

MR SULLY UNFOLDS PHYSICS ANSWERS

Specific heat capacity

AQA 4.1.1.3
Energy · Paper 1
Foundation & Higher · Required practical 1

Name _____ Class _____ Date _____

Different materials need different amounts of energy to warm up. This is their **specific heat capacity**.

KEY EQUATION

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

ΔE = change in thermal energy (J)
m = mass (kg)
c = specific heat capacity (J/kg °C)
$\Delta\theta$ = temperature change (°C)

WORKED EXAMPLE

How much energy heats 0.5 kg of water (c = 4200 J/kg °C) from 20 °C to 30 °C?
$\Delta\theta = 30 - 20 = 10$ °C
$\Delta E = 0.5 \times 4200 \times 10 =$ **21 000 J**

Section A · Recall and calculate

Grade 4–5

1 Define specific heat capacity. [2]

The amount of energy required to raise the temperature of 1 kg of the substance by 1 °C.

2 Calculate the energy needed to heat 2 kg of water by 10 °C. (c = 4200 J/kg °C) [2]

$\Delta E = 2 \times 4200 \times 10 = 84\,000$ J

3 Fill in the missing values in the table. [3]

Mass (kg)	c (J/kg °C)	Δθ (°C)	ΔE (J)
1.0	900	20	**18 000**
0.5	4200	**40**	84 000
2.0	385	50	38 500

Section B · Rearrange and apply

Grade 5–6

4 A 5 kg metal block is heated with 45 000 J and its temperature rises by 10 °C. Calculate the specific heat capacity and identify the metal: copper 385, iron 450, aluminium 900 J/kg °C. [3]

$c = 45\,000 \div (5 \times 10) = 900$ J/kg °C

Aluminium

5 A 2000 W kettle is switched on for 120 s. It contains 0.8 kg of water at 20 °C. Assuming no energy is wasted, calculate the final temperature. (c = 4200 J/kg °C) [4]

$E = Pt = 2000 \times 120 = 240\,000$ J

$\Delta\theta = 240\,000 \div (0.8 \times 4200) = 71.4$ °C

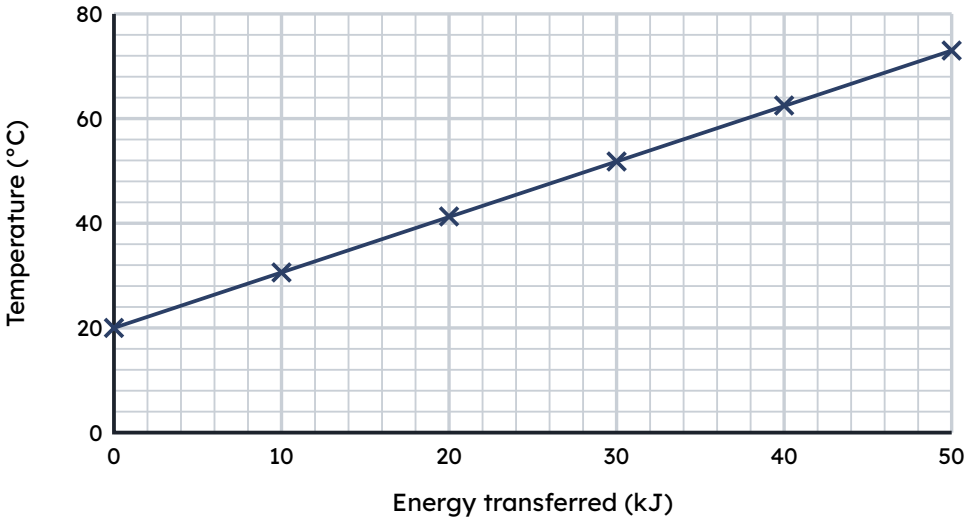
Final temperature = 20 + 71.4 = 91 °C

Section C · Required practical

Grade 6–7+

6 A student heats a 1.0 kg aluminium block and records the energy transferred and the temperature.

Energy (kJ)	Temp (°C)
0	20.0
10	30.6
20	41.3
30	51.8
40	62.5
50	73.0



a Plot the results and draw a line of best fit. [3]

Points plotted correctly (2), straight line of best fit (1).

b Calculate the gradient of your line in °C per J, then use c = 1 ÷ (gradient × mass) to find c. [3]

Gradient = (73.0 − 20.0) ÷ 50 000 = 0.00106 °C/J

c = 1 ÷ (0.00106 × 1.0) = 943 J/kg °C

c The true value is 900 J/kg °C. Explain why the student's value is higher. [2]

Some energy heated the surroundings, not the block,

so the temperature rise was smaller, giving a larger c.

Exam-style question

AQA style

7 Water is used in central heating systems.

a Water has a high specific heat capacity. Explain why this makes it useful in a heating system. [2]

It can store a lot of energy for each °C rise in temperature,

so it releases a lot of energy to the room as it cools.

b A radiator contains 12 kg of water. It cools from 70 °C to 45 °C. Calculate the energy released. (c = 4200 J/kg °C) [3]

ΔE = 12 × 4200 × 25

ΔE = 1 260 000 J

Total: _____ / 27

How confident am I?

	Not yet	Nearly	Got it
I can use ΔE = mcΔθ, including rearranging it	☐	☐	☐
I can describe the specific heat capacity practical	☐	☐	☐
I can explain why measured values are often too high	☐	☐	☐