AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.1.2.2

Efficiency

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**4**
Available paper years	**2019–2025**

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.

6.1.2.2 Efficiency

Answer 01 · Mark scheme June 2019 | 8464/P/1F | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
02.1	the brightness of the lamp		1	AO3/3a 6.1.3c WS 2.2	A
02.2	zero error		1	AO3/3b 6.1.3c WS 3.7	A
02.3	C		1	AO3/1b 6.1.3c WS 3.7	A
02.4	10.0	allow 10	1	AO3/1a 6.1.3c WS 3.5	G
02.5	$\frac{0.96}{8.0}$ = 0.12	an answer of 0.12 or 12% scores **2** marks allow 12%	1 1	AO2.1 6.1.2.2	E
02.6	replenished		1	AO1.1 in isolation 6.1.3b	G
02.7	E = 490 × 31 E = 15 190 E = 15 000 (J)	an answer of 15 000 (J) scores **3** marks allow 15 200 if correct substitution is seen allow an answer to 2 s.f. consistent with their calculated value of E using E=QV	1 1 1	AO2.1 6.2.4.2	E

6.1.2.2 Efficiency

Answer 01 · Mark scheme

June 2019 | 8464/P/1F | Original Q2

02.8	less fossil fuel is burned		1	AO3.2a 6.1.3e	A
Total			**11**		

6.1.2.2 Efficiency

Answer 01 · Mark scheme

June 2019 | 8464/P/1F | Original Q2



6.1.2.2 Efficiency

Answer 02 · Mark scheme November 2021 | 8464/P/1F | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	300 (W/m^2)		1	AO2 6.1.3
04.2	(cities closer to the equator) receive a greater solar intensity	allow (cities closer to the equator) receive more radiation/energy ignore they get more sunshine ignore they are hotter	1	AO2 6.1.3
04.3	carbon dioxide		1	AO1 6.1.3
04.4	0.61 × 1100 671 (W)	 allow 670 (W)	1 1	AO2 6.1.2.2
04.5	larger heating panels have a greater input power	allow larger heating panels have a greater input energy (per second)	1	AO3 6.1.3
04.6	the energy required to increase the temperature of 1kg of water by 1 °C		1	AO1 6.1.1.3 6.3.2.2
04.7	8 400 000 = 80 × 4200 × Δθ $\Delta\theta = \frac{8400000}{80 \times 4200}$ Δθ = 25 (°C)		1 1 1	AO2 6.1.1.3 6.3.2.2

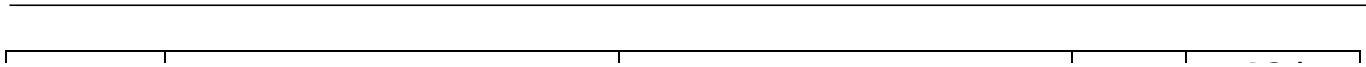
6.1.2.2 Efficiency

04.8	thermal insulation decreases the rate of energy transfer		1	AO1 6.1.2.1
04.9	B		1	AO2 6.1.2.1
Total			**12**	

6.1.2.2 Efficiency

Answer 02 · Mark scheme

November 2021 | 8464/P/1F | Original Q4



6.1.2.2 Efficiency

Answer 03 · Mark scheme

June 2022 | 8464/P/2F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	energy		1	AO1 6.6.2.1

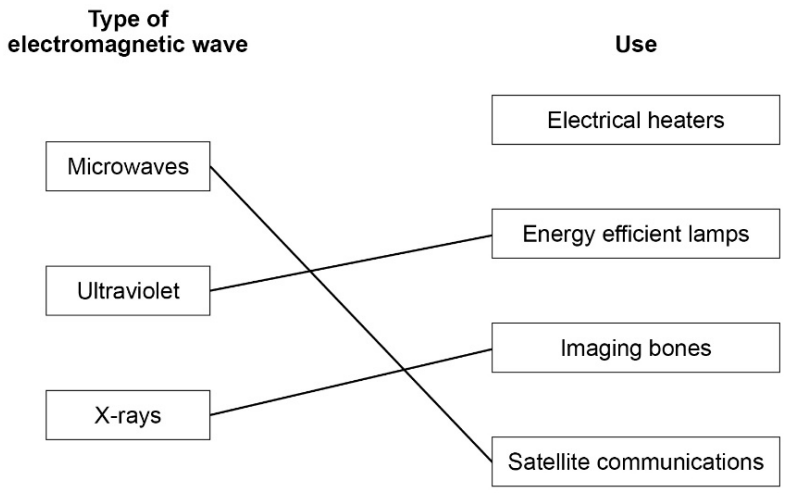
Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	frequency wavelength	either order	1 1	AO1 6.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	**A** = visible light **B** = gamma (rays / waves / radiation)	allow visible allow light	1 1	AO1 6.6.2.1

