Kingsborough Community College

The City University of New York

Calculation of the Solubility Product Constant of Silver Acetate

Theory:

When ionic compounds are dissolved in water the ions separate and are hydrated. When the ability of the water molecules to do this reaches its limit, the solution is said to be saturated. In this state the tendency of the ions to precipitate is equal to the rate of dissolution and an equilibrium is reached.

$$AgCH_3COO_{(s)} \leftrightarrow Ag^+_{(aq)} + CH_3COO^-_{(aq)}$$

The solubility product constant is expressed by:

$$K_{sp} = [Ag^+][CH_3COO^-]$$

This holds true in cases where the compound is dissolved in water or in a solvent containing no common ions. In cases where any of the equilibrium ions are in the solvent these concentrations must be taken into account. These ions will affect the solubility though not the constant.

Note; All silver solutions are saturated and must be filtered before use

A) AgAc in distilled water

Take about 40 mL of the AgAc solution and filter. Place this in a prepared burette, noting the initial reading.

Pipette 10mL of a 0.05M KCl solution into an Erlenmeyer flask. Add 15mL of distilled water (use a graduated cylinder for this). All final titration volumes will be 25mL. Add 1mL of a 5% Potassium Chromate solution as an endpoint indicator.

Titrate from a lemon yellow to a peach/light brown color. For accuracy do this 3 times Calculate the concentration of the silver ions. From the average of the 3 runs calculate the Ksp

B) AgAc in a solution of 0.1 M KNO_3

Take about 40 mL of the silver solution. Filter and load the burette as above, again noting the initial volume.

Pipet 10 mL of the KCl solution into an Erlenmeyer flask again adding the Potassium Chromate.

Titrate 3 times. Calculate the silver concentration and the Ksp as in 'A'

C) AgAc in a solution of 0.1 M $AgNO_3$

Here take 50 mL of the silver solution Filter and treat as before

Pipet 25 mL of the 0.05 KCl solution into an Erlenmeyer and add the Potassium Chromate.

Titrate as calculate as before

D) AgAc in a solution of 0.1 M NaAc

Take 60 mL of the AgAc solution.. Filter and treat as before

Place 10 mL of the KCl in an Erlenmeyer along with 15 mL of water and the 1 mL of Potassium Chromate.

Treat and calculate as before

Note: $C_2H_3O_2$ is the Acetate ion. It is sometimes abbreviated as Ac-

With large classes the students may be broken up into groups.

Group	1	2	3	4	5	6
	A&B	C&D	A&C	B&D	A&D	B&C

RESULTS

A) Silver Acetate/Water

mL KCl taken _____

Titration	#1	#2	#3
Initial volume	_____	_____	_____
Final volume	_____	_____	_____
Volume Used	_____	_____	_____
Ag Molarity	_____	_____	_____

Average Molarity _____

K_{sp} AgAc _____

B) Silver Acetate/Potassium Nitrate

mL KCl taken

Titration	#1	#2	#3
Initial volume	_____	_____	_____
Final volume	_____	_____	_____
Volume used	_____	_____	_____
Ag Molarity	_____	_____	_____

Average Molarity _____

K_{sp} AgAc _____

C) Silver Acetate/ Silver Nitrate

mL KCl taken _____

Titration	#1	#2	#3
Initial volume	_____	_____	_____
Final volume	_____	_____	_____
Volume used	_____	_____	_____
Ag Molarity	_____	_____	_____

Average Molarity _____

K_{sp} AgAc _____

D) Silver Acetate/ Sodium Acetate

mL KCl taken _____

Titration	#1	#2	#3
Initial volume	_____	_____	_____
Final volume	_____	_____	_____
Volume used	_____	_____	_____
Ag Molarity	_____	_____	_____

Average Molarity _____

K_{sp} AgAc _____

Calculate your average Ksp using the results from all 4 parts.

The Literature value is $2.3X10^{-3}$ Calculate the % error

From the data you have gathered, calculate the solubility of the Silver Acetate under all four conditions.

Questions:

1) What was the purpose of the Potassium Nitrate used in part B ?

2) By theory the K_{sp} should be a constant. What factors could have caused any deviation ?

3) The solubility of Silver Acetate in room temperature water is 10.2 g/L.

Explain the differences , if any, in the four solubilities you calculated.