Properties of the transition metals and their compounds

Topic

The periodic table, transition metals.

Timing

60 min.

Description

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

Apparatus and equipment (per group)

- Test-tubes
- Access to a bar magnet
- Dropping pipette. Use the type of teat pipette (usually fitted to Universal Indicator bottles) that does not allow squirting – *eg* Griffin.

Chemicals (per group)

- Samples of some transition metals (copper, iron, zinc) Avoid nickel and cobalt as they are carcinogenic. If others are to be used, check with CLEAPSS or (in Scotland) SSERC for suitability.
Access to solutions of:
- Copper(II) sulfate 0.01 mol dm^{-3}
- Iron(III) chloride 0.1 mol dm^{-3} (**Irritant**)

or other compounds with similar oxidation states
- Ammonia solution 2 mol dm^{-3} (Causes serious eye damage)
As many solid samples of transition metal compounds as possible in closed containers for observation of colours.

Teaching tips

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.

Background theory

Knowledge of the reactions of Group 1 metals with water for comparison.

Safety

Wear goggles (BS EN 166 3). If the ammonia solution is reduced to 1.5 mol dm^{-3} or less, safety spectacles will suffice..

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

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.

Credits

Health & safety checked January 2018

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