

Solubility Product Worksheet

1. Write the solubility product constant expression for the following:

- $\text{PbI}_2(s)$
- $\text{Cu}_3(\text{PO}_4)_2(s)$
- $\text{AgCN}(s)$

2. Excess PbI_2 is added to water and the resulting solution has an $[\text{I}^-]$ concentration of $1.21 \times 10^{-3} \text{ M}$. Find K_{sp} for PbI_2 ?

3. What is the K_{sp} value for AgCN , if the molar solubility of AgCN in pure water is $1.5 \times 10^{-8} \text{ M}$?

4. Find the molar solubility of AgCN in a $5 \times 10^{-6} \text{ M Ag}^+$ solution.

Compound	K_{sp}	Compound	K_{sp}
Ag_2CO_3	8.1×10^{-12}	CaC_2O_4	2.3×10^{-9}
BaCO_3	8.1×10^{-9}	AgCl	1.8×10^{-10}
CaCO_3	4.8×10^{-9}	$\text{Cr}(\text{OH})_3$	6.7×10^{-31}

5. Determine the molar solubility of CaC_2O_4 in water.

6. If Ag^+ and Cl^- are both present at 0.0001 M , will a precipitate form?

7. Suppose that 2.0 mL of $2.5 \times 10^{-5} \text{ M AgNO}_3$ and 8.0 mL of $1 \times 10^{-5} \text{ M HCl}$ are mixed together. Does precipitation occur?

8. If Na_2CO_3 is gradually added to a solution containing $1 \times 10^{-4} \text{ M Ag}^+$, $1 \times 10^{-4} \text{ M Ba}^{2+}$, and $1 \times 10^{-4} \text{ M Ca}^{2+}$, which carbonate is the first to begin precipitating?

9. In a saturated $\text{Cr}(\text{OH})_3$ solution, what is $[\text{Cr}^{+3}]$ if $\text{pH} = 8.5$?

Answers

1a. $K_{sp} = [\text{Pb}^{2+}][\text{I}^-]^2$

1b. $K_{sp} = [\text{Cu}^{2+}]^3[\text{PO}_4^{3-}]^2$

1c. $K_{sp} = [\text{Ag}^+][\text{CN}^-]$

2. 8.86×10^{-10}

3. 2.25×10^{-16}

4. $4.5 \times 10^{-11} \text{ M}$

5. $4.8 \times 10^{-5} \text{ M}$

6. $Q = 1 \times 10^{-8} > K_{sp}$, yes

7. $Q = 4 \times 10^{-11} < K_{sp}$, no

8. for Ag_2CO_3 , $[\text{CO}_3^{2-}] = 8.1 \times 10^{-4}$
for BaCO_3 , $[\text{CO}_3^{2-}] = 8.1 \times 10^{-5}$
for CaCO_3 , $[\text{CO}_3^{2-}] = 4.8 \times 10^{-5}$

since calcium carbonate requires the least amount of carbonate, it will precipitate first

9. $2.12 \times 10^{-14} \text{ M}$