

Section 7.6: Solubility Equilibria and the Solubility Product Constant

Tutorial 1 Practice, page 462

1. **Solution:** $[\text{MgCO}_3(\text{s})]$ is constant, so it is not included in the equation. Therefore,
 $K_{\text{sp}} = [\text{Mg}^{2+}(\text{aq})][\text{CO}_3^{2-}(\text{aq})]$

Statement: The solubility product constant equation for the solubility equilibrium is
 $K_{\text{sp}} = [\text{Mg}^{2+}(\text{aq})][\text{CO}_3^{2-}(\text{aq})]$

2. **Given:** iron(III) hydroxide dissolves in water

Required: K_{sp} equation

Solution:

Step 1. Write a balanced equation for the dissolution of iron(III) hydroxide in water.



Step 2. $[\text{Fe}(\text{OH})_3(\text{s})]$ is constant, so it is not included in the equation. Therefore,

$$K_{\text{sp}} = [\text{Fe}^3+(\text{aq})][\text{OH}^-(\text{aq})]^3$$

Statement: The solubility product constant equation for iron(III) hydroxide is

$$K_{\text{sp}} = [\text{Fe}^3+(\text{aq})][\text{OH}^-(\text{aq})]^3$$

3. **Given:** At 25 °C: $[\text{Ca}^{2+}(\text{aq})] = 4.53 \times 10^{-7} \text{ mol/L}$; $[\text{PO}_4^{3-}(\text{aq})] = 3.02 \times 10^{-7} \text{ mol/L}$

Required: K_{sp} of calcium phosphate at 25 °C

Solution:

Step 1. Write a balanced equation for the solution equilibrium.



Step 2. Write the solubility product constant equation for the equilibrium, omitting any solids.

$$K_{\text{sp}} = [\text{Ca}^{2+}(\text{aq})]^3[\text{PO}_4^{3-}(\text{aq})]^2$$

Step 3. Substitute the given ion concentrations into the K_{sp} equation and solve.

$$\begin{aligned} K_{\text{sp}} &= [\text{Ca}^{2+}(\text{aq})]^3[\text{PO}_4^{3-}(\text{aq})]^2 \\ &= (4.53 \times 10^{-7})^3(3.02 \times 10^{-7})^2 \\ K_{\text{sp}} &= 8.48 \times 10^{-33} \end{aligned}$$

Statement: The K_{sp} of calcium phosphate in a saturated solution at 25 °C is 8.48×10^{-33} .

Tutorial 2 Practice, page 464

1. **Given:** solubility of $\text{MgF}_2(\text{s}) = 1.72 \times 10^{-3} \text{ g/100 mL}$ at 25 °C

Required: K_{sp} of $\text{MgF}_2(\text{s})$ at 25 °C

Solution:

Step 1. Write the balanced equation.



Step 2. Write the solubility product constant equation.

$$K_{\text{sp}} = [\text{Mg}^{2+}(\text{aq})][\text{F}^-(\text{aq})]^2$$

Step 3. Determine the equilibrium concentrations in mol/L of the dissolved ions. Use an ICE table. Since the concentration of solid MgF_2 remains constant, it is not included.

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Michael Brown

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