 350 K, which of the following should be true ?

(A) pOH will decrease (B) pOH will increase

(C) pOH will remain 7.0 (D) concentration of H^+ ions will increase but that of OH^- will decrease

5 . Which of the following solution will have a pH exactly equal to 8 ?

(A) 10^{-8} M HCl solution at 25°C (B) 10^{-8} M H^+ solution at 25°

(C) 2×10^{-6} M $Ba(OH)_2$ solution at 25° C (D) 10^{-6} M NaOH solution at 50° C

6 . The number of hydrogen ions in 10 mL of a solution with pH = 13 is-

(A) 10^{13} (B) 6.023×10^8 (C) 6.023×10^{13} (D) 6.023×10^{10}

7.At 55°C autoprotolysis constant of water is 4×10^{-14}.If a given sample of water has a pH of 6.9, then it is-

(A) acidic (B) basic (C) neutral (D) explosive

8 . 0.1 mol HCl is dissolved in distilled water of volume V then $V \xrightarrow{\lim} \infty \ (pH)_{solution}$ is equal to-

(A) zero (B) 1 (C) 7 (D) 14

9 . A 50mL solution of pH = 1 is mixed with a 50 mL solution of pH = 2. then pH of the mixture will be nearly

(A) 0.76 (B) 1.26 (C) 1.76 (D) 2.26

1 0 . The pH of a solution obtained by mixing 50 mL of 0.4 N HCl and 50 mL of 0.2 N NaOH is-

(A) – log 2 (B) – log 0.2 (C) 1.0 (D) 2.0

1 1 . The pH of a solution is 7.00. To this solution sufficient base is added to increase the pH to 12.0. The increase OH^- ion concentration is-

(A) 5 times (B) 1000 times (C) 10^5 times (D) 4 times

1 2 . Which of the following solution will have pH close to 1.0 ?

(A) 100 mL of M/10HCl + 100 mL of M/10 NaOH (B) 55 mL of M/10 HCl + 45 mL of M/10 NaOH

(C) 10 mL of M/10 HCl + 90 mL of M/10 NaOH (D) 75 mL of M/5 HCl + 25 mL of M/5 NaOH.

1 3 . The dissociation constants of two acids HA_1 and HA_2 are 3.0×10^{-4} and 1.8×10^{-5} respectively. The relative strengths of the acids will be approximately-

(A) 1 : 4 (B) 4 : 1 (C) 1 : 16 (D) 16 : 1

1 4 . Which of the following is true-

(A) pk_b for OH^- is – 1.74 at 25°C

(B) the equilibrium constant for the reaction between HA(pK_a=4)and NaOH at 25°C will be equal to 10^{10}

(C) the pH of a solution containing 0.1 M HCOOH ($k_a = 1.8 \times 10^{-4}$) and 0.1 M HOCN.(ka = 3.2×10^{-4}) will be

nearly (3 – log 7).

(D) all the above are correct.

1 5 . Which statement/relationship is correct ?

(A) upon hydrolysis of salt of a strong base and weak acid gives a solution with pH < 7

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

(C) only at 25 °C the pH of water is 7

(D) the value of pK_w at 25 °C is 7

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ASSAINGMENT-2

1 . If 50 mL of 0.2 (M) KOH is added to 40 mL of 0.5(M) HCOOH. The pH of the resulting solution is ($K = 1.8 \times 10^{-4}$) :

(A) 3.75 (B) 5.6 (C) 7.5 (D) 3.4

2 . 50% neutralization of a solution of formic acid ($K_a = 2 \times 10^{-4}$) with NaOH would result in a solution having a hydrogen ion concentration of-

(A) 2×10^{-4} (B) 3.7 (C) 2.7 (D) 1.85

3 . The correct order of increasing $[H_3O^+]$ in the following aqueous solution is-

(A) 0.01 M H_2S < 0.01 M H_2SO_4 < 0.01 M NaCl < 0.01 M $NaNO_2$

(B) 0.01 M NaCl < 0.01 M $NaNO_2$ < 0.01 M H_2S < 0.01 M H_2SO_4

(C) 0.01 M $NaNO_2$ < 0.01 M NaCl < 0.01 M H_2S < 0.01 M H_2SO_4

(D) 0.01 M H_2S < 0.01 M $NaNO_2$ < 0.01 M NaCl < 0.01 M H_2SO_4

4 . The sodium salt of a certain weak monobasic organic acid is hydrolysed to an extent of 3% in its 0.1 M solution at 25 °C. Given that the ionic product of water is 10^{-14} at this temperature, what is the dissociation constant of the acid ?

