



GCSE Physics A (Gateway)
J249/04 Physics A P5-P8 and P9 (Higher Tier)

Question Set 20

A student has two radiators in her home. They are filled with different liquids and have different power ratings.

The diagram shows information about the two heaters.

Oil radiator	Water radiator
 <p>Heater contains 10 kg of oil</p>	 <p>Heater contains 10 kg of water</p>
<p>400 W heater</p> <p>Specific heat capacity for oil = 1 680 J/kg°C</p>	<p>1000 W heater</p> <p>Specific heat capacity for water = 4 200 J/kg°C</p>

- (a) The radiators are turned on and both radiators increase in temperature by 40 °C in 1 680 seconds.

Show, by calculation, that the heaters take the same time to heat up.

$$q = mc\Delta T$$

$$E = q = Pt$$

Oil Radiator

Water radiator

$$q = 10 \times 1680 \times 40$$

$$= 672,000$$

$$q = 10 \times 4200 \times 40$$

$$= 1,680,000$$

$$\frac{q}{P} = t$$

$$\frac{1680000}{1000}$$

$$\frac{672,000}{400}$$

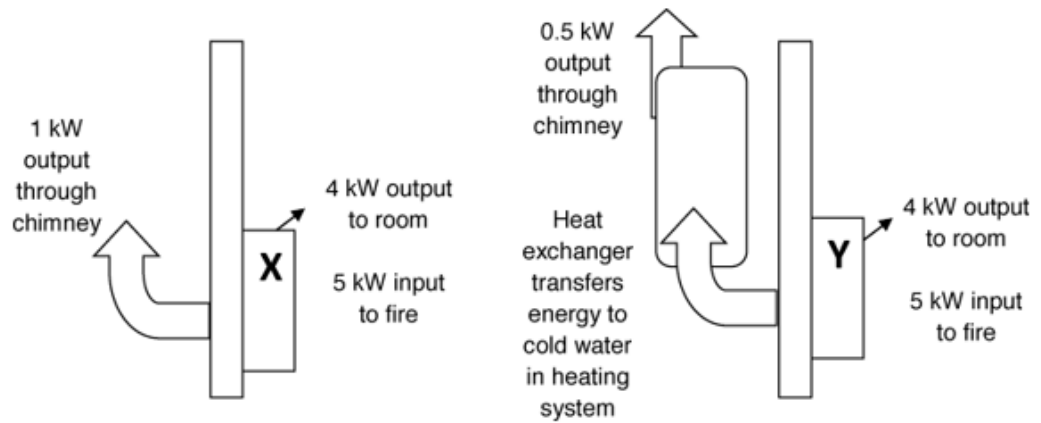
$$= 1680 \text{ seconds}$$

$$= 1680 \text{ seconds}$$

[4]

∴ heaters take the same time to heat up.

(b) The student has two fires in her home (X and Y) shown in the diagrams below.



Why does fire Y help to save money on the energy bills for her home?

Use calculations of efficiency in your answer.

X efficiency

$$\frac{4,000}{5,000} \times 100 = 80\%$$

Y efficiency

$$\frac{4,500}{5,000} \times 100 = 90\%$$

[4]

Y is 90% efficient while X is only 80% efficient. This is because even though they both output 4 kW to the room, Y also uses 0.5 kW to heat up cold water, this means only 0.5 kW is wasted through chimney, unlike X which is 1 kW wasted through the chimney instead.

OCR

Oxford Cambridge and RSA

Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact The OCR Copyright Team, The Triangle Building, Shaftesbury Road, Cambridge CB2 8EA.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge