Exercise walk-through

1.5
Conservation and dissipation of energy (4.1.2.1, RP2)

AQA · GCSE · Physics

Specific heat capacity

- When a substance is heated, the energy in its thermal store increases and its temperature rises:
- ΔE is the change in thermal energy in J, m the mass in kg and $\Delta\theta$ the temperature change in °C.
- The **specific heat capacity** c is the energy needed to raise the temperature of 1 kg of a substance by 1 °C, in J/kg °C.
- This equation is on the equations sheet.

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

Power

- **Power** is the rate at which energy is transferred, or the rate at which work is done.
- A more **powerful** motor lifts the same load through the same height in less time.
- P is **power** in watts, E energy transferred in J, W the **work done** in J and t the time in s.
- A transfer of 1 J per second is a power of 1 **watt** (W).

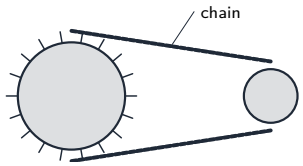
$$P = \frac{E}{t} \qquad P = \frac{W}{t}$$

National and global energy resources

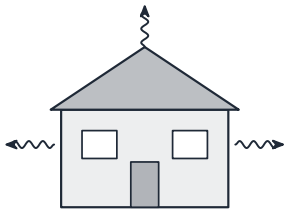
- The main energy resources are **fossil fuels** (coal, oil and gas), **nuclear fuel**, bio-fuel, wind, hydroelectricity, geothermal, the tides, the Sun and water waves.
- We use them for transport, electricity generation and **heating**.
- A **renewable** resource is one that is being, or can be, replaced as it is used.
- **Fossil fuels** and **nuclear fuel** are **non-renewable**: they will run out.

Exercises 2.1·2.2

2.1 A cyclist oils the chain of her bicycle. Explain why this helps. [2]

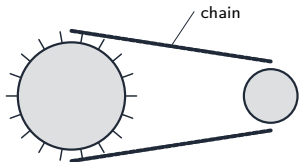


2.2 Give **two** ways to reduce the energy lost from a house. [2]



Exercises 2.1·2.2

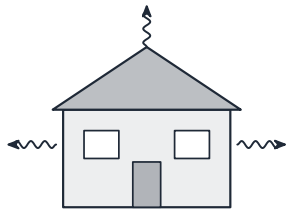
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2.1

- it reduces friction between the moving parts; so less energy is wasted by heating

2.2 Give **two** ways to reduce the energy lost from a house. [2]



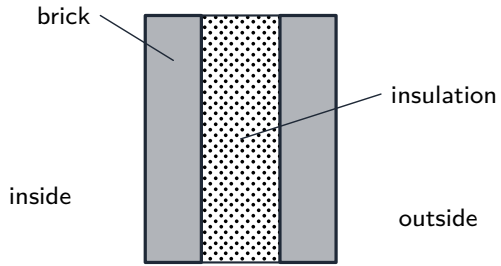
2.2

- any two: loft insulation; cavity wall insulation; double glazing; draught excluders

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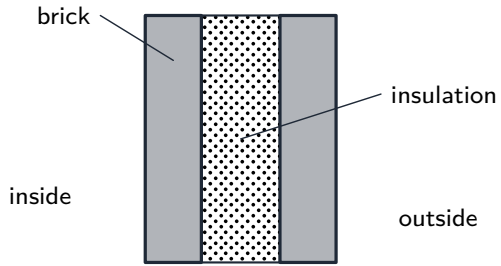
Exercise 3.1

3.1 Explain how cavity wall insulation reduces the energy lost from a house. [3]



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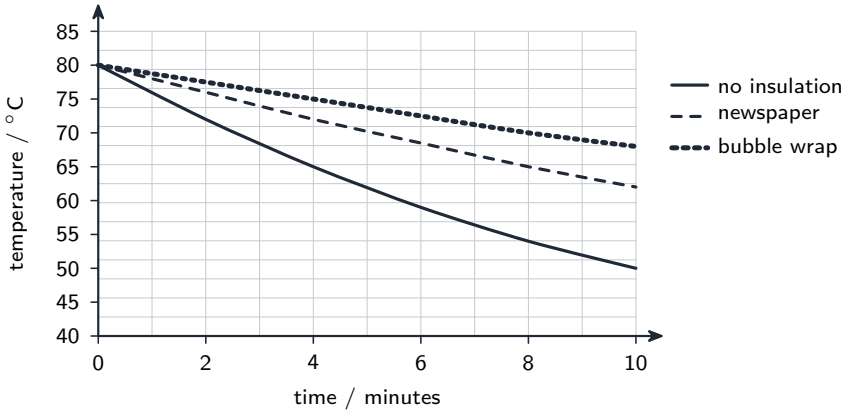
3.1