(A) $\approx 1 \times 10^{-10}$ (B) $\approx 1 \times 10^{-9}$ (C) 3.33×10^{-9} (D) 3.33×10^{-10}

5 . The correct order for the increasing extent of hydrolysis is-

(A) $PO_4^{3-} < HPO_4^{2-} < H_2PO_4^-$

(B) $H_2PO_4^- < HPO_4^{2-} < PO_4^{3-}$

(C) $HPO_4^{2-} < PO_4^{3-} < H_2PO_4^-$

(D) $PO_4^{3-} < H_3PO_4^- < HPO_4^{2-}$

6 . The correct order of increasing pH of decimolar solution of each of the following in-

(A) $NH_4NO_3 < NaNO_3 < NaHCO_3 < Na_2CO_3$

(B) $NaNO_3 < NH_4NO_3 < NaHCO_3 < Na_2CO_3$

(C) $NaNO_3 < NH_4NO_3 < Na_2CO_3 < NaHCO_3$

(D) $Na_2CO_3 < NaHCO_3 < NaNO_3 < NH_4NO_3$

7 . When 100 mL of 0.4 M CH_3COOH are mixed with 100 mL of 0.2 M NaOH, the $[H_3O^+]$ in the solution is approximately : [$K_a(CH_3COOH) = 1.8 \times 10^{-5}$]

(A) 1.8×10^{-6} (B) 1.8×10^{-5} (C) 9×10^{-6} (D) 9×10^{-5}

8 . A solution is 0.1 M CH_3COOH and 0.1 M CH_3COONa. Which of the following will change the pH significantly, of the solution ?

(A) addition of water

(B) addition of CH_3COONa without change in volume

(C) addition of CH_3COOH without change in volume

(D) none will change the pH significantly

9 . What will be the pH at the equivalence point during the titration of a 100 mL 0.2 M solution of CH_3COONa with 0.2 M solution of HCl ? $K_a = 2 \times 10^{-5}$

(A) 3 – log 2 (B) 3 + log 2 (C) 3 – log 2 (D) 3 + log 2

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

(A) 4 mL (B) 7.95 mL (C) 2 mL (D) 9.3 mL

11 . The pH of a solution obtained by mixing 100 mL of 0.2 M CH_3COOH with 100 mL of 0.2 M NaOH would be (pKa for CH3COOH = 4.74 and log 2 = 0.301)

(A) 4.74 (B) 8.87 (C) 9.10 (D) 8.57

12 . Which of the following when added to 1.0 L of 0.5 M HCl would result in maximum increase in pH ?

(A) 0.5 mol CH_3COOH (B) 1.0 mol NaCl (C) 0.4 mol NaOH (D) 0 .6 mole CH_3COONa

13 . What % of the carbon in the H_2CO_3, HCO_3^-. Buffer should be in the form of HCO_3^- so as to have a neutral solution ? ($Ka = 4 \times 10^{-7}$)

(A) 20 % (B) 40 % (C) 60 % (D) 80 %

14 . Which of the following solution would have same pH ?

(A) 100 mL of 0.2 M HCl + 100 mL of 0.4 M NH_3

(B) 50 mL of 0.1 M HCl + 50 mL of 0.2 M NH_3

(C) 100 mL of 0.3 M HCl + 100 mL of 0.6 M NH_3

(D) All will have same pH

15 . 50 mL of 0.1 M NaOH is added to 60 mL of 0.15 M H_3PO_4 solution (K_1, K_2 and K_3 may be taken as 10^{-3}, 10^{-8} and 10^{-13} respectively). The pH of the mixture would be about-

(A) 3.1 (B) 5.5 (C) 4.1 (D) 6.5

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ASSAINGMENT-3

1 . The solubility of a certain sparingly soluble substance MX_n is nearly 1.4×10^{-4} M. If the solubility Product is 1.1×10^{-11}, what is the value of n ?

(A) 1 (B) 2 (C) 3 (D) 1.5

2 . The concentration of Mg^{2+} in the solution made by mixing 10 mL of 0.25 M $Mg(NO_3)_2$ and 25 mL of 0.2 M NaF will be ($Ksp(MgF_2 = 8 \times 10^{-8}$)

(A) 0.0027 M (B) 0.0714 M (C) 0.0030 M (D) 0.0060 M

3 . The pH of a saturated solution of $Mg(OH)_2$ in water will be ($K_{sp} = 4 \times 10^{-12}$)

(A) 4 – log 2 (B) 10 – log 2 (C) 4 + log 2 (D) 10 + log 2

4 . In which of the following solvents will AgBr has highest solubility-

(A) 10^{-3} M NaBr (B) 10^{-3} M NH_4OH (C) pure water (D) 10^{-3} M HBr

5. In the system $CaF_2(s) \rightleftharpoons Ca^{+2}(aq) + 2F^-$ increasing the concentration of Ca^{2+} ions 4 times will cause the equilibrium concentration of F^- ions to change to .... times the initial value.

