

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 $25^\circ C$ (B) $10^{-8} M$ H^+ solution at 25°

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

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 $55^\circ C$ 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 50 mL 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

10. 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

11. 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

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

(A) 100 mL of M/10 HCl + 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.

13. 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

14. Which of the following is true-

(A) pK_b for OH^- is -1.74 at $25^\circ C$

(B) the equilibrium constant for the reaction between HA ($pK_a=4$) and NaOH at $25^\circ C$ 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. ($K_a = 3.2 \times 10^{-4}$) will be

nearly $(3 - \log 7)$.

(D) all the above are correct.

15 . Which statement/relationship is correct ?

(A) upon hydrolysis of salt of a strong base and weak acid gives a solution with $\text{pH} < 7$

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

(C) only at 25°C the pH of water is 7

(D) the value of pK_w at 25°C is 7

**TOPIC : IONIC EQUILIBRIUM
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) $0.01\text{ M H}_2\text{S} < 0.01\text{ M H}_2\text{SO}_4 < 0.01\text{ M NaCl} < 0.01\text{ M NaNO}_2$
 (B) $0.01\text{ M NaCl} < 0.01\text{ M NaNO}_2 < 0.01\text{ M H}_2\text{S} < 0.01\text{ M H}_2\text{SO}_4$
 (C) $0.01\text{ M NaNO}_2 < 0.01\text{ M NaCl} < 0.01\text{ M H}_2\text{S} < 0.01\text{ M H}_2\text{SO}_4$
 (D) $0.01\text{ M H}_2\text{S} < 0.01\text{ M NaNO}_2 < 0.01\text{ M NaCl} < 0.01\text{ M H}_2\text{SO}_4$
 - 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) $\text{PO}_4^{3-} < \text{HPO}_4^{2-} < \text{H}_2\text{PO}_4^-$
 (B) $\text{H}_2\text{PO}_4^- < \text{HPO}_4^{2-} < \text{PO}_4^{3-}$
 (C) $\text{HPO}_4^{2-} < \text{PO}_4^{3-} < \text{H}_2\text{PO}_4^-$
 (D) $\text{PO}_4^{3-} < \text{H}_3\text{PO}_4^- < \text{HPO}_4^{2-}$
 - 6 . The correct order of increasing pH of decimolar solution of each of the following in-

(A) $\text{NH}_4\text{NO}_3 < \text{NaNO}_3 < \text{NaHCO}_3 < \text{Na}_2\text{CO}_3$
 (B) $\text{NaNO}_3 < \text{NH}_4\text{NO}_3 < \text{NaHCO}_3 < \text{Na}_2\text{CO}_3$
 (C) $\text{NaNO}_3 < \text{NH}_4\text{NO}_3 < \text{Na}_2\text{CO}_3 < \text{NaHCO}_3$
 (D) $\text{Na}_2\text{CO}_3 < \text{NaHCO}_3 < \text{NaNO}_3 < \text{NH}_4\text{NO}_3$
 - 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 : [$K_a(\text{CH}_3\text{COOH}) = 1.8 \times 10^{-5}$]

(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-

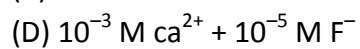
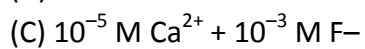
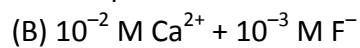
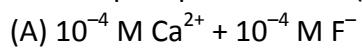
(A) 4 mL (B) 7.95 mL (C) 2 mL (D) 9.3 mL
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- 11 . The pH of a solution obtained by mixing 100 mL of 0.2 M CH_3COOH with 100 mL of 0.2 M NaOH would be (pK_a for $\text{CH}_3\text{COOH} = 4.74$ and $\log 2 = 0.301$)
(A) 4.74 (B) 8.87 (C) 9.10 (D) 8.57
- 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 ? ($\text{K}_a = 4 \times 10^{-7}$)
(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

TOPIC : IONIC EQUILIBRIUM
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 $\text{Mg}(\text{NO}_3)_2$ and 25 mL of 0.2 M NaF will be ($K_{sp}(\text{MgF}_2) = 8 \times 10^{-8}$)
 (A) 0.0027 M (B) 0.0714 M (C) 0.0030 M (D) 0.0060 M
- 3 . The pH of a saturated solution of $\text{Mg}(\text{OH})_2$ 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 $\text{CaF}_2(\text{s}) \rightleftharpoons \text{Ca}^{2+}(\text{aq}) + 2\text{F}^{-}$ 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 $\text{Fe}(\text{OH})_3$ 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 $\text{Ba}(\text{NO}_3)_2$ 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 $[\text{Cl}^-]/[\text{CNS}^-]$ and also $[\text{Ag}^+]$ in the solution.
 (A) $1.3 \times 10^2, 1.7 \times 10^{-5}$ M (B) $1.7 \times 10^2, 1.308 \times 10^{-5}$ M
 (C) $1.3 \times 10^4, 1.308 \times 10^{-4}$ M (D) $1.7 \times 10^3, 1.67 \times 10^{-6}$ 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 ($K_{sp} = 1.7 \times 10^{-10}$) is obtained when equal volumes of the following are mixed.



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.

