

Lesson 24 & 25: Solubility Equilibrium I

text: 374-395

what to know:

- solubility terminology and effect of temperature on solubility, §9-1
- solubility, molar solubility and solubility product constant and their interconvertability, §9-2
- effect of common ion on solubility(qualitative), §9-3
- effect of pH on the solubility, §9-4
- concept of complex ions and their solubility(qualitative), §9-5
- lead all around you (page 403)

questions:

1. What is the effect of temperature on the solubility of salts?
2. Write the equilibrium equation for the dissolving of the following and the K_{sp} expression.
AgCl PbBr₂ Bi₂S₃ Fe(OH)₃
3. Given the solubility of CaF₂ (78 g/mole) as 0.0016 g/100 mL in water.
 - a. What is the [Ca²⁺] of a saturated solution of CaF₂?
 - b. What is the [F⁻] of a saturated solution of CaF₂?
 - c. What is the K_{sp} of CaF₂?
4. Calculate the molar solubility of PbCl₂ (278 g/mole) in water if its K_{sp} is 1.7×10^{-5} .
5. Circle those of the following which are soluble in aqueous HCl.
AgBr CaCO₃ Fe(OH)₃ BaSO₄ PbI₂ AlPO₄ ZnS
6. The molar solubility of Mg(OH)₂ in water is 1.4×10^{-4} M at 25 °C.
 - a. What is the K_{sp} for magnesium hydroxide at this T?
 - b. What is the pH of a saturated magnesium hydroxide solution?
 - c. Show with equations why the solubility of magnesium hydroxide is increased in acidic solutions.
7. Given the K_{sp} of Ag₂CrO₄ as 1.0×10^{-12} . What is its molar solubility?
8. The K_{sp} for Ca(OH)₂ is 8.0×10^{-6} . Show that a precipitate will not form when 2.00 mL of 0.200 M NaOH is added to 1.00 L of 0.100 M CaCl₂?
9. The solubility of Ag₃PO₄ is 6.7×10^{-3} g/L. The molar mass of Ag₃PO₄ is 419 g/mole. What is the K_{sp} of Ag₃PO₄?
10. Limestone caverns are formed when the limestone is dissolved by acidic water.
 - a. What is the chemical composition of limestone?
 - b. What normal substance in the atmosphere makes rain water acidic?
 - c. How is this process related to "hard" ground water?
11. Which of the following pairs of equations would demonstrate that zinc hydroxide is amphoteric?
 - a) $Zn(OH)_2 + 2H^+ \rightleftharpoons Zn^{2+} + 2H_2O$, $Zn(OH)_2 + 2OH^- \rightleftharpoons Zn(OH)_4^{2-}$
 - b) $Zn(OH)_2 + H^+ \rightleftharpoons Zn(OH)^+$, $Zn(OH)^+ + H^+ \rightleftharpoons Zn^{2+} + 2H_2O$
 - c) $Zn(OH)_2 + OH^- \rightleftharpoons Zn(OH)_3^-$, $Zn(OH)_3^- + OH^- \rightleftharpoons Zn(OH)_4^{2-}$
12. K_{sp} s for Cu(OH)₂ and Mg(OH)₂ are 2.2×10^{-20} and 6×10^{-12} respectively. When adding aqueous NaOH drop by drop to a solution containing equal molar concentrations of Cu²⁺ and Mg²⁺, which hydroxide would begin to precipitate with the least number of drops?