

### 3Solubility Product Worksheet

- 1) What is the concentration of a saturated silver (I) acetate solution?  
 $K_{sp}(\text{AgC}_2\text{H}_3\text{O}_2) = 1.94 \times 10^{-3}$ .
  
- 2) What is the concentration of a saturated lead chloride solution?  
 $K_{sp}(\text{PbCl}_2) = 1.17 \times 10^{-5}$ .
  
- 3) I have discovered a new chemical compound with the formula  $\text{A}_2\text{B}$ . If a saturated solution of  $\text{A}_2\text{B}$  has a concentration of  $4.35 \times 10^{-4}$  M, what is the solubility product constant for  $\text{A}_2\text{B}$ ?
  
- 4) Solubility product constants are usually specified for  $25^\circ\text{C}$ . Why does the  $K_{sp}$  value for a chemical compound depend on the temperature?
  
- 5) The  $K_{sp}$  for nickel (II) hydroxide is  $5.47 \times 10^{-16}$ . What is the base dissociation constant for nickel (II) hydroxide?

## Solubility Product Worksheet - Answers

- 1) What is the concentration of a saturated silver (I) acetate solution?  
 $K_{sp}(\text{AgC}_2\text{H}_3\text{O}_2) = 1.94 \times 10^{-3}$ .

**Since  $K_{sp} = [\text{Ag}^+][\text{C}_2\text{H}_3\text{O}_2^-]$ , and the concentration of silver ions is the same as the concentration of acetate ions, we can set up the following equation:**

$$\begin{aligned}1.94 \times 10^{-3} &= x^2 \\ x &= 0.0440 \text{ M}\end{aligned}$$

- 2) What is the concentration of a saturated lead chloride solution?  
 $K_{sp}(\text{PbCl}_2) = 1.17 \times 10^{-5}$ .

**$K_{sp} = [\text{Pb}^{+2}][\text{Cl}^-]^2$ . Since the concentration of chloride ions is twice that of lead (II) ions, this boils down to the following equation:**

$$\begin{aligned}1.17 \times 10^{-5} &= (x)(2x)^2 \\ 1.17 \times 10^{-5} &= 4x^3 \\ x &= 0.0143 \text{ M}\end{aligned}$$

- 3) I have discovered a new chemical compound with the formula  $\text{A}_2\text{B}$ . If a saturated solution of  $\text{A}_2\text{B}$  has a concentration of  $4.35 \times 10^{-4}$  M, what is the solubility product constant for  $\text{A}_2\text{B}$ ?

**$K_{sp} = [\text{A}^+]^2[\text{B}^{2-}]$ . Since the concentration of A is twice that of B, and the concentration of B is  $4.35 \times 10^{-4}$  M, we can set up the following equation:**

$$\begin{aligned}K_{sp} &= [2(4.35 \times 10^{-4} \text{ M})]^2 [4.35 \times 10^{-4} \text{ M}] \\ K_{sp} &= 3.29 \times 10^{-10}\end{aligned}$$

- 4) Solubility product constants are usually specified for  $25^\circ \text{C}$ . Why does the  $K_{sp}$  value for a chemical compound depend on the temperature?

**$K_{sp}$  depends on temperature because solubility depends on temperature. Generally, solids become more soluble as the temperature of the solution increases. As a result,  $K_{sp}$  values of solids tend to increase as the temperature increases.**

- 5) The  $K_{sp}$  for nickel (II) hydroxide is  $5.47 \times 10^{-16}$ . What is the base dissociation constant for nickel (II) hydroxide?

**$5.47 \times 10^{-16}$ . Because nickel (II) hydroxide dissociates to become a base, the  $K_{sp}$  and  $K_b$  values are identical.**