

The chemistry of silver – teacher notes

Topic

Transition elements – complex formation, redox reactions.
Light sensitive compounds – photography.

Timing

20 mins

Apparatus

- Student worksheet
- Clear plastic sheet (eg ohp sheet) x1
- Piece of black or dark card
- Scissors Magnifying glass.

Chemicals

- Solutions contained in plastic pipettes, see our standard health and safety guidance.
- Ammonia solution 3 mol dm⁻³
- Iron(II) sulphate 0.2 mol dm⁻³
- Potassium bromide 0.2 mol dm⁻³
- Potassium iodide 0.2 mol dm⁻³
- Silver nitrate 0.1 mol dm⁻³
- Sodium chloride 0.2 mol dm⁻³

Observations

The addition of chloride, bromide and iodide solutions to silver nitrate solution produces immediate precipitates – white, pale yellow and yellow respectively.

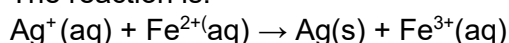
The appearance of the silver halide precipitates is retained if they are covered from the light.

The colours of the silver chloride and bromide gradually darken due to the formation of grey metallic silver, while the iodide appears to be more stable when left exposed to light (artificial or sunlight).

Silver chloride dissolves readily in ammonia solution while the bromide partially dissolves, and the iodide does not.

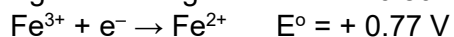
Adding iron(II) solution to the silver nitrate solution produces a glittering of metallic silver which can be seen using a magnifying glass.

The reaction is:



Discussion of this reaction could centre around the respective redox potentials.

The relevant standard redox potentials are:



Thus $E^\ominus = -0.03 \text{ V}$ for the reaction

As $\Delta G^\ominus = -zFE^\ominus$ thus ΔG^\ominus is +ve

Health, safety and technical notes

- Students must wear suitable eye protection (Splash resistant goggles to BS EN166 3).
- Ammonia solution, 3 mol.dm⁻³ NH₃(aq) is CORROSIVE and a respiratory irritant.
- Iron(II) sulphate, 0.2 mol dm⁻³, FeSO₄.7H₂O(aq), Potassium bromide, 0.2 mol dm⁻³, KBr (aq) and Potassium iodide, 0.2 mol dm⁻³, KI(aq) are low hazard.
- Silver nitrate, 0.1 mol dm⁻³, AgNO₃(aq) is an eye irritant. Keep separate from organic waste containers.