

Specific Heat Capacity

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

Name _____ Class _____ Date _____

1. Worked example

Calculate the energy needed to warm 0.40 kg of water by 25 °C. Specific heat capacity of water = 4200 J/kg °C. (2 marks)

Step 1 · Write the equation

$$\Delta E = m c \Delta \theta$$

Step 2 · Substitute

$$\Delta E = 0.40 \times 4200 \times 25$$

Step 3 · Calculate

$$\Delta E = 42\,000 \text{ J (42 kJ)}$$

Answer: 42 000 J

Check: $\Delta\theta$ is the temperature change, not the final temperature.

2. Now try one with the steps

10 000 J is supplied to 1.0 kg of aluminium ($c = 900 \text{ J/kg } ^\circ\text{C}$) and to 1.0 kg of water ($c = 4200 \text{ J/kg } ^\circ\text{C}$). Compare the temperature rises. (3 marks)

Step 1 · Rearrange

Step 2 · Aluminium

Step 3 · Water

Step 4 · Compare

Answer:

3. Practice

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

1. Define specific heat capacity. [2]

2. State the unit of specific heat capacity. [1]

3. Calculate the energy needed to heat 2.0 kg of water by 10 °C. $c = 4200 \text{ J/kg } ^\circ\text{C}$. Give your answer in joules. [2]
- _____
- _____
4. Calculate the energy needed to heat 0.50 kg of aluminium by 20 °C. $c = 900 \text{ J/kg } ^\circ\text{C}$. Give your answer in joules. [2]
- _____
- _____
5. Equal masses of copper and water are given the same amount of energy. State which has the bigger temperature rise and explain why. [2]
- _____
- _____
6. A kettle heats 1.2 kg of water from 15 °C to 100 °C. Calculate the energy transferred to the water. $c = 4200 \text{ J/kg } ^\circ\text{C}$. Give your answer in kJ to 3 significant figures. [3]
- _____
- _____
- _____
7. 21 000 J of energy raises the temperature of 0.50 kg of a liquid by 20 °C. Calculate the specific heat capacity of the liquid in $\text{J/kg } ^\circ\text{C}$. [3]
- _____
- _____
- _____
8. A 2.0 kg steel block ($c = 450 \text{ J/kg } ^\circ\text{C}$) is supplied with 36 000 J. Calculate its temperature rise. [3]
- _____
- _____
- _____
9. Explain why water is used to carry energy in central heating systems. [2]
- _____
- _____
10. Explain why places by the sea usually have smaller temperature changes between summer and winter than places far inland. [2]
- _____
- _____

11. 50 400 J of energy raises the temperature of some water by 6.0 °C. Calculate the mass of the water. $c = 4200 \text{ J/kg } ^\circ\text{C}$. [3]

12. 0.25 kg of water at 18 °C is given 21 000 J. Calculate its final temperature. $c = 4200 \text{ J/kg } ^\circ\text{C}$. [3]

13. A storage heater contains an 80 kg concrete block ($c = 880 \text{ J/kg } ^\circ\text{C}$). Overnight it is heated to 60 °C, and during the day it cools to 20 °C. Calculate the energy it releases. Give your answer in MJ to 2 significant figures. [3]

14. A student measures the specific heat capacity of a metal block and gets a value higher than the true value. Explain why. [2]

4. Before you hand it in

Using the final temperature (100 °C) as $\Delta\theta$

$\Delta\theta$ = final temperature – starting temperature. Heating from 15 °C to 100 °C gives $\Delta\theta = 85 \text{ } ^\circ\text{C}$.

Putting 250 g into the equation as 250

Convert grams to kilograms first: 250 g = 0.25 kg.

Using $\Delta E = m c \Delta\theta$ while ice is melting

Use specific heat capacity when the temperature changes and specific latent heat ($E = m L$) when the state changes.

"Water has a high specific heat capacity, so it heats up quickly."

A high specific heat capacity means a lot of energy is needed for each degree, so the temperature rises slowly.