K_{sp} Problems - Set IV – Titrations

1. An ace chemistry student does a titration to determine the concentration of Co^{2+} in a solution. She finds that 10.7 ml of the Co^{2+} solution requires 15.2 ml of 0.01 M Na_2S to reach the endpoint of the titration. The reaction is:

   i. $Co^{2+}_{(aq)} + Na_2S_{(aq)} \rightarrow CoS_{(s)} + 2\ Na^{+}_{(aq)}$

   b. How many moles of Na_2S was used in the titration ? (0.000152mol)

   c. What is the molarity of the Co^{2+} solution ? (0.014M)

   d. Assume that the Co^{2+} solution was a saturated solution of $CoCO_3$, determine the K_{sp} value of cobalt carbonate. Start by writing a equilibrium equation that represents the saturated solution. ($1.96x10^{-4}$)

2. A 20.0mL of lead solution (Pb^{2+}) of unknown concentration was titrated using 0.005M Cl^-. The ace chemistry student finds that it takes 12.2 ml of the Cl^- solution to reach the endpoint of the titration. The reaction is:
   $Pb^{2+} + 2Cl^- \rightarrow PbCl^2$

   a. Calculate the molarity of the lead solution. (answer: $1.5\ x10^{-3}$ M)

   b. Assume the unknown lead solution was a saturated solution of lead iodide, PbI_2.
   Calculate the K_{sp} of lead iodide. (answer : $1.4x10^{-8}$)

3. An ace chemistry student does a titration to determine the concentration of mercury ions, Hg^{2+}, in a sample of lake water. She places a 15.0 ml sample of the lake water in a small flask and adds three drops of an indicator. She finds that it takes 7.5 ml of a 0.000005 M I^- solution to reach the endpoint of the titration. The reaction involved is

   $$Hg^{2+} + 2\ I^- \rightarrow HgI_2.$$

   a. Calculate the molarity of the Hg^{2+} lake water. (ans. $1.25x10^{-6}$ M)

   b. Assume that the lake water was a saturated solution of HgS, what is the K_{sp} of HgS? ($1.56x10^{-12}$)