(A) 4 (B) 1/2 (C) 2 (D) 1/4

6 . The solubility of $Fe(OH)_3$ would be maximum in-

(A) 0.1 M NaOH (B) 0.1 M HCl (C) 0.1 M KOH (D) 0.1 M H_2SO_4

7. Arrange in increasing order of solubility of AgBr in solutions given :

(i) 0.1 M NH_3 (ii) 0.1 M $AgNO_3$ (iii) 0.2 M NaBr (iv) pure water

(A) (iii) < (ii) < (iv) < (i) (B) (iii) < (ii) < (i) < (iv) (C) (iii) < (ii) = (i) < (iv) (D) (ii) < (iii) < (iv) < (i)

8 . The solubility product of $BaCrO_4$ is 2.4×10^{-10} M^2. The maximum concentration of $Ba(NO_3)_2$ possible Without precipitation in a 6×10^{-4} M K_2CrO_4 solution is-

(A) 4×10^{-7} M (B) 1.2×10^{10} M (C) 6×10^{-4} M (D) 3×10^{-4}M

9 . At 25 °C, the solubility product values of AgCl and AgCNS are 1.7×10^{-10} and 1.0×10^{-12} respectively. When water is saturated with both solids, calculate the ratio $[Cl^-]/[CNS^-]$ and also $[Ag^+]$ in the solution.

(A) 1.3×10^2, 1.7×10^{-5} M (B) 1.7×10^2, 1.308×10^{-5} M

(C) 1.3×10^4, 1.308×10^{-4} M (D) 1.7×10^3, 1.67×10^{-6} M

10 . When pure water is saturated with $CaCO_3$ and CaC_2O_4, the concentration of calcium ion in the solution under equilibrium is 8.426×10^{-5} M. If the ratio of the solubility product of $CaCO_3$ to that of CaC_2O_4 is 2.087, what is the solubility product of $CaCO_3$ in pure water ?

(A) 4.80×10^{-8} (B) 9.60×10^{-9} (C) 9.60×10^{-8} (D) 4.80×10^{-9}

11 . The solubility of Ag_2CO_3 in water at 25 °C is 1×10^{-4} mole/litre. What is its solubility in 0.1 M Na_2CO_3 solution ? Assume no hydrolysis of CO_3^{2-} ion.

(A) 6.323×10^{-6} mole/litre (B) 4.74×10^{-5} mole/litre

(C) 3.16×10^{-6} mole/litre (D) 5.51×10^{-5} mole/litre

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

(A) 108 x^2 (B) 36 x^3 (C) 36 x^5 (D) 108 x^5

13 . The solubility product of AgCl is 1.8×10^{-10}. Precipitation of AgCl will occur only when equal volumes of solutions of-

(A) 10^{-4} M Ag^+ and 10^{-4} M Cl– are mixed (B) 10^{-7} M Ag^+ and 10^{-7} M Cl^- are mixed

(C) 10–5 M Ag+ and 10–5 M Cl– are mixed (D) 10^{-10} M Ag^+ and 10^{-10} M Cl– are mixed

14. The precipitate of CaF_2(Ksp = 1.7×10^{-10}) is obtained when equal volumes of the following are mixed.

(A) 10^{-4} M Ca^{2+} + 10^{-4} M F^- (B) 10^{-2} M Ca^{2+} + 10^{-3} M F^-

(C) 10^{-5} M Ca^{2+} + 10^{-3} M F– (D) 10^{-3} M ca^{2+} + 10^{-5} M F^-

15 . Let the solubilities of AgCl in H_2O, 0.01 M $CaCl_2$, 0.01 M NaCl & 0.05 M $AgNO_3$ be S_1, S_2, S_3 & S_4 respectively what is the correct relationship between these quantities. Neglect any complexation.

(A) $S_1 > S_2 > S_3 > S_4$ (B) $S_1 > S_2 = S_3 > S_4$

(C) $S_1 > S_3 > S_2 > S_4$ (D) $S_4 > S_2 > S_3 > S_1$