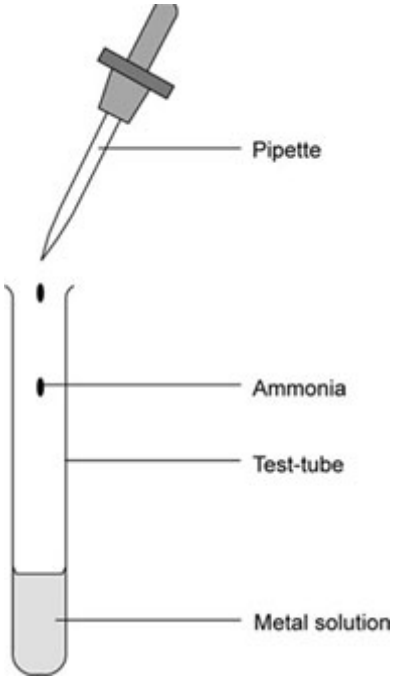
Properties of the transition metals and their compounds – student sheet

Introduction

The Periodic Table allows chemists to see similarities and trends in the properties of chemical elements. This experiment illustrates some properties of the common transition elements and their compounds.



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/3XHOX0F
- 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.

Procedure

1. Test the metal samples for hardness and ability to bend without breaking. your answers qualitatively.
2. Find out which samples are magnetic.
3. Set up an experiment to see if the metals react with water. (This may need to be left for some time).
4. Take a small sample of a solution of copper(II) sulfate (approximately 2 cm3), add ammonia solution to it a few drops at a time.
5. Record your observations.
6. Add ammonia solution until there is no further change.
7. Repeat with the other solutions of transition metal compounds.

Questions

Record your observations – create a table is desired.

1. Describe the physical properties of transition metals.
2. How do transition metals react with water?
3. What properties do the compounds of transition metals have in common?