1. The indicator constant for an acidic indicator, HIn is 5×10^{-6} M. This indicator appears only in the colour of acidic form when $\frac{[In^-]}{[HIn]} \le \frac{1}{20}$ and it appears only in the colour of basic form when $\frac{[HIn]}{[In^-]} \le \frac{1}{40}$. The pH range of indicator is

(A) 3.7 – 6.9 (B) 4.0 – 6.6 (C) 4.0 – 6.9 (D) 3.7 – 6.6

2. What will be the pOH at the equivalence point during the titration of a 100 mL, 0.2 M solution of NH_4Cl with 0.2 M solution of NaOH ? K_b for ammonium hydroxide = 2×10^{-5}.

(A) $3 - \log\sqrt{2}$ (B) $3 + \log\sqrt{2}$ (C) $3 - \log 2$ (D) $3 + \log 2$

3. To a 100 mL of 0.1 M weak acid HA solution, 22.5 mL of 0.2 M solution of NaOH are added. Now, what volume of 0.1 M NaOH solution be added into above solution, so that pH of resulting solution be 4.7

[Given : ($K_b(A^-) = 5 \times 10^{-10}$)]

(A) 5 mL (B) 20 mL (C) 10 mL (D) 15 mL

4. 60 mL of 0.2 M $Ba(OH)_2$ solution is added to 50 mL of 0.6 N H_3PO_4 solution. The pH of the mixture would be about : (K_{a1}, K_{a2} and K_{a3} for H_3PO_4 are 10^{-3}, 10^{-8} and 10^{-12} respectively).

(A) 11.82 (B) 3.6 (C) 12.18 (D)7.82

Solubility of sparingly soluble salt:

5. The solubility of A_2X salt (producing A^+ & X^{2-} ions in aqueous solution) in pure water is y mol dm^{-3}. Its solubility product is :

(A) 27 y^4 (B) 8 y^3 (C) 2 y^2 (D) 4 y^3

6. The solubility of sparingly soluble electrolyte M_mA_a (producing M^{a+} & A^{m-} ions in aqueous solution) in water is given by the expression :

(A) $s = \left(\frac{K_{sp}}{m^m a^a}\right)^{m+a}$ (B) $s = \left(\frac{K_{sp}}{m^m a^a}\right)^{1/m+a}$ (C) $s = \left(\frac{K_{sp}}{m^a a^m}\right)^{m+a}$ (D) $s = \left(\frac{K_{sp}}{m^a a^m}\right)^{1/m+a}$

7. Calculate the solubility of A_2X_3 (producing A^{3+} & X^{2-} ions in aqueous solution) in pure water, assuming that neither kind of ion reacts with water. For A_2X_3, $K_{sp} = 1.08 \times 10^{-23}$.

(A) 8×10^{-7} mol L^{-1} (B) 10^{-5} mol L^{-1} (C) 6.4×10^{-5} mol L^{-1} (D) 2×10^{-5} mol L^{-1}

8. A particular saturated solution of silver chromate, Ag_2CrO_4, has $[Ag^+] = 5 \times 10^{-5}$ M and $[CrO_4^{2-}] = 4.4 \times 10^{-4}$ M. What is value of K_{sp} for Ag_2CrO_4 ?

(A) 1.1×10^{-12} (B) 2.2×10^{-8} (C) 9.68×10^{-12} (D) 4.4×10^{-12}

9. If the solubility of Ag_2SO_4 in 10^{-2} M Na_2SO_4 solution be 2×10^{-8} M, then K_{sp} of Ag_2SO_4 will be :

(A) 32×10^{-24} (B) 16×10^{-18} (C) 32×10^{-18} (D) 16×10^{-24}

10. A solution is saturated with respect to $SrCO_3$ & SrF_2. The $[CO_3^{2-}]$ was found to be 1.2×10^{-3} M. The concentration of F^- in the solution would be : $K_{sp}(SrCO_3) = 10^{-9}$, $K_{sp}(SrF_2) = 3 \times 10^{-11}$.

(A) 3×10^{-3} M (B) 3.6×10^{-5} M (C) 6×10^{-3} M (D) 6×10^{-2} M

11. Buffer solutions have constant acidity and alkalinity because :

(A) these give unionised acid or base on reaction with added acid or alkali.

(B) acids and alkalies in these solution are shielded from attack by other ions.

(C) they have large excess of H^+ or OH^- ions

(D) they have fixed value of pH.

