AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.2.3.2

Mains electricity

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**6**
Available paper years	**2018–2025**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

6.2.3.2 Mains electricity

Answer 01 · Mark scheme

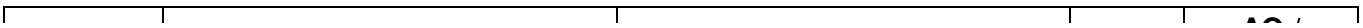
June 2018 | 8464/P/1F | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	(casing is) not made of metal	allow (casing is) made of plastic allow they are double insulated	1	AO3 6.2.3.2
	little / no chance of electric shock		1	
04.2	charge flow = current × time	allow the equation given in symbols	1	AO1 6.2.1.2
04.3	Q = 2.95 × 60	an answer of 177 scores **2** marks	1	AO2 6.2.1.2
	Q = 177 (C)	allow 180 (C)	1	
04.4	straight line with a different positive gradient	must go through the first and third quadrant	1	AO1 6.2.1.4
	straight line with positive gradient through the origin		1	
04.5			1	AO1 6.2.1.1
04.6	the particles vibrate about a fixed position regular arrangement	allow the particles are in a regular arrangement	1	AO1 6.3.1.1
	(the particles change) to being free to move around	allow correct description of translational kinetic energy	1	
04.7		an answer of 100 000 000 scores **3** marks		AO2 6.3.2.3
	L = 200 000 (J/kg)		1	
	E = 500 × 200 000	allow 1×10^8 (J)	1	
	E = 100 000 000 (J)	allow correct calculation for incorrect conversion or no conversion of L for **2** marks	1	
Total			**13**	

6.2.3.2 Mains electricity

Answer 01 · Mark scheme

June 2018 | 8464/P/1F | Original Q4



6.2.3.2 Mains electricity

Answer 02 · Mark scheme June 2019 | 8464/P/1F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
05.1	to stop the metal case of the toaster becoming live if a fault occurs		1	AO1.1 6.2.3.2	A
05.2	yellow brown blue		1 1 1	AO1.1 AO1 in isolation 6.2.3.2	G
05.3	E = 850 ×120 E = 102 000 (J)	an answer of 102 000 (J) scores **2** marks	1 1	AO2.1 6.2.4.2 6.1.1.4 WS 3.3	E
05.4	elastic potential kinetic		1 1	AO1.1 6.1.1.1	G
05.5	gravitational potential energy = mass × gravitational field strength × height or $E_p = m\ g\ h$	allow gpe allow any correct re-arrangement	1	AO1.1 AO1 in isolation 6.1.1.2	E
05.6	$0.049 = 0.050 \times 9.8 \times h$ $h = \frac{0.049}{0.050 \times 9.8}$ h = 0.10 (m)	an answer of 0.10 (m) scores **3** marks	1 1 1	AO2.1 6.1.1.2 WS 3.3	E
Total			**12**		

6.2.3.2 Mains electricity

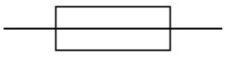
Answer 02 · Mark scheme

June 2019 | 8464/P/1F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID

6.2.3.2 Mains electricity

Answer 03 · Mark scheme November 2020 | 8464/P/1F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	swap the blue wire and the green and yellow wire	allow connect the blue wire to the neutral pin and the yellow and green wire to the earth pin. allow swap the earth and neutral wires ignore the earth wire and neutral wire are wrongly connected	1	AO2 6.2.3.2
05.2	230 (V) 50 (Hz)		1 1	AO1 6.2.3.1 6.2.3.2
05.3	0 (V)		1	AO1 6.2.3.2
05.4			1	AO1 6.2.1.1
05.5	the person could get an electric shock because there is a current in the person	allow so the person could be electrocuted allow because the person provides a connection (from the washing machine) to earth allow because there is a potential difference across the person	1 1	AO3 6.2.3.2

