Problem Set 8: Solubility Equilibrium

1) Arrange the following solutes in order of increasing molar solubility in water: AgCN, AgIO$_3$, AgI, AgNO$_2$, Ag$_2$SO$_4$. Explain your reasoning.

2) A 725-mL sample of a saturated aqueous solution of calcium oxalate, CaC$_2$O$_4$, at 95°C is cooled to 13°C. How many milligrams of calcium oxalate will precipitate? For CaC$_2$O$_4$, $K_{sp}$ = 1.2*10$^{-8}$ at 95°C and 2.7*10$^{-9}$ at 13°C.

3) How would you expect the presence of each of the following solutes to affect the molar solubility of CaCO$_3$ in water: (a) Na$_2$CO$_3$; (b) HCl. Explain.

4) A 0.150 M Na$_2$SO$_4$ solution that is saturated with Ag$_2$SO$_4$ has [Ag$^+$] = 9.7*10$^{-3}$ M. What is the value of $K_{sp}$ for Ag$_2$SO$_4$ obtained with these data?

5) If 100.0 mL of 0.0025 M Na$_2$SO$_4$ (aq) is saturated with CaSO$_4$, how many grams of CaSO$_4$ would be present in the solution?

6) Will precipitation of MgF$_2$ (s) occur if a 22.5 mg sample of MgCl$_2$. 6H$_2$O is added to 325 mL of 0.035 M KF?

7) What is the minimum pH at which Cd(OH)$_2$ (s) will precipitate from a solution that is 0.0055 M in Cd$^{2+}$ (aq)?

8) Calculate the $K_{sp}$ of calcium sulfate (CaSO$_4$) if the solubility is 0.56 g/L.

9) Exactly 100 ml of 0.05 M AgNO$_3$ are added to exactly 500 ml of 0.05 M HCl. Will a precipitate form?

10) A student carefully adds solid silver nitrate, AgNO$_3$, to a 0.0030 M solution of sodium sulfate, Na$_2$SO$_4$. What [Ag$^+$] in the solution is needed to just initiate precipitation of silver sulfate, Ag$_2$SO$_4$ ($K_{sp}$ = 1.4 x 10$^{-5}$).