6.1.2.2 Efficiency

Answer 03 · Mark scheme

June 2022 | 8464/P/2F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	 additional line from a box on the left negates the mark for that box		1 1 1	AO1 6.6.2.4

Total Question 1		8

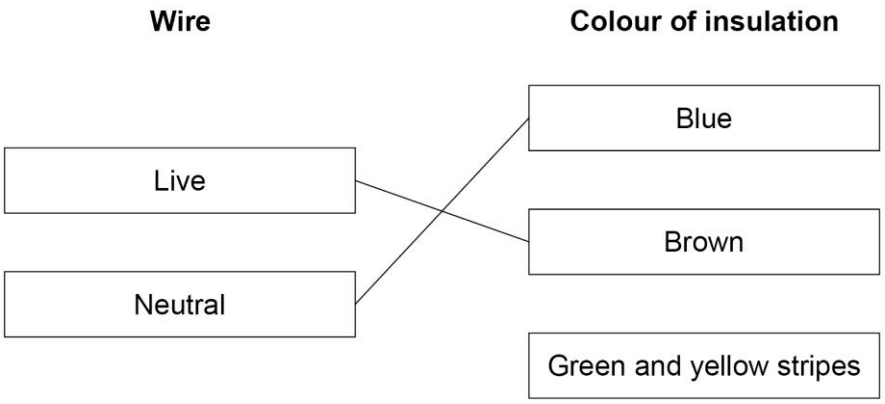
6.1.2.2 Efficiency

Answer 04 · 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

6.1.2.2 Efficiency

Answer 04 · 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)			

6.1.2.2 Efficiency

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

6.1.2.2 Efficiency

Answer 01 · Examiner comments June 2019 | 8464/P/1F | Original Q2

Question 2

02.1 Nearly 70% of students correctly chose the brightness of the lamp as the control variable.

02.2 This question was correctly answered by just over 30% of students.

02.3 The anomalous result was recognised by about 70% of students.

02.4 Slightly less than half of the students identified the pattern in the data, and used this to predict the most likely value using the information in the table. Many students who didn't score a mark tried to calculate a mean using some data from the table.

02.5 This calculation was answered well, with around four fifths of students dividing the two values correctly and expressing their answer as either a decimal or a percentage.

02.6 Understanding that renewable resources are replenished was shown by three quarters of students.

02.7 Just over 5% of students gained only 1 mark on this question, for correctly substituting the numbers into an equation. Another 80% or so of students completed the calculation, but the ability to express it to two significant figures was shown by only approximately 30% of students. Some students did not try, some rounded incorrectly, but many reduced 15190 to just 15.

02.8 Just over 70% of students knew that using solar panels would reduce the need to burn fossil fuels.

Answer 02 · Examiner comments November 2021 | 8464/P/1F | Original Q4

Question 4 (Low/standard demand)

04.1 The graph was read correctly by slightly more than 50% of the students.

04.2 Many students did not use the information provided in the question. It was not uncommon to see answers such as the equator being closer to the Sun, which gained no credit. Around one in eight students scored a mark.

04.3 The majority of students recalled that carbon dioxide contributes to global warming and is released when fossil fuels are burned.

04.4 Over 90% of students gained both marks.

04.5 Answers such as "bigger panels will heat more water" or "water can be heated up quicker if the panels have a larger surface area" did not answer the question. There were misconceptions which also arose when answering this question, such as the idea that bigger panels hold more water and therefore would take longer to heat up.

If students are asked how the size of the heating panels affects the input power, then their answers need to be in terms of the size of the heating panels and the input power.

Only about a third of students gained this mark, with nearly 10% of students not attempting to answer the question.

6.1.2.2 Efficiency

Answer 02 · Examiner comments November 2021 | 8464/P/1F | Original Q4

04.6 Fewer than half of the students chose the correct definition of specific heat capacity.

04.7 Despite being directed to the Physics Equations Sheet, and being given the specific heat capacity value in the question, more than 5% of students did not make any attempt to answer this question. Nearly a third of students gained full marks, but over half of the students gained no marks.

04.8 Just under a third of students answered correctly, with nearly half thinking that thermal insulation increases the rate of energy transfer.

04.9 Only about one in ten students selected the correct answer, with more than 80% choosing option C. Questions 04.8 and 04.9 together suggest that many of the students were confused about the relationship between thermal conduction and thermal insulation.