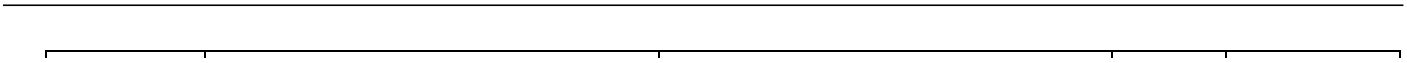
6.2.3.2 Mains electricity

05.6	the charge flows through the earth wire (instead of the person) because the resistance of the earth wire is much less than that of a person	 allow so the case does not become live allow so the fuse will break / melt / blow	1 1	AO3 6.2.3.2
Total			**9**	

6.2.3.2 Mains electricity

Answer 03 · Mark scheme

November 2020 | 8464/P/1F | Original Q5



6.2.3.2 Mains electricity

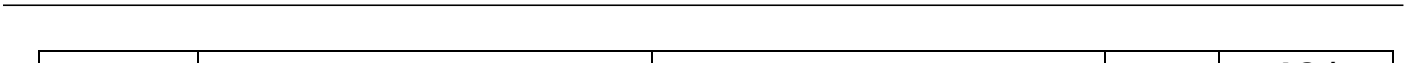
Answer 04 · Mark scheme November 2021 | 8464/P/1F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	$V = I\ R$		1	AO1 6.2.1.3
05.2	3.9 = 0.12 × R $R = \frac{3.9}{0.12}$ R = 32.5 (Ω)	 allow R = 33 (Ω)	1 1 1	AO2 6.2.1.3
05.3	energy = power × time **or** E = P t		1	AO1 6.2.4.2
05.4	time = 150 000s energy = 0.46 × 150 000 energy = 69 000 (J)	 allow a substitution using an incorrectly/not converted value of time allow a correct calculation using an incorrectly/not converted value of time	1 1 1	AO2 6.2.4.2
05.5	thermistor		1	AO1 6.2.1.1
05.6	the current will increase (because) the resistance decreases		1 1	AO1 6.2.1.4
Total			**11**	

6.2.3.2 Mains electricity

Answer 04 · Mark scheme

November 2021 | 8464/P/1F | Original Q5



6.2.3.2 Mains electricity

Answer 05 · Mark scheme

June 2024 | 8464/P/1F | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	kinetic energy (of the beater / food) internal / thermal energy (of the surroundings / whisk / food)	ignore sound	1 1	AO1 6.2.4.2 6.1.2.1 6.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	power = $\frac{\text{work done}}{\text{time}}$ or $P = \frac{W}{t}$		1	AO1 6.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	$92 = \frac{23\,000}{\text{time}}$ $\text{time} = \frac{23\,000}{92}$ 250 (s)		1 1 1	AO2 6.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	$P = I^2 R$		1	AO1 6.2.4.1

6.2.3.2 Mains electricity

Answer 05 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	I = 0.500 A		1	AO2 6.2.4.1
	$P = 0.500^2 \times 640$	allow a correct substitution of an incorrectly / not converted current	1	
	P = 160 (W)	allow a correct calculation using an incorrectly / not converted current	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	230 (V)		1	AO1 6.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.7	decreases		1	AO1 6.2.4.1

Total Question 6	**12**

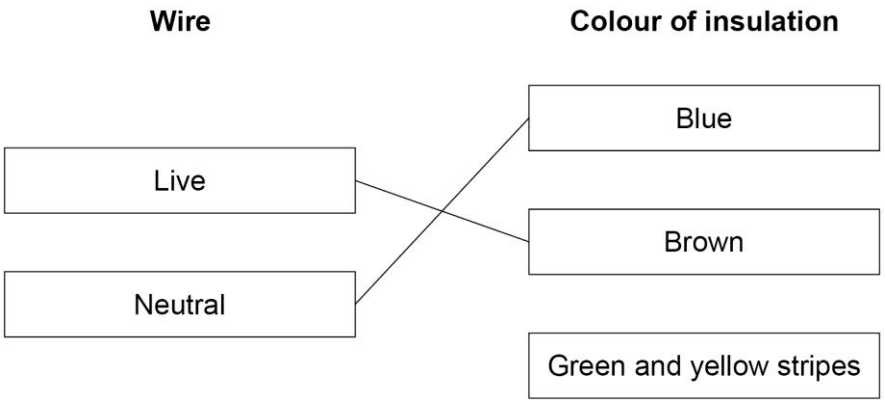
6.2.3.2 Mains electricity

Answer 06 · Mark scheme

June 2025 | 8464/P/1F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	50 Hz		1	AO1 6.2.3.1