- the insulation has a low thermal conductivity
- it traps air, which is a poor conductor, and stops air moving in the cavity
- so the rate of energy transfer through the wall is lower

Exercise 3.2 (a)

3.2 A student fills three beakers with hot water. One has no insulation, one is wrapped in newspaper and one in bubble wrap. The graph shows how the water cools.

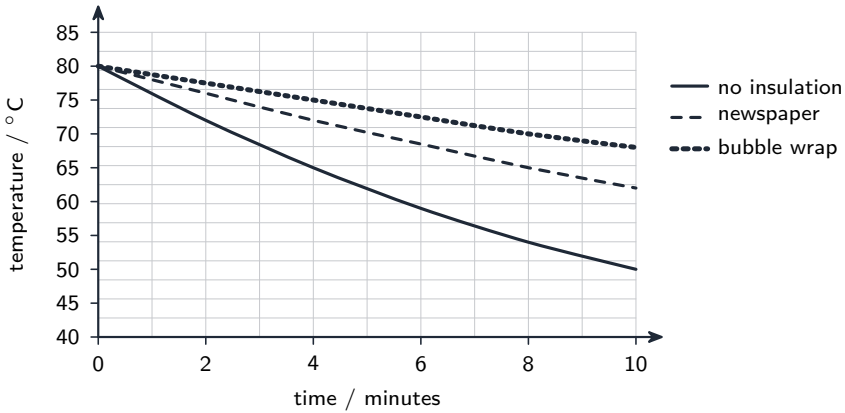
(a) Use the graph to find the temperature drop of the beaker with no insulation in 10 minutes. [2]



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(a) Use the graph to find the temperature drop of the beaker with no insulation in 10 minutes. [2]



(a) $80 - 50 = \mathbf{30}\,^{\circ}\mathrm{C}$

Exercise 3.2 (b)

3.2 A student fills three beakers with hot water. One has no insulation, one is wrapped in newspaper and one in bubble wrap. The graph shows how the water cools.

(b) Which material is the best insulator? Explain your answer. [3]

Exercise 3.2 (b)

3.2 A student fills three beakers with hot water. One has no insulation, one is wrapped in newspaper and one in bubble wrap. The graph shows how the water cools.

(b) Which material is the best insulator? Explain your answer. [3]

(b) **bubble wrap**; its water had the smallest temperature drop, so it cooled most slowly; it traps air, which has a low thermal conductivity

Exercise 3.2 (c)

3.2 A student fills three beakers with hot water. One has no insulation, one is wrapped in newspaper and one in bubble wrap. The graph shows how the water cools.

(c) Give **two** variables the student must keep the same. [2]

Exercise 3.2 (c)

3.2 A student fills three beakers with hot water. One has no insulation, one is wrapped in newspaper and one in bubble wrap. The graph shows how the water cools.

(c) Give **two** variables the student must keep the same. [2]

(c) any two: the same volume of water; the same starting temperature; the same thickness of material; the same beaker

Exercise 3.2 (d)

3.2 A student fills three beakers with hot water. One has no insulation, one is wrapped in newspaper and one in bubble wrap. The graph shows how the water cools.

(d) Describe how the student should carry out this investigation. [6]

Exercise 3.2 (d)

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(d) Describe how the student should carry out this investigation. [6]

(d) points to include:

- wrap each beaker in a different material, using the same thickness, and leave one with none
- pour the same volume of hot water into each beaker, using a measuring cylinder
- put a lid on each and a thermometer in each
- record the starting temperature and start a stopwatch
- record the temperature every 2 minutes for 10 minutes
- compare the temperature drops; the smallest drop shows the best insulator

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.