Measuring enthalpy changes

Teacher notes, student sheet and slides are available from **rsc.li/3T9sEQD**.

In the lesson, learners carry out two practical activities to observe what happens when water is added to anhydrous copper(II) sulfate, and when hydrated copper(II) sulfate is dissolved in water. This is used to introduce them to Hess's law and its application.

Equipment

- Anhydrous copper(II) sulfate powder (DANGER: corrosive, irritant, environmental hazard)
- Hydrated copper(II) sulfate crystals (DANGER: corrosive, irritant, environmental hazard)
- Spatula
- Weighing boat (or similar)
- Insulated cardboard cup*
- Beaker (to fit cup inside)
- Thermometer reading 0–110°C in 0.1°C increments
- Water
- 50 cm^3 pipette or measuring cylinder
- Access to a mass balance
- Safety glasses

Preparation

Chemicals supplied for the practical	Hazards
Anhydrous copper(II) sulfate powder  **DANGER**	Harmful if swallowed. Causes skin irritation. Causes serious eye damage. Very toxic to aquatic life with long lasting effects. Dangerous in contact with water: exothermic reaction, heat is generated. Use only small amounts and add water with care. See CLEAPSS Hazcard HC027c.
Hydrated copper(II) sulfate crystals  **DANGER**	Harmful if swallowed. Causes skin irritation. Causes serious eye damage. Very toxic to aquatic life with long lasting effects. See CLEAPSS Hazcard HC027c.

Additional notes

Read our standard health and safety guidance (**rsc.li/3zyJLkx**) and carry out a risk assessment before running any live practical.

You can use hydrated copper(II) sulfate crystals prepared by students in other experiments for this practical.

The cup is more stable if placed inside a beaker, reducing the risk of accidents.

*Originally this practical called for a polystyrene cup but they are no longer available for sale in the UK (since October 2003). An insulated cardboard cup produces similar results. Use insulated beakers if available. Alternatively, wrap a small beaker with insulation material, e.g. bubble wrap and place inside a larger beaker.

Disposal

Dilute solutions to below 0.2 M then rinse away down a foul-water drain.