THE SOLUBILITY PRODUCT CONSTANT OF SILVER ACETATE

Introduction:

In a saturated solution, the ions are in equilibrium with the solid. The rate at which ions are leaving the solid crystal is equal to the rate at which they are returning to the solid:

$$CH_3COOAg_{(s)} \leftrightarrow Ag^+_{(aq)} + CH_3COO^-_{(aq)}$$

The concentrations of the ionic species, $Ag^+_{(aq)}$ and $CH_3COO^-_{(aq)}$, when no net change in concentration is taking place, determine the equilibrium solubility. The equilibrium expression for this reaction is

$$Ksp = [Ag^+] [CH_3COO^-]$$

If pure silver acetate is dissolved, the acetate concentration is the same as the silver ion concentration. Thus, the solubility product constant can be calculated after experimentally determining the equilibrium concentration of either ion.

In this experiment you will determine the equilibrium concentration of the silver ions in a saturated solution of silver acetate at room temperature. The concentration of the silver ions will be determined indirectly by reacting them with copper.

$$Cu_{(s)} + 2\ Ag^+_{(aq)} \rightarrow Cu^{2+}_{(aq)} + 2\ Ag_{(s)}$$

From the amount of copper reacted, the concentrations of silver and acetate ions will be found and the Ksp will be calculated and compared with the literature value.

Purpose:

The purpose of this experiment is to determine the solubility product constant for silver acetate.

Equipment/Materials:

saturated silver acetate solution	copper wire
150 mL beaker	balance
acetone	wash bottle

Safety:

- Always wear an apron and goggles in the lab.

Procedure:

1. Carefully measure 100 mL of saturated silver acetate solution in a 100 mL graduated cylinder. It is important that the volume be as close to 100 mL as possible since this will be the assumed volume in the calculations. Pour the solution into a clean, dry 150 mL beaker.

2. Obtain a 30 cm length of heavy copper wire. Clean the surface with some emery cloth and wind into a loose coil around a large test tube. Leave a portion of the copper unwound so that it can serve as a handle.

3. Find the mass of the copper coil and record it in the data table. Place the coil into the beaker containing the saturated silver acetate solution. Allow the system to stand overnight so all the silver ions will have an opportunity to react.

4. Shake the silver crystals free from the copper wire into the beaker. Wash any adhering crystals into the beaker with a stream of distilled water from a wash bottle. Finally rinse the wire in acetone and when it is dry, find and record its mass.

5. Decant the solution off the silver crystals and rinse them with distilled water. Place the silver in a container designated by your instructor so that it can be recycled.

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Data Table: Name ________________________

	Trial 1	Trial 2
Mass of Copper (before)		
Mass of Copper (after)		
Mass of Copper reacted		
Moles of Copper reacted		
Moles of Silver reacted		
Concentration of Silver		
Concentration of Acetate		
Value for Ksp		
Accepted value for Ksp		

Calculations:

1. Calculate the moles of copper reacted.

2. Calculate the moles of silver reacted.

3. Calculate the concentration of silver.

4. Determine the concentration of acetate.

5. Determine the value for Ksp.

Questions:

1. If 100 mL of 0.020 M $AgNO_3$ and 100 mL of 0.020 M CH_3COONa were mixed, would a precipitate of silver acetate be expected to form? In your calculation, use the average value for the Ksp obtained by members of your class.

2. Suppose that some solid sodium acetate, $CH_3COONa_{(s)}$, were added to a saturated solution of silver acetate which is in equilibrium with some $CH_3COOAg_{(s)}$. After the sodium acetate has dissolved, what will be the effect of the increased concentration of the acetate ion on the equilibrium?

$$CH_3COOAg \leftrightarrow Ag^{+}_{(aq)} + CH_3COO^{-}_{(aq)}$$

3. a. Calculate the $[Ag^+]$ if the $[CH_3COO^-]$ in the solution of question 2 is 1.0 M.
   b. How does this value compare to the $[Ag^+]$ in a saturated solution of silver acetate at room temperature?