

Determination of the specific heat capacity of a material

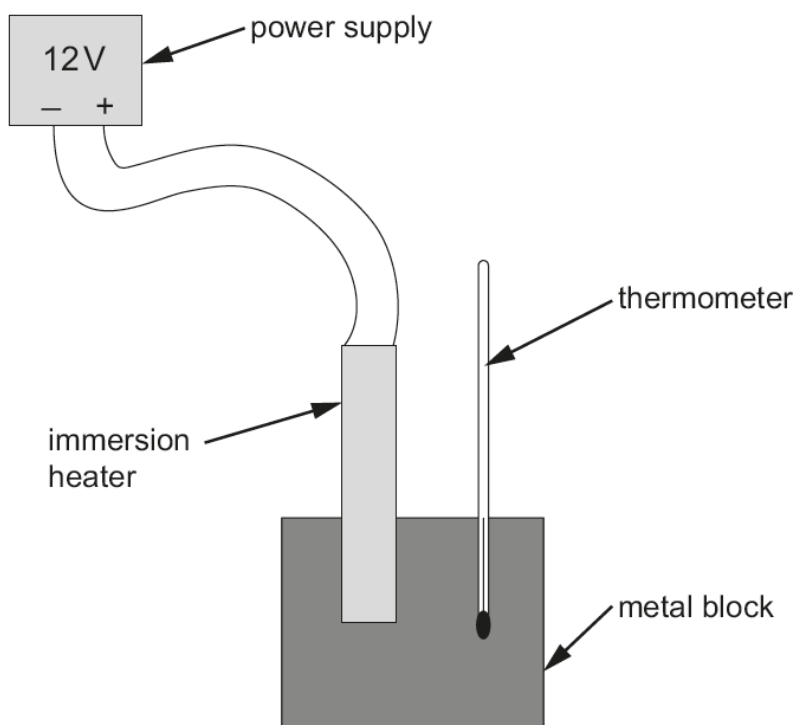
Introduction

You will determine the specific heat capacity of metals by measuring the heat energy transferred to the metal by an immersion heater and the temperature rise of the metal.

Apparatus

1 kg metal block
stopwatch
12V d.c. power supply
connecting leads
50W 12V immersion heater
thermometer

Diagram of Apparatus



Method

1. Ensure the power supply is switched off.
2. Place the immersion heater and thermometer in the holes provided in the metal block.
3. Record the initial temperature of the metal block.
4. Switch on the 12V power supply.
5. Record the temperature of the metal block every minute for 10 minutes.

Analysis

1. The heat energy transferred to the metal can be calculated from the equation:

$$\text{Energy} = \text{Power} \times \text{Time (seconds)}$$

2. The specific heat capacity (c) of the metal can be calculated from:

$$Q = mc\Delta\theta$$

Where:

Q = Heat energy supplied

m = Mass of block

$\Delta\theta$ = Temperature rise of block

Calculate the specific heat capacity of the metal.

Risk Assessment

Hazard	Risk	Control measure
Hot immersion heater can burn	Moving hot immersion heater	Do not switch on the immersion heater unless in the metal block. Allow to cool before touching

Technician / Teacher notes

Do not switch on the immersion heater outside the metal block.

Power supplies should be set at 12V.

A variety of materials could be used by different groups, e.g. aluminium, copper or iron and the results compared. In addition, students could be given the published value for the specific heat capacity for each metal and then compare it with the value they have calculated.

Working scientifically skills covered

2. **Experimental skills and strategies**

Make and record observations and measurements using a range of apparatus and methods.

3. **Analysis and Evaluation**

Carry out and representing mathematical analysis.

Represent distributions of results and make estimations of uncertainty.

Evaluate data in terms of accuracy, precision, repeatability and reproducibility and identifying potential sources of random and systematic error.

4. **Scientific vocabulary, quantities, units, symbols and nomenclature**

Use SI units and IUPAC chemical nomenclature unless inappropriate.

Use prefixes and powers of ten for orders of magnitude.