



St Andrew's Junior College
H2 Chemistry 2025
Assignment 20: Solubility Equilibria

1. [2008/P2/Q2]

Silver forms a series of halides of general formula AgX . The chloride, bromide and iodide of silver are sparingly soluble in water at room temperature.

Data about the solubilities in water and the solubility products of the chloride, bromide and iodide of silver at 298 K are given below.

Salt	Solubility / mol dm^{-3}	Solubility product / $\text{mol}^2 \text{dm}^{-6}$
AgCl	1.4×10^{-5}	2.0×10^{-10}
AgBr	7.1×10^{-7}	to be calculated
AgI	8.9×10^{-9}	8.0×10^{-17}

In this question, give **each** of your numerical answers to **one** decimal place.

(a) (i) Write an expression for the solubility product, K_{sp} , of silver bromide. [1]

(ii) From the data above, calculate a value for K_{sp} of silver bromide. [1]

(b) When a precipitate is formed, $\Delta G_{\text{ppt}}^{\circ}$, in J mol^{-1} , is given by the following expression.

$$\Delta G_{\text{ppt}}^{\circ} = 2.303RT \lg K_{\text{sp}}$$

Use the data above to calculate $\Delta G_{\text{ppt}}^{\circ}$, in kJ mol^{-1} , for silver chloride. [1]

2. [2017/P3/Q1e] modified

Silver chloride is sparingly soluble in water.



- (i) Write the expression for the solubility product, K_{sp} , of silver chloride, stating its units. [2]
- (ii) An excess of solid silver chloride was stirred with $0.50 \text{ mol dm}^{-3} \text{ AgNO}_3$ until equilibrium was established. Calculate $[\text{Cl}^- \text{ (aq)}]$ in the resulting solution, given the value of K_{sp} is 2.0×10^{-10} . [1]
- (iii) Describe and explain how the solubility of AgCl is affected by
- adding $\text{NH}_3 \text{ (aq)}$,
 - adding NaCl (aq) .
- [3]

3. [2016/P1/Q13] modified

Values of two solubility products are given.

$$K_{\text{sp}} (\text{ZnF}_2) = 3.2 \times 10^{-2} \text{ mol}^3 \text{ dm}^{-9}$$

$$K_{\text{sp}} (\text{BaF}_2) = 1.6 \times 10^{-7} \text{ mol}^3 \text{ dm}^{-9}$$

Solid zinc fluoride is shaken with water. The remaining solid is filtered off, leaving a saturated solution X.

Drops of dilute aqueous barium nitrate are added to X until barium fluoride just precipitates.

What is $[\text{Ba}^{2+}]$ in the solution when BaF_2 just precipitates?

[2]

4. A solution contains $1.5 \times 10^{-2} \text{ mol dm}^{-3} \text{ I}^-$ and $8.0 \times 10^{-3} \text{ mol dm}^{-3} \text{ C}_2\text{O}_4^{2-}$. If aqueous $\text{Pb}(\text{NO}_3)_2$ is added, predict which of the following solid, PbI_2 or PbC_2O_4 will be precipitated out first. **[2]**

K_{sp} of $\text{PbI}_2 = 9.8 \times 10^{-9} \text{ mol}^3 \text{ dm}^{-9}$ and K_{sp} of $\text{PbC}_2\text{O}_4 = 8.5 \times 10^{-9} \text{ mol}^2 \text{ dm}^{-6}$ at 298K.