CH 223 – Worksheet 3

1. The K_{sp} for Ag_2SO_3 is 1.5×10^{-14}. Calculate the solubility of Ag_2SO_3 a) in pure water and b) in 0.01 M $RbSO_3$?

a)

$$Ag_2SO_3(s) \rightleftharpoons 2\,Ag^+(aq) + SO_3^{2-}$$

$$\begin{array}{ccc} 0 & & 0 \\ 2x & & x \\ \hline 2x & & x \end{array}$$

$$K_{sp} = [Ag^+]^2[SO_3^{2-}]$$
$$= (2x)^2 \cdot x = 4x^3$$

$4x^3 = 1.5 \times 10^{-14}$

$X = \left(\dfrac{1.5 \times 10^{-14}}{4}\right)^{1/3}$

$= 1.55 \times 10^{-5} \dfrac{mol}{L}$

Solubility is 9 $\therefore$ need

$M\,M\,Ag_2SO_3 = 295.87 \frac{g}{mol}$

$\therefore$ Solubility $= \left(1.55 \times 10^{-5} \frac{mol}{L}\right)\left(295.87\frac{g}{mol}\right)$

$= 0.00460 \frac{g}{L}$

b. 0.01 M SO_3^{2-} much more concentrated than 1×10^{-5}

$\therefore K_{sp} = (2x)^2(0.01)$

$4x^2(0.01) = 1.5 \times 10^{-14}$

$X = \left(\dfrac{1.5 \times 10^{-14}}{4(0.01)}\right)^{1/2}$

$= 6.1 \times 10^{-7} \frac{mol}{L}$

$\left(6.1 \times 10^{-7}\frac{mol}{L}\right)\left(295.87\frac{g}{mol}\right) =$

$1.81 \times 10^{-4}\frac{g}{L}$

2. Will Ag_2SO_4 ($Ksp = 1.5 \times 10^{-5}$) precipitate when 100 mL of 0.050 M $AgNO_3$ is mixed with 10 mL of 5.0×10^{-2} M Na_2SO_4 solution? Is $Q > K_{sp}$?

$\left(0.100\,L\,AgNO_3\right)\left(0.050\frac{mol}{L}\right) = 0.005\,mol\;Ag^+$

$\left(0.010\,L\,Na_2SO_4\right)\left(0.05\frac{mol}{L}\right) = 0.0005\,mol\;SO_4^{2-}$