Question	Answers	Mark	AO / Spec. Ref.
04.2	 do **not** accept more than one line from a box on the left	1 1	AO1 6.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	power = potential difference × current **or** $P = VI$		1	AO1 6.2.4.1

6.2.3.2 Mains electricity

Answer 06 · Mark scheme

June 2025 | 8464/P/1F | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	$2100 = 230 \times I$		1	AO2 6.2.4.1
	$I = \frac{2100}{230}$		1	
	$I = 9.13\ldots$		1	
	$I = 9.1$ (A)	allow an answer calculated using the numbers from the question given to two significant figures	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	$18\,000 = 0.0080 \times L$		1	AO2 6.3.2.3
	$L = \frac{18\,000}{0.0080}$		1	
	$L = 2\,250\,000$ (J/kg)	allow 2 300 000	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	efficiency $= \frac{75\,600}{84\,000}$		1	AO2 6.1.2.2
	efficiency = 0.9		1	
	OR			
	efficiency $= \frac{75\,600}{84\,000} \times 100$ (1)			
	efficiency = 90% (1)			

6.2.3.2 Mains electricity

Answer 06 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	less energy is wasted	allow power for energy throughout	1	AO1
	(so) costs less to run **or** (so) uses less electricity / energy	allow so the appliance is used for less time	1	AO2 6.1.2.1 6.1.2.2 6.2.4.2

Total Question 4	15

6.2.3.2 Mains electricity

Answer 02 · Examiner comments — June 2019 | 8464/P/1F | Original Q5

Question 5

05.1 Just under half the students knew the function of the earth wire.

05.2 Nearly 80% of students gained at least one mark and around 37% gained all three marks for knowing the colours of the wires in a plug.

05.3 Over 90% of students gained at least 1 mark and the vast majority of these gained 2 marks for a calculation using a given formula. A few students incorrectly converted the time in seconds into minutes.

05.4 More than half of the students gained both marks for correctly identifying both energy stores from the given list. Around a quarter of the students made one correct choice. Often, the correct energies were chosen but placed in the wrong order.

05.5 About 30% of students could write an equation linking gravitational field strength, gravitational potential energy, height and mass. Some kept the order in which quantities were written the same and inserted incorrect mathematical operators into the given

Answer 02 · Examiner comments — June 2019 | 8464/P/1F | Original Q5

sequence (GFS = GPE × h × g was a very common incorrect answer, as was GFS = GPE ÷ h × g without brackets around h × g). 15% of students did not attempt the question. For this examination, the abbreviations GFS and GPE were acceptable, as were upper and lower case letters E for energy, h for height and m for mass. A capital G was not acceptable for g, as G is the universal gravitational constant which has a different meaning to g, the gravitational field strength.

05.6 Students found rearrangement of E_p = mgh difficult, even if they had written the correct equation in the previous question. About 15% of students scored marks on this question and about 10% did not attempt it. Many students just multiplied all of the numbers in the question together. Some students produced answers that could not be reasonable for the change in height of the toast – such as 1mm or less, and 1 000m.

6.2.3.2 Mains electricity

Answer 04 · Examiner comments November 2021 | 8464/P/1F | Original Q5

Question 05 (Standard demand)

05.1 Slightly over a third of students selected the correct equation.

05.2 Full marks were gained by approximately a third of the students, with more than 50% failing to gain any credit.

05.3 This equation was correctly recalled by slightly less than half of students.

05.4 Most students did not attempt to convert 2500 minutes into seconds. Very few students gained all 3 marks, although over 60 % gained at least 2 marks.

