

Required Practical Thermal Insulation

GCSE Physics · Written to the shared content for AQA, Edexcel and OCR

Name _____ Class _____ Date _____

1. Worked example

Identify the independent variable, the dependent variable and two control variables in this practical. (4 marks)

Step 1 · Independent (what you change)

The insulating material (or the number of layers of one material).

Step 2 · Dependent (what you measure)

The temperature of the water after a fixed time (or the temperature drop).

Step 3 · Control variables

Any two: volume (mass) of water; starting temperature; thickness of material; size and type of beaker; using a lid; room temperature; time interval.

Answer: IV: material; DV: temperature drop; controls: e.g. volume of water and starting temperature

Check: Keeping the starting temperature the same matters because cooling is faster when the water is hotter.

2. Now try one with the steps

Use the results table to state which material is the best insulator. Give a reason using data. (2 marks)

Step 1 · Find each temperature drop after 20 minutes

Step 2 · Conclude

Answer:

3. Practice

Show your working. The marks tell you how much is expected.

1. State the independent variable in this investigation. [1]

2. State the dependent variable. [1]

3. Give two control variables. [2]

4. Calculate the temperature drop for the newspaper beaker over 20 minutes. [1]
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5. Give one safety precaution when using hot water in this practical. [1]
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6. Explain why a lid is placed on each beaker. [1]
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7. Suggest why one beaker is left with no insulation. [1]
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8. Calculate the mean rate of cooling for the bubble wrap beaker over 20 minutes, in °C per minute. [2]
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9. Explain why each material must be the same thickness. [2]
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10. Use the results to compare newspaper and cotton wool [2]
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11. Explain why materials that trap air, such wool, are good insulators. [2]
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12. Explain why the rate of cooling decreases during the experiment. [2]
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13. Suggest two improvements to make the results more repeatable or more precise. [2]
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14. The cotton wool beaker held 0.20 kg of water and cooled by 14.2 °C. Calculate the energy transferred to the surroundings. $c = 4200 \text{ J/kg } ^\circ\text{C}$. Give your answer in joules to 3 significant figures. [3]

4. Before you hand it in

"Cotton wool is best because it ended up coolest."

A good insulator gives the smallest temperature drop, so the water stays warmest.

Starting the beakers at different temperatures

Start every beaker at the same temperature (for example 80 °C) and start timing at that reading.

"Insulation stops heat getting out."

Say the insulator reduces the rate of energy transfer to the surroundings.

Calling the beaker without insulation a 'control variable'

Call it a control (comparison), and list things like volume and starting temperature variables.