Specific heat capacity

Physics required practical | AQA Combined Science 8464 and AQA GCSE Physics 8463 | 14 questions, 36 marks

GCSE science required practicals

This practical online

Name: _____ **Date:** _____ **Score:** _____ **/ 36**

Aim: To find the specific heat capacity of a metal block by heating it with an electric heater and measuring the energy supplied and the rise in temperature.

Equipment: 1 kg metal block (for example aluminium) with two holes drilled in it; 12 V immersion heater that fits one hole; Low voltage power supply; Joulemeter, or an ammeter and a voltmeter; Connecting leads; Thermometer (a digital one reading to 0.1 °C is best); Stopwatch; Insulating jacket or thick layer of foam to wrap the block; Heatproof mat; Pipette with a little water or oil; Top-pan balance.

Results

Rohan heated a 1.00 kg aluminium block with a 12 V heater. The voltmeter across the heater read 11.8 V and the ammeter read 4.20 A for the whole experiment. He read a digital thermometer in the block every 120 s.

Time in s	Temperature in °C
0	20.5
120	25.9
240	31.4
360	37.2
480	40.1
600	48.6

Questions

1 Look at Rohan's experiment.

a. Name the dependent variable.

b. Give one control variable.

(2 marks)

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2 Rohan wrapped a thick foam jacket around the block before he switched the heater on. Explain why.

(2 marks)

3 Before reading the thermometer, Rohan put a few drops of water into the hole the thermometer sits in. Give the reason for this.

(1 mark)

4 Give one hazard in this experiment and say how Rohan can reduce the risk of harm from it.

(2 marks)

5 Describe how the temperature of the block changes with time in Rohan's results.

(2 marks)

6 One of Rohan's temperature readings is anomalous.

a. Which reading is it?

b. What should Rohan do with it?

(2 marks)

7 Calculate the energy transferred by the heater in 600 s. Use the voltmeter and ammeter readings in the box above the table.

Give your answer to 3 significant figures. Show your working.

(3 marks)

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8 Use your answer to the previous question and Rohan's readings at 0 s and 600 s to calculate the specific heat capacity of aluminium.

The change in thermal energy of the block is given by $\Delta E = mc\Delta\theta$, where m is the mass in kg, c is the specific heat capacity in J/kg °C and $\Delta\theta$ is the temperature change in °C.

Give your answer to 3 significant figures. Show your working.

(3 marks)

9 **Higher tier**

A better method uses the steady part of the results. Between 120 s and 360 s the power of the heater was 49.56 W.

a. Calculate the mean rate of temperature rise of the block between 120 s and 360 s, in °C/s.

b. Use your answer to part a) to calculate the specific heat capacity of aluminium.

The change in thermal energy of the block is given by $\Delta E = mc\Delta\theta$.

Give your final answer to 3 significant figures. Show your working.

(4 marks)

10 Amara did the same experiment with a steel block of mass 800 g. She used a joulemeter instead of a voltmeter and ammeter.

The joulemeter read 0 J at the start and 15 100 J at the end. The temperature of the block went from 19.0 °C to 58.5 °C.

Calculate the specific heat capacity of steel from Amara's results. The change in thermal energy is given by $\Delta E = mc\Delta\theta$.

Give your answer to 2 significant figures. Show your working.

(3 marks)

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11 A data book gives the specific heat capacity of aluminium as 900 J/kg °C. Rohan's value is bigger than this. Explain why.

(2 marks)

12 Suggest one change to Rohan's method that would give a value closer to 900 J/kg °C. Explain how it helps.

(2 marks)

13 **Higher tier**

Rohan says that if he repeats the experiment three times and takes a mean, his value will get much closer to 900 J/kg °C. Explain why he is wrong.

(2 marks)

14 Plan an investigation to find the specific heat capacity of water, using an electric heater. Include how you would use your measurements to work out the answer.

(6 marks)

End of questions | Total 36 marks | The answers sheet has the full method as revision notes.

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