



Interactive Example Candidate Responses

Paper 4 (May / June 2016), Question 4

Cambridge IGCSE™
Physics 0625



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- 4 (a) The source of solar energy is the Sun.

Tick the box next to those resources for which the Sun is also the source of energy.

- ☒ coal
☐ geothermal
☒ hydroelectric
☐ nuclear
☒ wind

[2]

- (b) Fig. 4.1 shows a solar water-heating panel on the roof of a house.

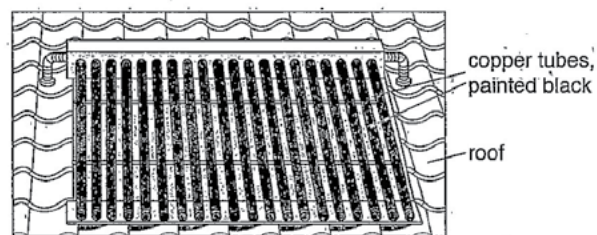


Fig. 4.1

Cold water flows into the copper tubes, which are heated by solar radiation. Hot water flows out of the tubes and is stored in a tank.

- (i) Explain why the tubes are made of copper and are painted black.

The tubes are made of copper because copper is a good conductor of heat, so it will be heated easily. It is painted black because black objects are good absorbers of heat. [2]

- (ii) In 5.0 s, 0.019 kg of water flows through the tubes. The temperature of the water increases from 20 °C to 72 °C. The specific heat capacity of water is 4200 J/(kg °C).

Calculate the thermal energy gained by the water in 5.0 s.

$$\begin{aligned} \text{energy} &= mc\Delta T \\ \text{energy} &= 0.019 \times 4200 \times (72 - 20) \\ &= 79.8 \times 52 \\ &= 4149.6 \text{ J} \end{aligned}$$

thermal energy = 4149.6 J [3]

Select
page

Your
Mark

4(a)

4(b)(i)

4(b)(ii)

4(b)(iii)

Q4 Mark scheme

(a)	Coal, hydroelectric and wind boxes ticked
(b)(i)	Copper is a good conductor of thermal energy/heat Black surface is a good/the best absorber of radiation/ infra-red
(b)(ii)	(Temp rise =) 72 – 20 = 52 (°C) (Q =) $mc\Delta\theta$ OR $0.019 \times 4200 \times 52$ 4100 J
(b)(iii)	Efficiency = (power) output/(power) input (× 100) OR $\frac{\left(\frac{4100}{5}\right) \times 100}{\text{power input}}$ OR $\frac{(4100 \times 100)}{\text{power input}}$ OR rearranged Power input = 1200W

(iii) The efficiency of the solar panel is 70%.

Calculate the power of the solar radiation incident on the panel.

$$\begin{aligned} 70\% &\rightarrow 4149.6 \\ 100\% &\rightarrow \frac{4149.6}{70} \times 100 = 5928 \end{aligned}$$

power = 5928 W [2]

[Total: 9]

Select
page

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4(b)(iii)

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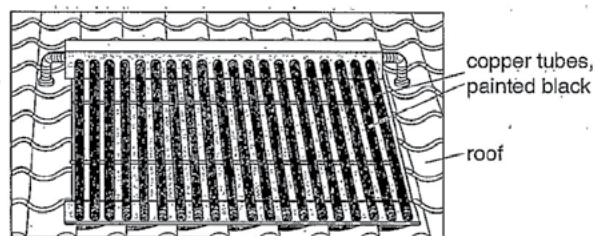


Fig. 4.1

Cold water flows into the copper tubes, which are heated by solar radiation. Hot water flows out of the tubes and is stored in a tank.

- (i) Explain why the tubes are made of copper and are painted black.

• Copper tubes conduct heat and can easily pass heat to the water flowing.
 • Black painted tube

[2]

- (ii) In 5.0 s, 0.019 kg of water flows through the tubes. The temperature of the water increases from 20 °C to 72 °C. The specific heat capacity of water is 4200 J/(kg °C).

Calculate the thermal energy gained by the water in 5.0 s.

$$H = mc\Delta T$$

$$H = 0.019 \times 4200 \times 52 = 4149.6 \times 5 = 20748$$

thermal energy = 20748 J [3]

Select page

Your Mark

4(a)

4(b)(i)

4(b)(ii)

4(b)(iii)

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(b)(i)	Copper is a good conductor of thermal energy/heat Black surface is a good/the best absorber of radiation/ infra-red
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(b)(iii)	Efficiency = (power) output/(power) input (× 100) OR $\frac{\left(\frac{4100}{5}\right) \times 100}{\text{power input}}$ OR $\frac{(4100 \times 100)}{\text{power input}}$ OR rearranged Power input = 1200W

(iii). The efficiency of the solar panel is 70%.

Calculate the power of the solar radiation incident on the panel.

$$\frac{4149.6 \times 100}{1 \times 70} = 5928$$

power = 5928 W/s.....[2]

[Total: 9]

Select
page

Your
Mark

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4(b)(i)

4(b)(ii)

4(b)(iii)

Q4	Mark scheme
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(b)(ii)	(Temp rise =) $72 - 20 = 52$ (°C) (Q =) $mc\Delta\theta$ OR $0.019 \times 4200 \times 52$ 4100 J
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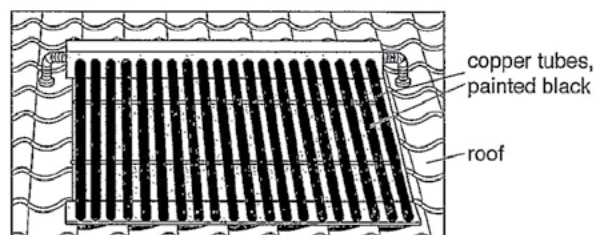


Fig. 4.1

Cold water flows into the copper tubes, which are heated by solar radiation. Hot water flows out of the tubes and is stored in a tank.

- (i) Explain why the tubes are made of copper and are painted black.

Copper is a good conductor of heat and colour black is a good absorber of heat.

[2]

- (ii) In 5.0 s, 0.019 kg of water flows through the tubes. The temperature of the water increases from 20 °C to 72 °C. The specific heat capacity of water is 4200 J/(kg °C).

Calculate the thermal energy gained by the water in 5.0 s.

$$Q = m \times \Delta \theta \times c$$

$$Q = 0.019 \times 52 \times 4200 \text{ J/kg}^\circ\text{C}$$

$$= 4149.6 \text{ J} \times 5 = 20748 \text{ J}$$

thermal energy = ~~4149.6 J~~ 20748 J [3]

Select page

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(b)(i)	Copper is a good conductor of thermal energy/heat Black surface is a good/the best absorber of radiation/ <u>infra-red</u>
(b)(ii)	(Temp rise =) 72 – 20 = 52 (°C) (Q =) mcΔθ OR 0.019 × 4200 × 52 4100 J
(b)(iii)	Efficiency = (power) output/(power) input (× 100) OR $\left(\frac{4100}{5}\right) \times 100$ OR $\frac{(4100 \times 100)}{\text{power input}}$ OR rearranged Power input = 1200W

(iii) The efficiency of the solar panel is 70%.

Calculate the power of the solar radiation incident on the panel.

$$\frac{x}{4149.6} \times 100 = 70 \Rightarrow 2904.72 \text{ J}$$

power = 2904.72 J[2]

[Total: 9]

Your
Mark

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