05.5 Only a very small proportion of foundation tier students were able to correctly identify the symbol for a thermistor.

05.6 Most students failed to recognise that the resistance of the thermistor would decrease as temperature increased, with many students stating that because the potential different across the thermistor was constant, the current in the thermistor must also be constant. Another misconception demonstrated in a number of responses was that the current would increase because the increased temperature gives the current more energy. Nearly one in five students did not attempt the question.

Answer 05 · Examiner comments

June 2024 | 8464/P/1F | Original Q6

Question 6 (standard demand)

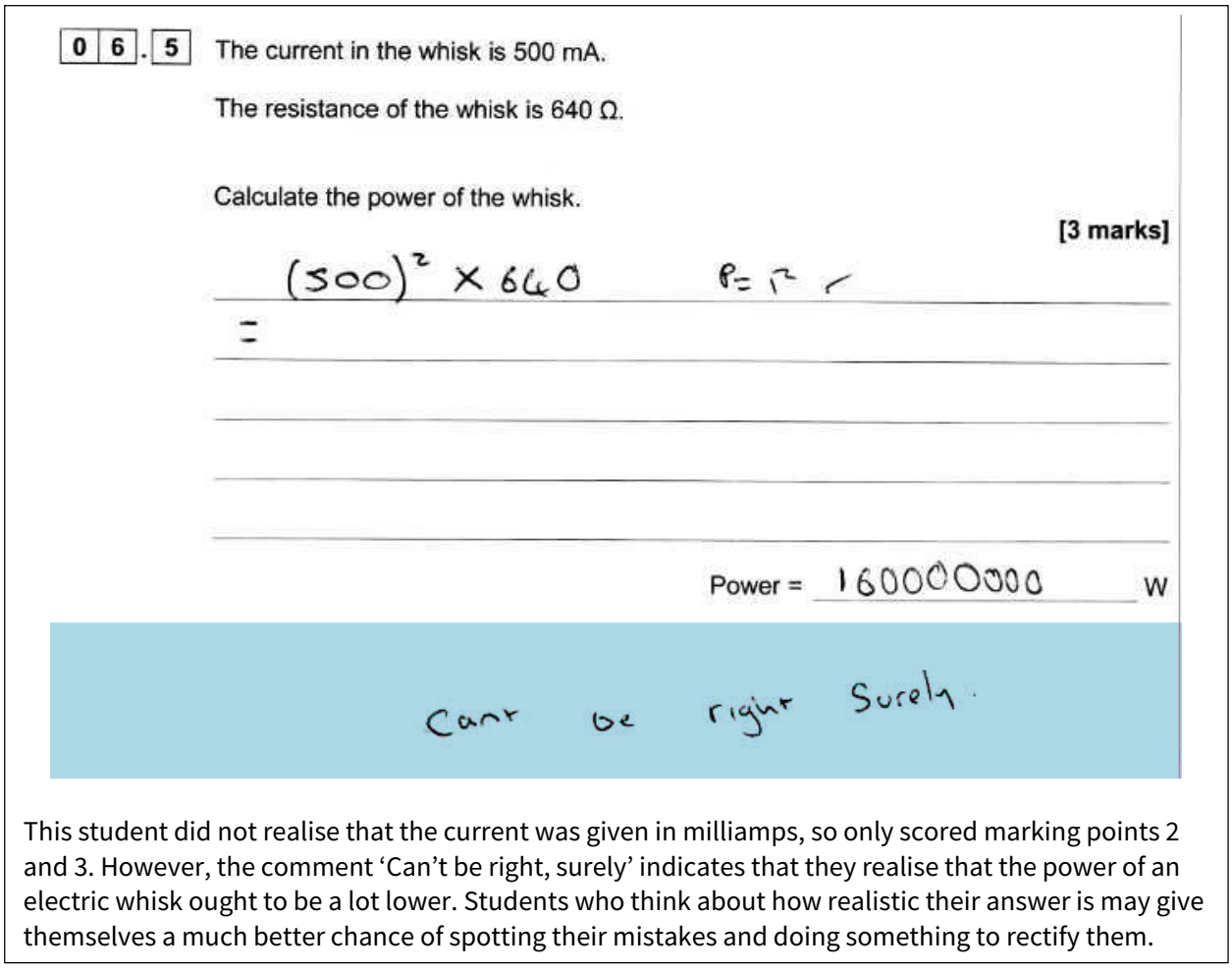
06.1 Roughly two-thirds of students gained at least 1 mark on this question, with about half of these gaining both marks. The most common incorrect answers were an increase in electrical energy and an increase in chemical energy.

