HOT ROCK

Purpose

To determine the specific heat of a rock and thus how much heat can be obtained from a given volume of hot rock.

Instructions

1 Weigh the cylinder of rock and then heat cylinder of rock to about 100C.

2 Set out a table like this with 20 extra lines below

Before adding water to rock		
	Temperature of water	***Temperature of rock***
After adding water to cover rock		
Time	***Water temperature***	***Rock temperature***

3 Pour 250ml of water into the jug, allow it to reach room temperature and then record its temperature.

4 Remove the heated cylinder from the oven and place it in the insulated container with the hole uppermost.

5 Put a small amount of oil into the hole in the heated rock cylinder, put in the thermometer and close the hole with plasticine. Record the temperature of the rock.

6 Pour enough water from the jug into the container to just cover the cylinder.

7 Put the stirring rod around the cylinder and then place the top on.

8 Put the second thermometer through the outer hole into the water.

9 Stir the water and then record the temperatures every minute until the water and rock temperatures are within 5°C of each other.

10 Record the volume of water left in the jug and calculate the volume around the cylinder.

Data manipulation

1 *Plot your data on a graph.*

2 *Calculate the specific heat of the rock*

a. Calculate the amount by which the water was heated by the rock.

b. Calculate the amount by which the rock was cooled by the water.

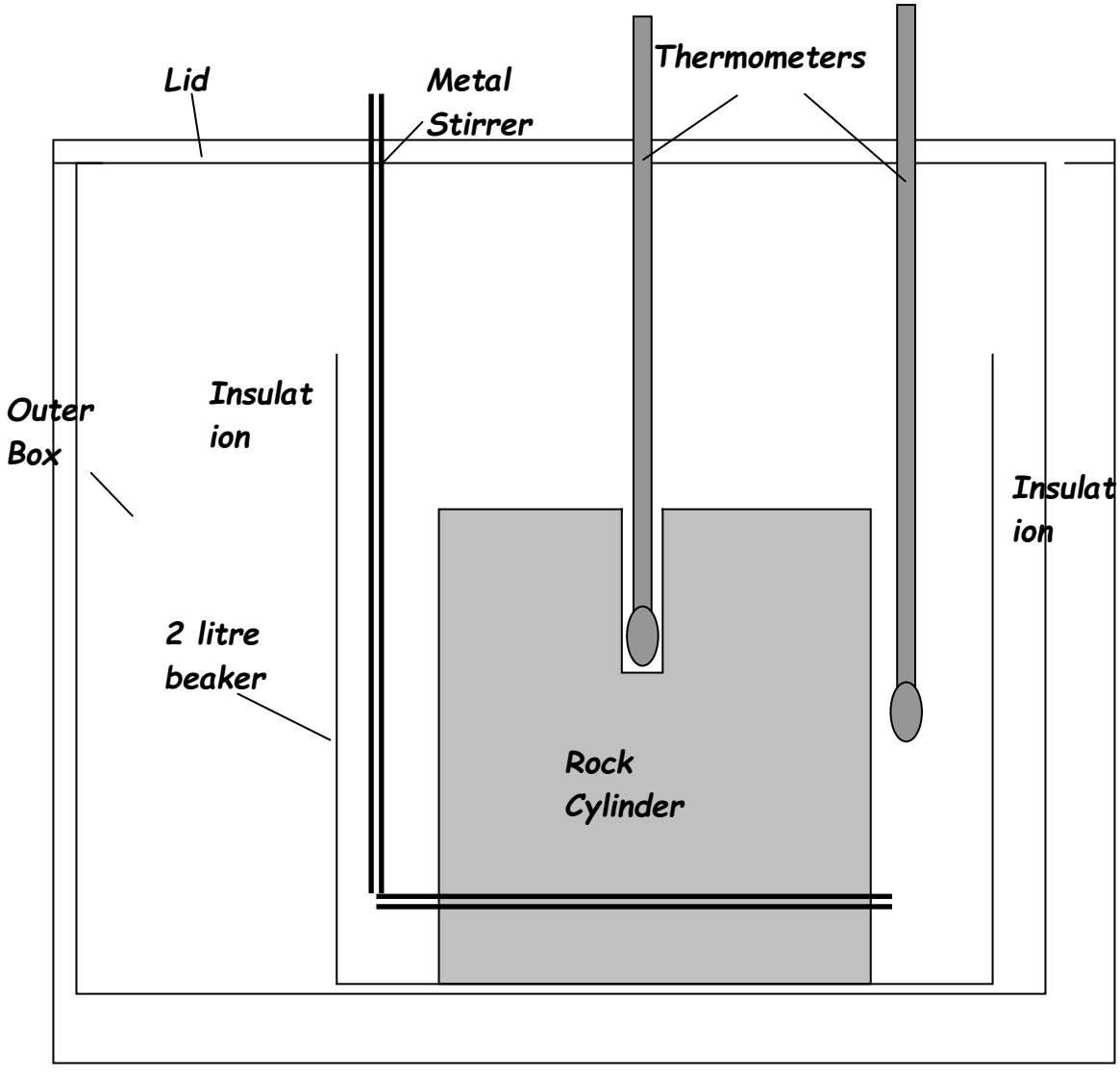
energy transfer = mass of water in grams x increase in water temperature in °C x specific heat of water

= mass of rock x reduction in rock temperature in °C x specific heat of rock

(The specific heat of water is 4.2 joules per gram)

(1ml of water weighs one gram)

3 *Assume you have a hundred metric tonnes of rock at 100°C and that you pump water into it at 20°C. What volume of water can you expect to pump out at a temperature of 50°C?*



Teacher's Section

Requirements

Cylinder of rock, about 8cm diameter and 8cm high
2 thermometers, stirrer
Insulated 2 litre beaker.
250ml measuring cylinder.
Soft wire (e.g. coat hanger) to make stirrer
One litre jug
Box 20cm by 20cm by 20cm and insulation
Polystyrene tile
Oil and a small blob of plasticine

Preparation

Heat the cylinder to 100°c prior to the start of the experiment but students must weigh the cylinder first.

Making the equipment (About an hour to make the box.)

Drill a hole 4cm deep in the centre of one end of the cylinder. The hole should be just large enough to take a thermometer and you will need a concrete drill bit and a drill press to do it. Stonemasons will do it for you.

Either get a block of expanded polystryrene and cut a hole in it to take the two litre beaker. Or make a box about 20cm by 20cm by 20cm and put the beaker into it surrounded by insulation. Make a lid from a piece of expanded polystyrene and cut holes just large enough for the two thermometers and the stirrer.

The stirrer is made from a 60cm long piece of wire bent so that it fits around the cylinder of rock and in the beaker.

Notes

Rock cylinders can be obtained free of charge from stonemasons.
Plotting a graph enables students to make a more accurate estimate of the increase in temperature of the water but the calculation can be done without a graph.

Checks

Make sure the students stir the water before measuring the temperature.

Results

The specific heat of rocks should be about 1.0 joules per g. but results will vary from about 0.7 to 1.3 because the experiment is not accurate.

Time

40 minutes

Apparatus for determining specific heat showing inside