

Properties of the transition metals and their compounds – teacher notes

Introduction

Students extend their knowledge of the Periodic Table by examining the transition metals and their compounds

This experiment should take 60 minutes.

Equipment

Apparatus

- Eye protection
- Test tubes
- Access to a bar magnet
- Dropping pipette

Chemicals

- Samples of some transition metals, such as copper, iron and zinc. (Avoid nickel and cobalt as they are carcinogenic.)

Access to solutions of:

- Copper(II) sulfate 0.01 mol dm^{-3}
- Iron(III) chloride 0.1 mol dm^{-3}

Other compounds with similar oxidation states:

- Ammonia solution 2 mol dm^{-3}
- As many solid samples of transition metal compounds as possible in closed containers for observation of colours

Health, safety and technical notes

- Read our standard health and safety guidance here <https://rsc.li/3XH0X0F>
- Always wear eye protection.
- The transition metal compounds may be harmful or irritant, as may their solutions, depending on the concentration.
- Ammonia vapour irritates eyes, lungs and the respiratory system.
- For more information on copper sulfate, see CLEAPSS Hazcard [HC027c](#).
- For more information on iron chloride, see CLEAPSS Hazcard [HC055b](#).
- For more information on ammonia see CLEAPSS Hazcard [HC006](#).

Notes

This experiment is a good test of observational skills, and students' attention could be drawn to this.

In the reaction with water very little happens and when forming the complexes some colour changes could be missed.

If students have not used an inverted filter funnel over a metal sample with an inverted test-tube to collect any gas produced then some discussion may be required.

Answers

1. They are hard, dense and shiny. They are good conductors of heat and electricity. They are also malleable and ductile.
2. Transition metals react with water very slowly, if at all.
3. As well as the above, they also form coloured compounds. They form compounds that can have more than one formula.