$[Ag^+] = \dfrac{0.005\,mol}{0.110\,L} = 0.04545\frac{mol}{L}\;Ag^+$

$[SO_4^{2-}] = \dfrac{0.0005\,mol}{0.110\,L} = 0.004545\;SO_4^{2-}$

$$Ag_2SO_4(s) \rightleftharpoons 2\,Ag^+(aq) + SO_4^{2-}(aq)$$

$$\begin{array}{cc} 0 & 0 \\ 2x & x \end{array}$$

$Q = [Ag^+]^2[SO_4^{2-}] = (0.04545)^2(0.004545)$

$= 9.39 \times 10^{-6}$
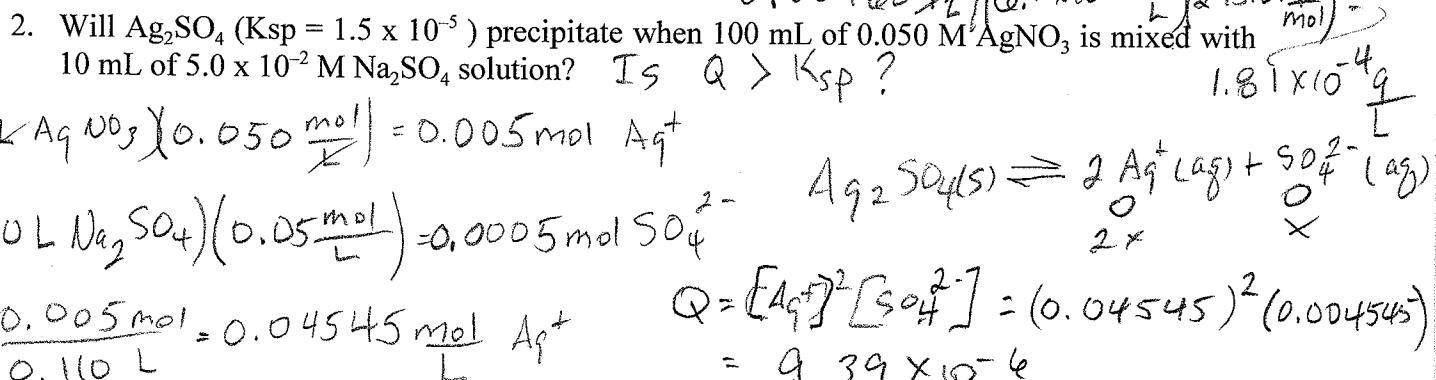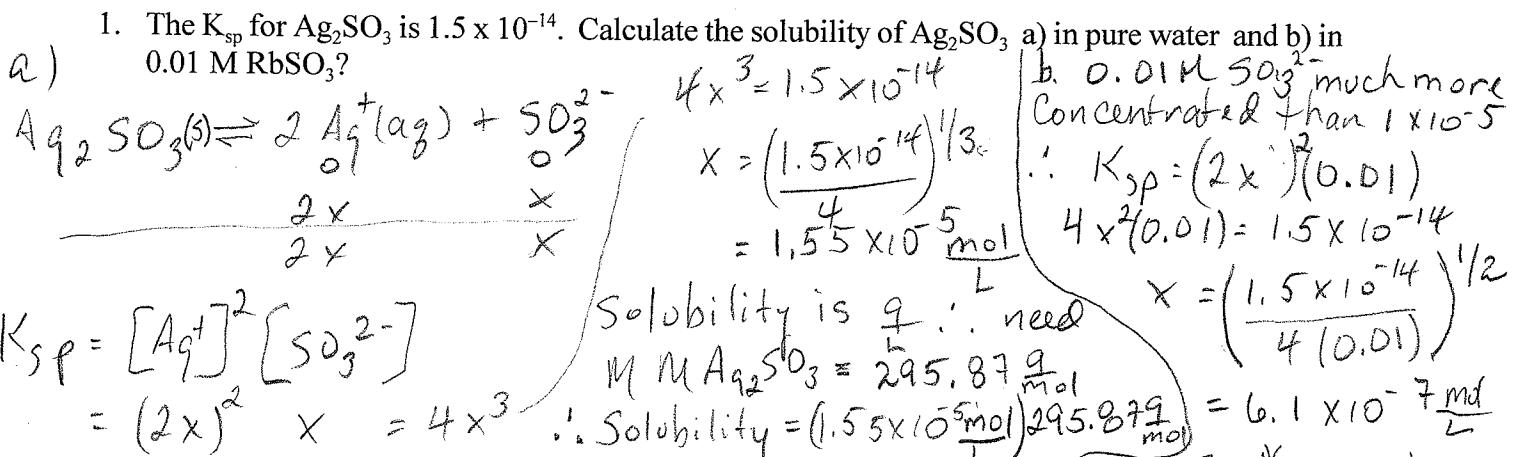
$Q = 9.39 \times 10^{-6} < K_{sp} = 1.5 \times 10^{-5}$

$\therefore$ No precipitate

3. (a) What is the charge of the complex formed by a platinum (II) metal ion surrounded by two ammonia molecules and two bromide ions? (b) Write a formula for this complex?

$[Pt(NH_3)Br_2]$ Charge $= 0$

4. (a) What is the difference between a monodentate ligand and a bidentate ligand? (b) how many bidentate ligands are necessary to fill the coordination sphere of a six coordinate complex?

a) monodentate – one coordinate site
   bidentate – 2 coordination sites

b.) 3

5. Indicate the coordination number of the metal and the oxidation number of the metal in each of the following complexes: (a) $K_4[Fe(CN)_6]$, (b) $[Co(en)_2(C_2O_4)]^+$, (c) $[Ni(CN)_5]^{3-}$.

(a) $+4$ $(+2)$ -6
        $+3$

(b) 0 -2
       $+3$

(c) -5
       $+2$