

NEATH PORT TALBOT COLLEGE COLEG CASTELL NEDD PORT TALBOT

School of Maths & Science Science Practical

d-block practical

◆ Aim

By the end of this practical you should be able to;

- Describe the colours of d-block hydroxides and state whether they are amphoteric in excess hydroxide
- Describe the colours which are produced when d-block elements undergo ligand exchange reactions.

◆ Introduction.

The elements scandium to zinc form the first period of the d-block. However, by definition only titanium to copper inclusive are considered to be transition elements. One characteristic property of transition elements is their ability to form complex ions, many of which are coloured. The colour of some of these complexes can be explained in terms of d-orbital splitting. Some of the complex ions of copper illustrate this.

◆ Safety

Control Measures

- The wearing of **safety glasses** and a **laboratory coat at all times** will be sufficient to take account of most hazards and significant risks.
- All waste is to be placed in the labelled container immediately after use.
- You are reminded of the need of good laboratory practice in order to maintain a safe working environment.

Hazards

Harmful Copper Sulfate, Fe(II) Chloride Fe(III) Chloride, Zinc Chloride

Corrosive Conc. Hydrochloric acid, Sodium hydroxide

Irritant Ammonia, Chromium Nitrate



◆ **Procedure**

1. Record the colour of copper (II) sulfate solution.
2. Draw the structure of the species responsible for this colour.

3. Add 1 drop of aqueous ammonia to 2cm³ copper (II) sulfate solution and shake the tube.

Observation:

Equation:

4. Repeat 3 except add aqueous ammonia to excess.

Observation:

Equation:

What is the name of this complex ion ?

5. To 2cm³ of copper (II) sulfate solution add a few drops of conc. HCl **care!** Shake the tube.

Observation:

Explanation:

Equation:

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What shape is the complex ion giving the new colour?

6. Add a few cm³ of deionised water to the mixture in 5 and shake the tube.

Observation:

Explanation:

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The hydroxides of many transition metals are also coloured and some are amphoteric. Complete the table by adding NaOH(aq) dropwise to excess to the following metal ion solutions.

Metal ion(aq)	Addition of NaOH to excess	Amphoteric or not?
Cr ³⁺ (aq)		
Fe ²⁺ (aq)		
Fe ³⁺ (aq)		
Cu ²⁺ (aq)		
Zn ²⁺ (aq)		

The reactions of Al³⁺_(aq) and Pb²⁺_(aq) with NaOH (aq) are also important as they give precipitates which dissolve in excess sodium hydroxide solution to give a colourless solution.

Write ionic equations for all reactions occurring in the table above and for aluminium and lead.