

Redox reactions

Topic

Transition elements – redox reactions; electrochemistry – redox reactions – changes in reduction potentials down Group VII.

Timing

20 min.

Apparatus (per group)

- One student worksheet
- One clear plastic sheet (eg ohp sheet)
- Magnifying glass.

Chemicals (per group)

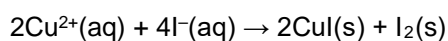
Solutions contained in plastic pipettes, see 'Apparatus and techniques for microscale chemistry' handout.

- Potassium bromide 0.2 mol dm⁻³
- Potassium iodide 0.2 mol dm⁻³
- Sodium chloride 0.2 mol dm⁻³
- Silver nitrate 0.1 mol dm⁻³
- Copper(II) sulphate 0.2 mol dm⁻³
- Iron(II) sulphate 0.2 mol dm⁻³
- Iron(III) nitrate 0.2 mol dm⁻³
- Potassium thiocyanate 0.1 mol dm⁻³
- Starch solution (freshly made).

Observations

Part A

No changes are observed on adding chloride or bromide to the copper(II) solution. However, the addition of iodide gives an immediate light brown precipitate of copper(I) iodide. The addition of starch solution gives the intense blue-black colour characteristic of the starch–iodine complex (see reference). Iodide reduces copper(II):



Part B

The addition of iron(II) solution to silver nitrate produces silver metal by reduction. Glittering can be seen in the drop.

The addition of a drop of thiocyanate produces a deep red colour indicative of iron(III). A whitish precipitate of silver thiocyanate can also be seen.

The second part of this experiment is for students to do sequential reactions of thiocyanate with silver(I), iron(II) and iron(III), helping them to interpret this redox reaction.



Note

Unless very pure and freshly prepared, iron(II) solutions will contain a small amount of iron(III) which gives a slight red coloration in the reaction between the iron(III) solution and the thiocyanate. However, the intensity of the colour is less than that observed in the reaction between iron(III) solution and thiocyanate ions. This point could be explored further in subsequent discussions on the purity of chemicals.

Reference

School Sci. Rev., 1990, **72**, 104.

Health & Safety

Students must wear suitable eye protection (Splash resistant goggles to BS EN166 3 for part A).

Potassium bromide, 0.2 mol dm⁻³, KBr (aq), Iron(II) sulphate, 0.2 mol dm⁻³, FeSO₄.7H₂O (aq), Iron(III) nitrate, 0.2 mol dm⁻³, Fe(NO₃)₃.9H₂O (aq), Potassium thiocyanate, 0.1 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.

Copper(II) sulphate solution, 0.2 mol dm⁻³, CuSO₄ (aq) causes eye damage and is hazardous to the aquatic environment.

Credits

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Health & safety checked May 2018

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