06.2 Almost 90% of students wrote the correct equation.

06.3 Over half of all students arrived at the correct final answer, gaining 3 marks.

06.4 Just under 90% of students selected the correct equation.

06.5 For this calculation, very few students correctly converted the current from milliamps into amps. Some students forgot to show that the current should be squared in their substitution. Others showed a valid substitution but forgot to square the current when they entered it in their calculator. Less than 5% scored all 3 marks, but about 65% gained 2 marks on this question.



0 6 . 5 The current in the whisk is 500 mA.

The resistance of the whisk is 640 Ω.

Calculate the power of the whisk.

[3 marks]

$(500)^2 \times 640$ $P = I^2 R$

=

Power = 160000000 W

Can't be right Surely.

This student did not realise that the current was given in milliamps, so only scored marking points 2 and 3. However, the comment 'Can't be right, surely' indicates that they realise that the power of an electric whisk ought to be a lot lower. Students who think about how realistic their answer is may give themselves a much better chance of spotting their mistakes and doing something to rectify them.

06.6 The proportion of students who recalled the potential difference between the live and neutral wires was very low, with less than 15% of students answering correctly.

06.7 Slightly more than half of all students identified that an increase in current would be caused by a decrease in resistance.

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6.2.3.2 Mains electricity

Answer 06 · Examiner comments

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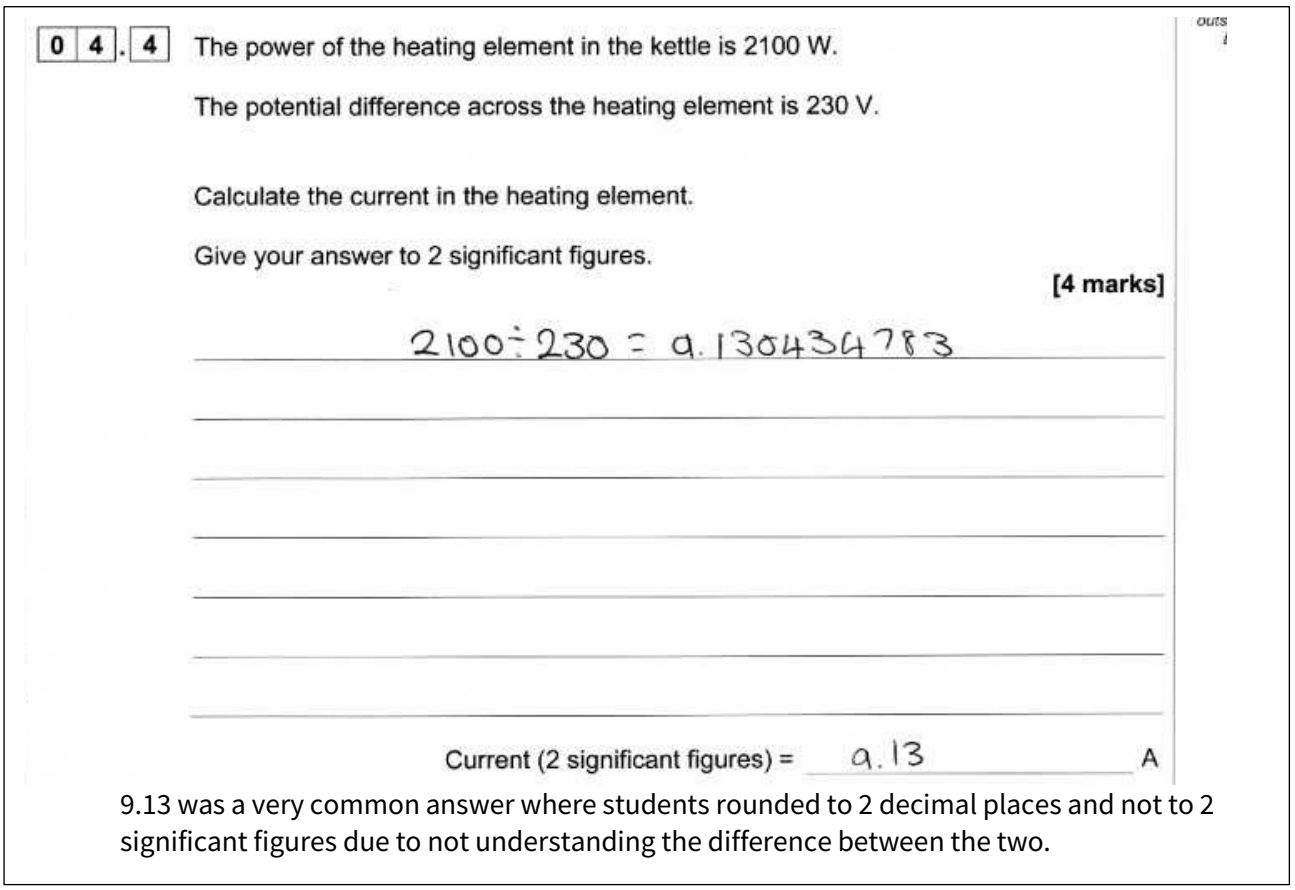
Question 4 (Low and standard demand)

