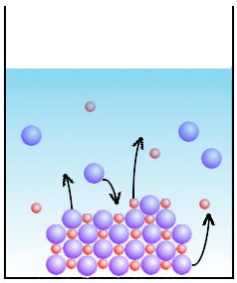
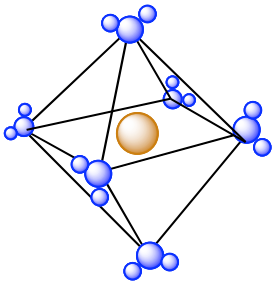


Chemistry 106
Fundamental Chemistry

Practice Problems for Solubility Product and Complex Ion Equilibria



1) a) K_{sp} for $CaSO_4$ is 2.4×10^{-5}. Calculate the molar solubility of calcium sulfate.

b) K_{sp} for Li_2CO_3 is 2.5×10^{-2}. Calculate the molar solubility of lithium carbonate.

c) The molar solubility of Ag_3PO_4 is 2.7×10^{-6} M. Calculate K_{sp} for silver phosphate.

d) The molar solubility of calcium carbonate is 9.3×10^{-5} M. Calculate Ksp for $CaCO_3$.

2) a) The solubility product constants for the hydroxides of Al^{3+}, Ca^{2+}, Fe^{3+} and Zn^{2+} are 1.0×10^{-33}, 5.5×10^{-6}, 2.0×10^{-39} and 2.0×10^{-17} respectively. If you add 1.0×10^{-4} moles of each metal ion to 1.00 L of a buffered solution (pOH=7), which will form a precipitate and which will not form a precipitate?

b) The pK_{sp}'s for the phosphates of Ba^{2+}, Cu^{2+} and Pb^{2+} are 22.5, 36.9 and 42.1 respectively. What minimum concentration of PO_4^{3-} is needed to precipitate each metal ion from solutions with metal ion concentrations of 1.00×10^{-9} M?

3) a) Fe^{+3} forms a complex ion with $C_2O_4^{-2}$. A 0.010 M solution of Fe^{+3} also contains $C_2O_4^{-2}$ with an original concentration of 0.500 M. K_f for the complex is 2.0×10^{20}. Calculate the concentration of "free" Fe^{+3} in this solution.

$$Fe^{+3} + 3\,C_2O_4^{-2} \rightarrow Fe(C_2O_4)_3^{-3}$$

b) Ni^{+2} forms a complex ion with NH_3. A 0.040 M solution of Ni^{+2} also contains NH_3 with an original concentration of 0.800 M. K_f for the complex is 5.5×10^8. Calculate the concentration of "free" Ni^{+2} in this solution.

$$Ni^{+2} + 6\,NH_3 \rightarrow Ni(NH_3)_6^{+2}$$

Answers

1) a) 4.9×10^{-3} M b) 0.18 M c) 1.4×10^{-21} d) 8.6×10^{-9}

2) a) will precipitate: Al^{+3}, Fe^{+3}

b) Ba^{+2} 178 M
Cu^{+2} 1.1×10^{-5}
Pb^{+2} 2.8×10^{-8}

3) a) $[Fe^{+3}] = 4.8 \times 10^{-22}$ M

b) $[Ni^{+2}] = 2.4 \times 10^{-9}$ M