12. Three sparingly soluble salts M_2X, MX and MX_3 have the solubility product are in the ratio of 4: 1 : 27. Their solubilities will be in the order :

(A) $MX_3 > MX > M_2X$ (B) $MX_3 > M_2X > MX$

(C) $MX > MX_3 > M_2X$ (D) $MX > M_2X > MX_3$

13. A student wants to prepare a saturated solution containing Ag^+ ion. He has got three salts : AgCl ($K_{sp} = 10^{-10}$), AgBr ($K_{sp} = 1.6 \times 10^{-13}$) and Ag_2CrO_4 ($K_{sp} = 3.2 \times 10^{-11}$). Which of the above compounds will be used by him in minimum weight to prepare 1 L of saturated solution ?

(A) AgCl (B) AgBr (C) Ag_2CrO_4 (D) any of the above

14. The solubility of CaF_2 in water at 1518°C is 2×10^{-4} mole/litre. Calculate K_{sp} of CaF_2 and its solubility in 0.1 M NaF solution. Assume no hydrolysis of cation or anion.

(A) $K_{sp} = 3.2 \times 10^{-11}$ (B) Solubility = 3.2×10^{-9} mole/litre

(C) Both (A) & (B) (D) None of these

15. The precipitate of CaF_2 (K_{sp} = 1.7 x 10^{-10}) is obtained when equal volumes of the following solutions are mixed:

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

(C) 10^{-4} M Ca^{2+} + 10^{-1} M F^- (D) 10^{-1} M Ca^{2+} + 10^{-4} M F^-

16. If the amount given below is added in pure water, will all of the salt dissolve before equilibrium can be established, or will some salt remain undissolved ?

(a) 4.96 mg of MgF_2 in 125 mL of pure water, K_{sp} of MgF_2 = 3.2 x 10^{-8}

(b) 3.9 mg of CaF_2 in 100 mL of pure water, K_{sp} of CaF_2 = 4 x 10^{-12}

Also find the percentage saturation in each case. Assume no hydrolysis of cation or anion.

(A) MgF_2 will completely dissolve (B) MgF_2 solution will have 32% saturation

(C) CaF_2 will not completely dissolve (D) CaF_2 solution will have 100% saturation

17. The solubility product for silver iodate $AgIO_3$ is 1 x 10^{-8} . If 0.1 g of solid $AgIO_3$ is added to 100 mL of 0.02 M KIO_3 solution, what are the concentrations of K^+, IO_3^- & Ag^+ at equilibrium?

(A) $[Ag^+] = 5 \times 10^{-7}$ M (B) $[IO_3^-] = 2 \times 10^{-2}$ M

(C) $[K^+] = 2 \times 10^{-2}$ M (D) $[IO_3^-]$ = 0.023 M

18. Calculate $[F^-]$ in a solution saturated with respect of both MgF_2 and SrF_2. Assume no hydrolysis of cation or anion.

$K_{sp}(MgF_2)$ = 9.5 x 10^{-9}, $K_{sp}(SrF_2)$ = 4 x 10^{-9}.

Report your answer after multiplying by 10^4.

19. pH of a saturated solution of $Ba(OH)_2$ is 12. The value of solubility product (K_{SP}) of $Ba(OH)_2$ is

(A) 3.3×10^{-7} (B) 5.0×10^{-7} (C) 4.0×10^{-6} (D) 5.0×10^{-6}

20. The solubility product of As_2O_3 is 10.8×10^{-9}. It is 50% dissociated in saturated solution. The solubility of salt is :

(A) 10^{-2} (B) 2×10^{-2} (C) 5×10^{-3} (D) 5.4×10^{-9}

21. On adding 0.1 M solution each of $[Ag^+]$, $[Ba^{2+}]$, $[Ca^{2+}]$ in a Na_2SO_4 solution, species first precipitated is

[K_{sp} $BaSO_4$ = 10^{-11}, K_{sp} $CaSO_4$ = 10^{-6} , K_{sp} Ag_2SO_4 = 10^{-5}]

(A) Ag_2SO_4 (B) $BaSO_4$ (C) $CaSO_4$ (D) All of these

Answers

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1. (C) **2.** (A) **3.** (A) **4.** (A) **5.** (D) **6.** (B) **7.** (B) **8.** (A) **9.** (B) **10.** (C)
11. (A) **12.** (B) **13.** (B) **14.** (C) **15.** (ABC) **16.** (ABCD) **17.** (ABC)
18. (30) **19.** (B) **20.** (B) **21.** (B)