

Complex Ion/Solubility Review

1. If you add 0.005M $\text{Cu}(\text{NO}_3)_2$ to a solution of pH 8.25, would you expect a precipitate to form? The K_{sp} of the $\text{Cu}(\text{OH})_2$ is 2.2×10^{-20} . Write all pertinent chemical equations.
2. Determine the solubility of the bismuth ion in water if the K_{sp} of Bi_2S_3 is 1.1×10^{-73} .
3. For a solution of MgF_2 (K_{sp} is 5.2×10^{-11}). Determine its molar solubility
4. a) Determine the molar solubility of $\text{Cu}(\text{OH})_2$ in water if its K_{sp} is 2.2×10^{-20} .

b) What is the molar solubility if you add 0.15 M KOH?

c) What is the molar solubility of you add 0.0147 M LiOH?
5. If you have a 0.0000150 M solution of calcium chloride and add 0.0010 M potassium hydroxide will a precipitate form? The K_{sp} of calcium hydroxide is 5.5×10^{-5} .
6. What is the concentration of silver ion in a saturated solution of silver carbonate? $K_{sp} = 8.5 \times 10^{-12}$.
7. What is the concentration of silver ion in a saturated solution of silver carbonate with 0.1200 M silver nitrate added to it?
8. How many grams of KCl (molar mass 74.54 g/mol) must be added to a 250.0 mL of 0.36 M $\text{Pb}(\text{NO}_3)_2$ solution to initiate precipitation of PbCl_2 (K_{sp} 1.7×10^{-5})?

9. Assume you have a solution of calcium nitrate and $\text{Pb}(\text{NO}_3)_2$, both at 0.15 M. What is the concentration of the first ion that precipitates when the second more soluble one begins to precipitate upon addition of sodium sulfate? $K_{\text{sp}} \text{CaSO}_4 = 2.4 \times 10^{-5}$, $K_{\text{sp}} \text{PbSO}_4 = 1.8 \times 10^{-8}$
10. Consider a solution with both Pb^{2+} and Mg^{2+} ions of 0.15 M. If you add sodium fluoride to it what percentage remains of the first ion that precipitates just before the second, more soluble one begins to precipitate? $K_{\text{sp}} \text{PbF}_2 = 3.3 \times 10^{-8}$, and $K_{\text{sp}} \text{MgF}_2 = 5.2 \times 10^{-11}$
11. A solution contains 0.010 M Ca^{2+} and 0.010M Ba^{2+} ions. The two ions can be separated based on the solubilities of their sulfates if K_2SO_4 is added to the solution. $K_{\text{sp}} \text{CaSO}_4 = 2.0 \times 10^{-4}$, $K_{\text{sp}} \text{BaSO}_4 = 1.5 \times 10^{-9}$. What concentration of sulfate ion would be needed to achieve maximum separation of the two ions?
12. Write the net ionic equation for the following reactions:
- excess dilute nitric acid is added to a solution of tetramminecadmium(II) ion
--what is the coordination number of the complex ion?
 - pellets of aluminum metal are added to a solution containing an excess of sodium hydroxide
--which reactant acts as a Lewis acid? explain
 - an excess of ammonia gas is bubbled through a solution saturated with silver chloride
--which reactant acts as a Lewis base? explain
 - a concentrated solution of ammonia is added to a suspension of zinc hydroxide
--what visual change occurs in the reaction mixture?
 - a solution of ammonium thiocyanate is added to a solution of iron(III) chloride
--describe the color changes that occur during the reaction