Exercise walk-through

3.3
Specific heat capacity and temperature changes (4.3.2.2)

AQA · GCSE · Physics

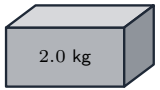
Specific heat capacity and temperature changes

- When the temperature of a substance changes, the energy transferred is:
- The **specific heat capacity** c is the energy needed to raise the temperature of 1 kg of the substance by 1 °C, in J/kg °C.
- Required practical 1, which measures it, is in topic 1.
- **Worked example 4.** 0.030 kg of olive oil ($c = 1800$ J/kg °C) is heated from 21 °C to 96 °C.

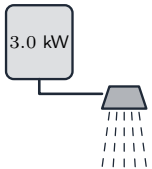
$$\Delta E = m\,c\,\Delta\theta$$

Exercises 2.1·2.2

2.1 Calculate the energy needed to raise the temperature of 2.0 kg of copper by 15 °C. Copper has $c = 390$ J/kg °C. [2]

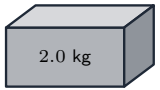


2.2 A 3.0 kW electric shower heats water for 5.0 minutes. Calculate the energy transferred. [2]



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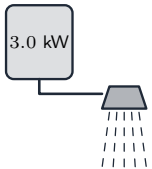
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2.1

- $2.0 \times 390 \times 15 = \mathbf{11\,700}$ J

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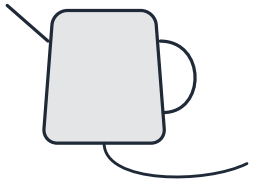


2.2

- $3000 \times 300 = \mathbf{900\,000}$ J

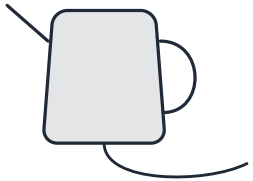
Exercise 3.1

3.1 A kettle transfers 67 200 J to 0.40 kg of water. The water starts at 20 °C. Calculate the final temperature. [3]



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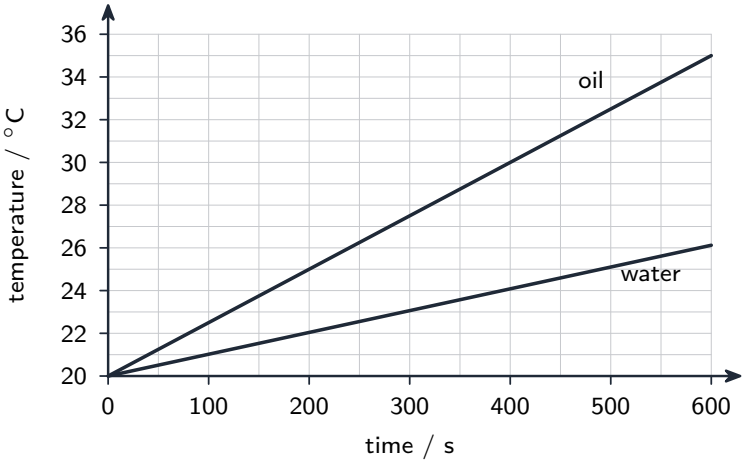
3.1

- $\Delta\theta = 67\,200 \div (0.40 \times 4200)$
- $\Delta\theta = 40$ °C
- final temperature $= 20 + 40 =$ **60** °C

Exercise 3.2 (a)

3.2 A 50 W heater is used to heat 1.0 kg of water and, separately, 1.0 kg of oil. The graph shows the results.

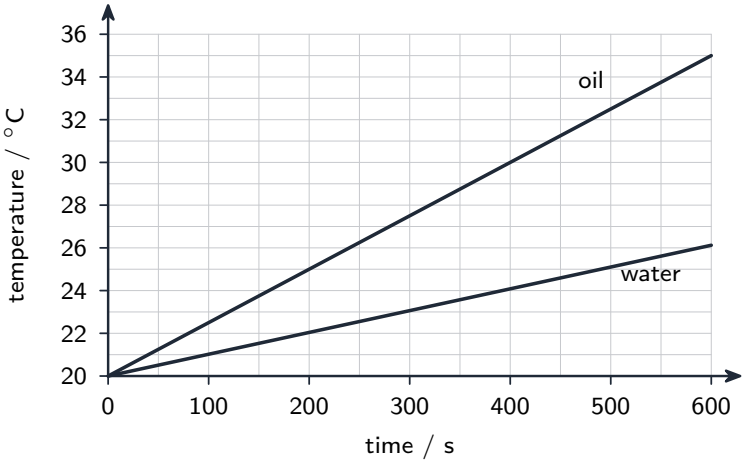
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(a) 20 °C to 25 °C; rise = **5** °C

Exercise 3.2 (b)

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(b) $E = 50 \times 200 = 10\,000$ J; $c = 10\,000 \div (1.0 \times 5) = \mathbf{2000}$ J/kg °C

Exercise 3.2 (c)

3.2 A 50 W heater is used to heat 1.0 kg of water and, separately, 1.0 kg of oil. The graph shows the results.

(c) The value for water from this experiment is higher than 4200 J/kg °C. Explain why. [2]

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3.2 A 50 W heater is used to heat 1.0 kg of water and, separately, 1.0 kg of oil. The graph shows the results.

(c) The value for water from this experiment is higher than 4200 J/kg °C. Explain why. [2]

(c) some energy is transferred to the surroundings and the beaker; so the measured temperature rise is smaller than it should be, which gives a larger value of c

Exercise 3.2 (d)

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(d) Compare the two lines, and explain how a student could make this experiment more accurate. [6]

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(d) points to include:

- the oil line is steeper: the oil warms up more than twice as fast
- the same energy is supplied each second, so the oil has the lower specific heat capacity
- insulate the beaker (for example with cotton wool) and put a lid on it
- stir the liquid so the temperature is the same everywhere
- measure the energy with a joulemeter instead of using the power rating
- take readings at regular times and draw a line of best fit to find the gradient

Levels: **5–6** a full, logical answer with correct physics and correct terms; **3–4** several correct points, partly linked; **1–2** one or two relevant points.