Practical 11 Specific heat capacity of a solid

Purpose

The aim of this experiment is to measure the specific heat capacity of a solid using an electrical method.

You will need:

- Aluminium (or other metal block) with a mass of 1 kg
- Heat-resistant mat
- Low-voltage heater and suitable power supply
- Ammeter and voltmeter
- Thermometer (0–50 °C)
- Stop clock
- Insulating jacket with a hole for the thermometer or sensor
- Silicone grease

(A temperature sensor and data logger can be used instead of the thermometer and stop clock.)

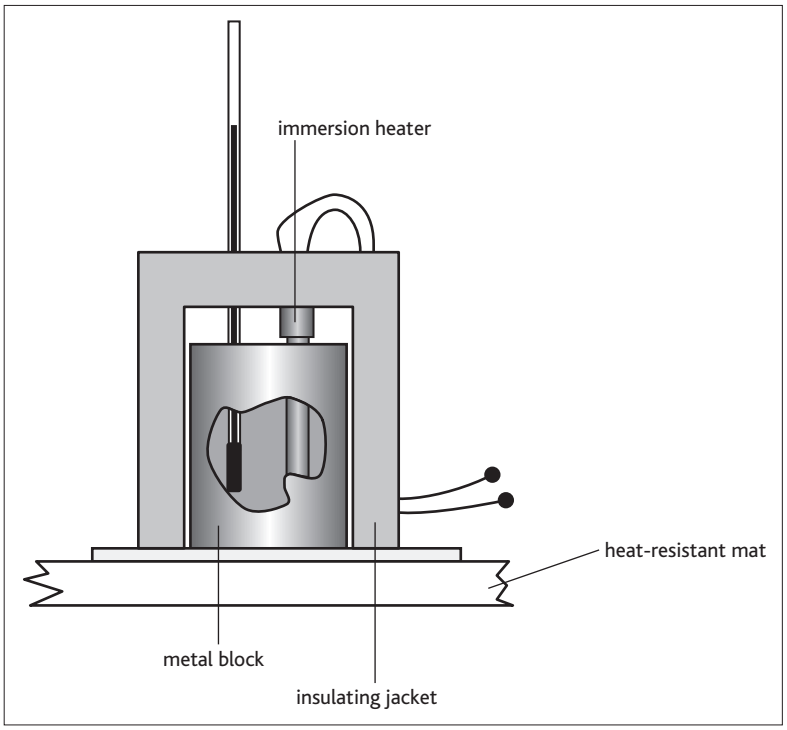

Figure 1: Setup for measuring the specific heat capacity of a solid

Experimental instructions

Measure the mass of the metal block (m). Put the thermometer in the small hole in the metal block. Place the heater in the large hole in the block and switch it on. A small amount of silicone grease in the holes in the block can improve thermal contact. Place the insulating jacket around the apparatus.

Set the voltage (V) to a convenient value and record this with the value of the current (I).

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Measure the initial temperature (θ) and start the stop clock (or use a temperature sensor and data logger). Record the temperature at one-minute intervals. Switch off the heater when the temperature reaches 50 °C.

(You may need to adjust the value of V during the experiment so that the power input remains constant.)

Analysis and conclusions

Plot a graph of temperature against time and choose a section of the graph where the temperature is rising steadily. In this area find the temperature rise $\Delta\theta$ in a time Δt.

Calculate the electrical energy supplied to the heater ($VI\Delta t$).

Calculate the specific heat capacity (c) of the metal of your block using the formula:

$$c = \frac{VI\Delta t}{m\Delta\theta}$$

where m is the mass of the block.

Assume that there are no heat losses during the experiment.

Predict the effect on your answer of significant heat loss.

Suggest the most likely sources of error in your experiment and how they might be reduced.