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School of Maths & Science
Science Practical

To Determine an Enthalpy Change of Reaction

◆ Aim

The purpose of this experiment is to determine the enthalpy change for the displacement reaction:

$$Zn(s) + Cu^{2+}_{(aq)} \longrightarrow Cu_{(s)} + Zn^{2+}_{(aq)}$$

◆ Introduction

By adding an excess of zinc powder to a measured amount of aqueous copper (II) sulfate and measuring the temperature change over a period of time, you can then calculate the enthalpy change for the reaction.

◆ 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.
- Keep stoppers on bottles as much as is possible
- Keep flammable liquids away from flames
- You are reminded of the need of good laboratory practise in order to maintain a safe working environment.

Hazards

Harmful/Irritant Copper (II) Sulfate Solution
Zinc Powder

◆ Procedure

1. Pipette 25.0cm^3 of the copper (II) sulfate solution into a polystyrene cup.

2. Weigh about 6g of zinc powder in the weighing bottle. Since this is an excess, there is no need to be accurate.

3. Put the thermometer into the solution, stir and record the temperature to the nearest 0.1°C every half minute for $2^1/_2$ minutes.

4. At precisely 3 minutes, add the zinc powder to the cup.

5. Continue stirring and record the temperature for an additional 6 minutes to complete the Results Table.

◆ Results

Time/Min	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5
Temperature ^oC										
Time/Min	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5
Temperature ^oC										

◆ Calculations

1. Plot the temperature (y-axis) against time (x-axis).

2. Extrapolate the curve to 3.0 minutes to establish the maximum temperature rise as shown in figure 1

3. Calculate the enthalpy change for the quantities used. Assume that the density of the solution is 1 .00gcm^{-3} and it's specific heat capacity is 4.18 J g^{-1} k^{-1}. Ignore the heat capacity of the metals.

4. Calculate the enthalpy change for one mole of Zn and $CuSO_{4(aq)}$ and write the thermochemical equation for the reaction.

Fig 1.