PHYSICAL / INORGANIC CHEMISTRY

DPP
DAILY PRACTICE PROBLEMS

DPP No. 21

Total Marks : 48

Max. Time : 57 min.

Topic : Ionic Equilibrium

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks, 3 min.)	[12, 12]
Subjective Questions ('–1' negative marking) Q.5 to Q.13	(4 marks, 5 min.)	[36, 45]

1. The pK_a of iodic acid HIO_3 is log 6. Calculate the pH of a 1M HIO_3 solution
(A) log 6 (B) log 5 (C) log 4 (D) log 3

2. The pH of a solution containing 0.1 M CH_3COONa and 0.1 M $(C_2H_5COO)_2Ba$ will be $K_a(CH_3COOH) = 2 \times 10^{-5}$, $K_a(C_2H_5COOH) = 8 \times 10^{-6}$:
(A) 8.13 (B) 9.24 (C) 10.18 (D) 11.18

3. 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}

4. 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) 2×10^{-2} M (C) 6×10^{-2} M (D) 6×10^{-7} M

5. Find the solubility of CaF_2 in 0.5 M solution of $CaCl_2$ and water. How many times in solubility in the second case greater than in the first ? $K_{sp}(CaF_2) = 3.2 \times 10^{-11}$.

6. If you place the amounts given below 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, $K_{sp} = 3.2 \times 10^{-8}$
(b) 3.9 mg of CaF_2 in 100 ml of pure water, $K_{sp} = 4 \times 10^{-12}$
Also find the percentage saturation in each case.

7. The solubility product constant for silver iodate $AgIO_3$ is 1.0×10^{-8}. If 0.10 g of solid $AgIO_3$ is added to 100.0 ml of 0.02 M KIO_3, what are the concentrations of K^+, IO_3^- & Ag^+ at equilibrium?

8. Calculate the volume (mL) of 0.1 M Na_2SO_4 which must be added to 10 mL of HCl (pH = 1.0) so that pH of the resulting solution becomes two. (Given K_2 for $H_2SO_4 = 10^{-2}$]

9. Calculate the molar solubility of silver thiocyanate, AgSCN, in pure water & in water containing 0.01 M NaSCN. K_{sp} (AgSCN) = 10^{-12}.

10. Assume you place 1.234 g of solid $Ca(OH)_2$ in 1.00 litre of pure water at 25° C. The pH of the solution is found to be 12. Estimate the K_{sp} for $Ca(OH)_2$.

11. 25 ml clear saturated solution of PbI_2 (aq.) requires 12.5 ml of $AgNO_3$ (aq.) solution. What is molarity of $AgNO_3$ solution ? K_{sp} of PbI_2 is 5×10^{-10}, K_{sp} of AgI = 1.2×10^{-17} .

12. Calculate F^- in a solution saturated with respect of both MgF_2 and SrF_2.
$K_{sp}(MgF_2) = 9.5 \times 10^{-9}$, $K_{sp}(SrF_2) = 4 \times 10^{-9}$.

13. A solution is saturated with respect to $MgCO_3$ & Ag_2CO_3 . It is found to have $[Mg^{2+}] = 2.2 \times 10^{-5}$ M. Find $[Ag^+]$, given $K_{sp}(Ag_2CO_3) = 8.8 \times 10^{-12}$ M^3 and K_{sp} $(MgCO_3) = 1.6 \times 10^{-6}$ M^2.

Answer Key

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1. (D) **2.** (B) **3.** (B) **4.** (C)

5. 4×10^{-6} M, 2×10^{-4} M, 50 times.

6. (a) Will dissolve, 32% saturation (b) will not dissolve, 100% saturation.

7. $[Ag^+] = 5 \times 10^{-7}$M , $[IO_3^-] = 2 \times 10^{-2}$M, $[K^+] = 2 \times 10^{-2}$M. **8.** 15 ml. **9.** 10^{-6} M, 10^{-10} M.

10. $K_{sp} = 5 \times 10^{-7}$. **11.** 2×10^{-3}. **12.** $[F^-] = 3 \times 10^{-3}$M. **13.** 1.1×10^{-5} M.

Hints & Solutions

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3. $Ag_2SO_4 \rightleftharpoons 2Ag^+ + SO_4^{-2}$

$2s' \quad (s' + 10^{-2}) \approx 10^{-2}$

$K_{sp} = (2s')^2 (10^{-2}) = (2 \times 2 \times 10^{-8})^2 (10^{-2}) = 16 \times 10^{-18}$.