04.1 45% of students selected the correct answer for the frequency of the UK mains electricity supply.

04.2 Just over 20% of students gained 1 mark for correctly identifying the colour of the insulation on one of the wires. 35% of students were able to identify both the colours of the insulation.

04.3 Students now have the equation sheet to select the equation from, so 90% of students gained the mark on this question. Approximately 5% of students selected the incorrect equation.

04.4 The vast majority of students who correctly substituted into the equation scored the 3 calculation marks. Approximately 75% of students gained 3 marks, but only 35% of students gained the mark for the significant figures. Many students gave their answer to 2 decimal places and not to two significant figures.



0 4 . 4 The power of the heating element in the kettle is 2100 W.

The potential difference across the heating element is 230 V.

Calculate the current in the heating element.

Give your answer to 2 significant figures.

[4 marks]

2100 ÷ 230 = 9.130434783

Current (2 significant figures) = 9.13 A

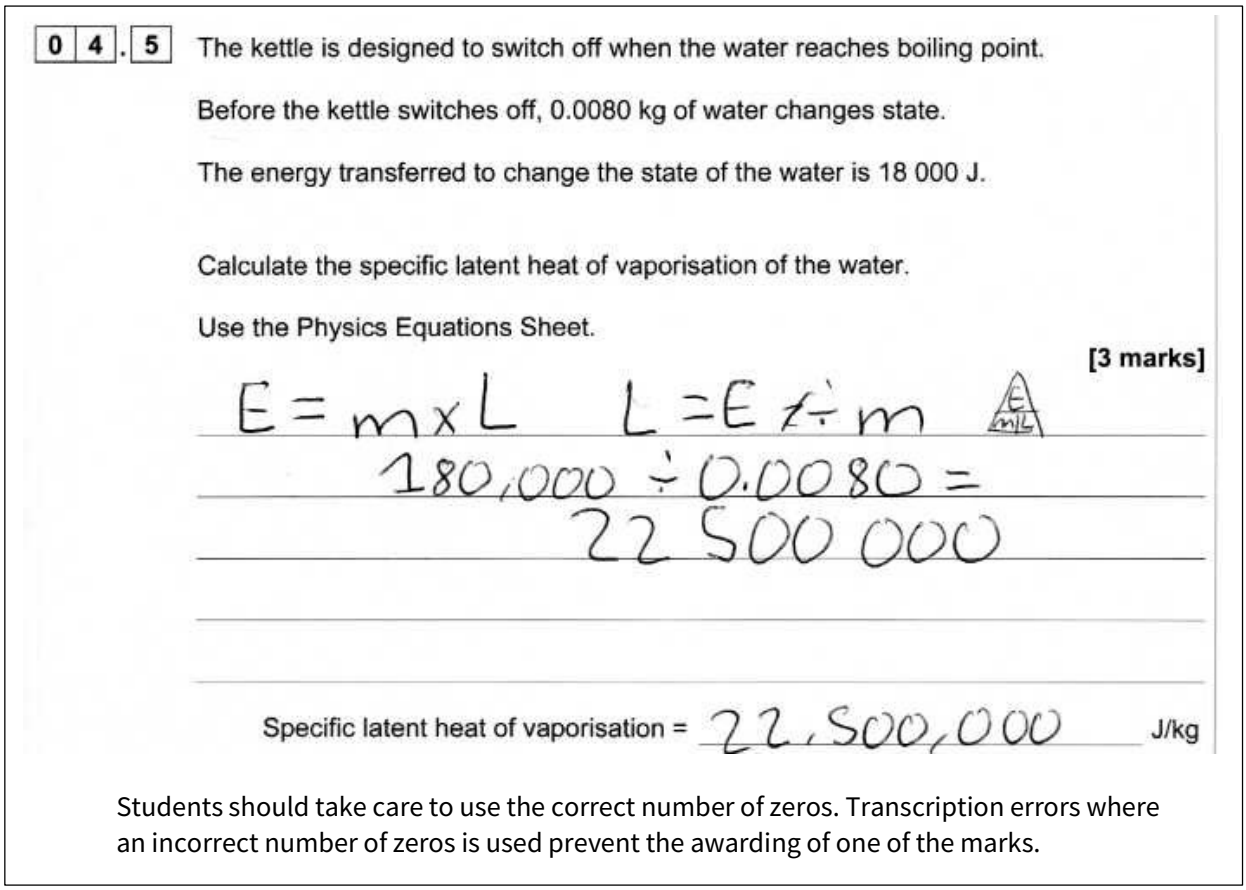
9.13 was a very common answer where students rounded to 2 decimal places and not to 2 significant figures due to not understanding the difference between the two.

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6.2.3.2 Mains electricity

Answer 06 · Examiner comments June 2025 | 8464/P/1F | Original Q4

04.5 This calculation proved to be more challenging with approximately 50% of students gaining 3 marks. The vast majority of students who substituted correctly were able to rearrange the equation correctly and then arrive at the correct answer. Most students who did not gain any marks either did not select the correct equation from the equation sheet or did an incorrect initial substitution.



0 4 . 5 The kettle is designed to switch off when the water reaches boiling point.

Before the kettle switches off, 0.0080 kg of water changes state.

The energy transferred to change the state of the water is 18 000 J.

Calculate the specific latent heat of vaporisation of the water.

Use the Physics Equations Sheet.

[3 marks]

$E = m \times L$ $L = E \div m$

$180,000 \div 0.0080 =$

$22\,500\,000$

Specific latent heat of vaporisation = 22,500,000 J/kg

Students should take care to use the correct number of zeros. Transcription errors where an incorrect number of zeros is used prevent the awarding of one of the marks.

04.6 This calculation was well answered with approximately 90% of students gaining 2 marks.

04.7 40% of students gained a mark on this question, but only 3% gained both marks. Very few explained that higher efficiency means less energy is wasted. Many students answered in terms of a kettle due to the previous question and explained that the appliance would complete its task in less time. This was awarded a mark due to the context of the question.

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