Answer 03 · Examiner comments June 2022 | 8464/P/2F | Original Q1

Question 1 (Low demand)

01.1 A little over 70% of students knew that waves transfer energy.

01.2 Nearly all students scored a mark on this question comparing electromagnetic waves, with approximately two thirds scoring both marks.

01.3 50% of students could name either visible light or gamma - of those that did only score one mark, gamma was the most common correct answer. Less than 25% of students scored 2 marks.

01.4 Over 95% of students scored at least one mark on this question. 65% scored two marks, with most that did failing to identify the correct use of microwaves. Approximately 15% of students scored all three marks.

6.1.2.2 Efficiency

Answer 04 · Examiner comments

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

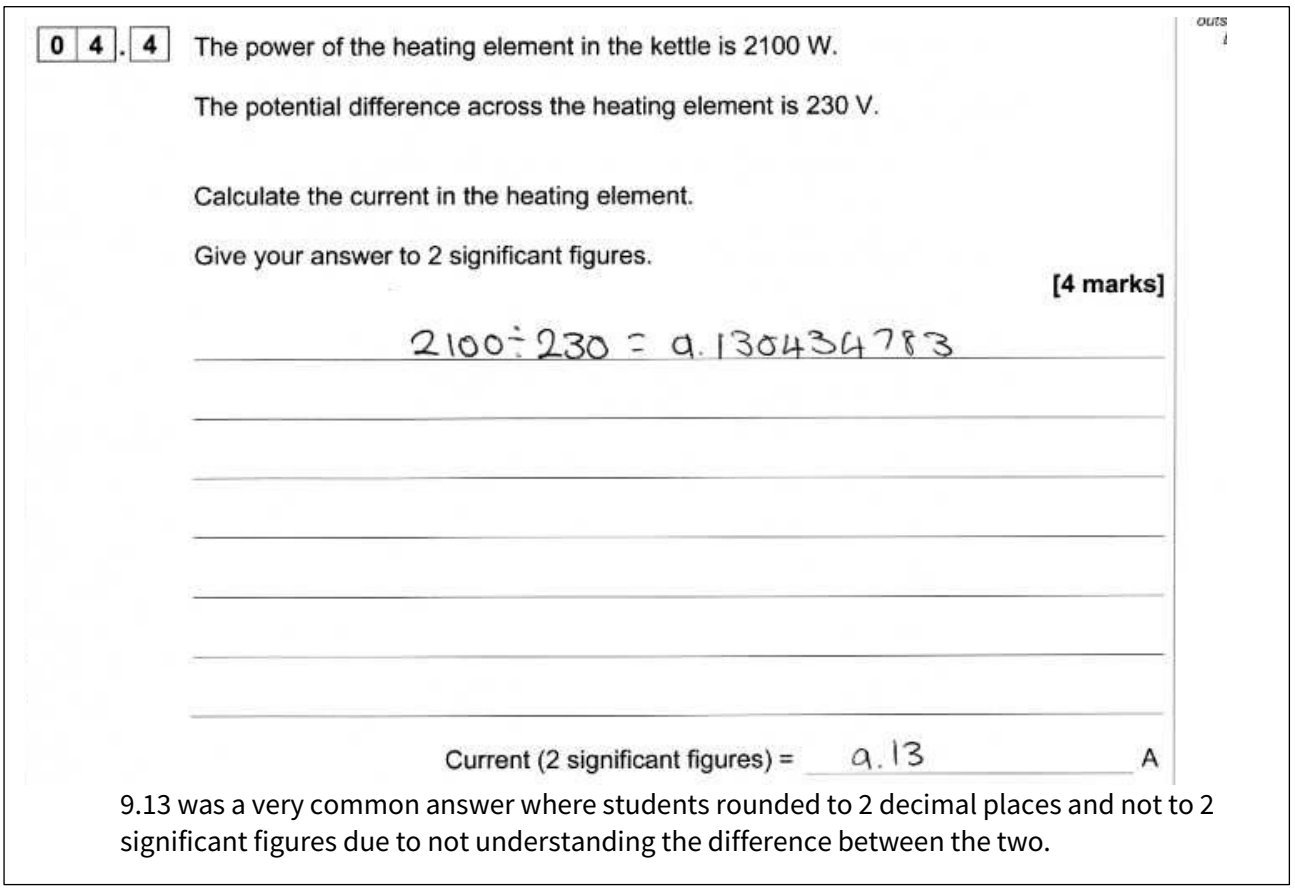
Question 4 (Low and standard demand)

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

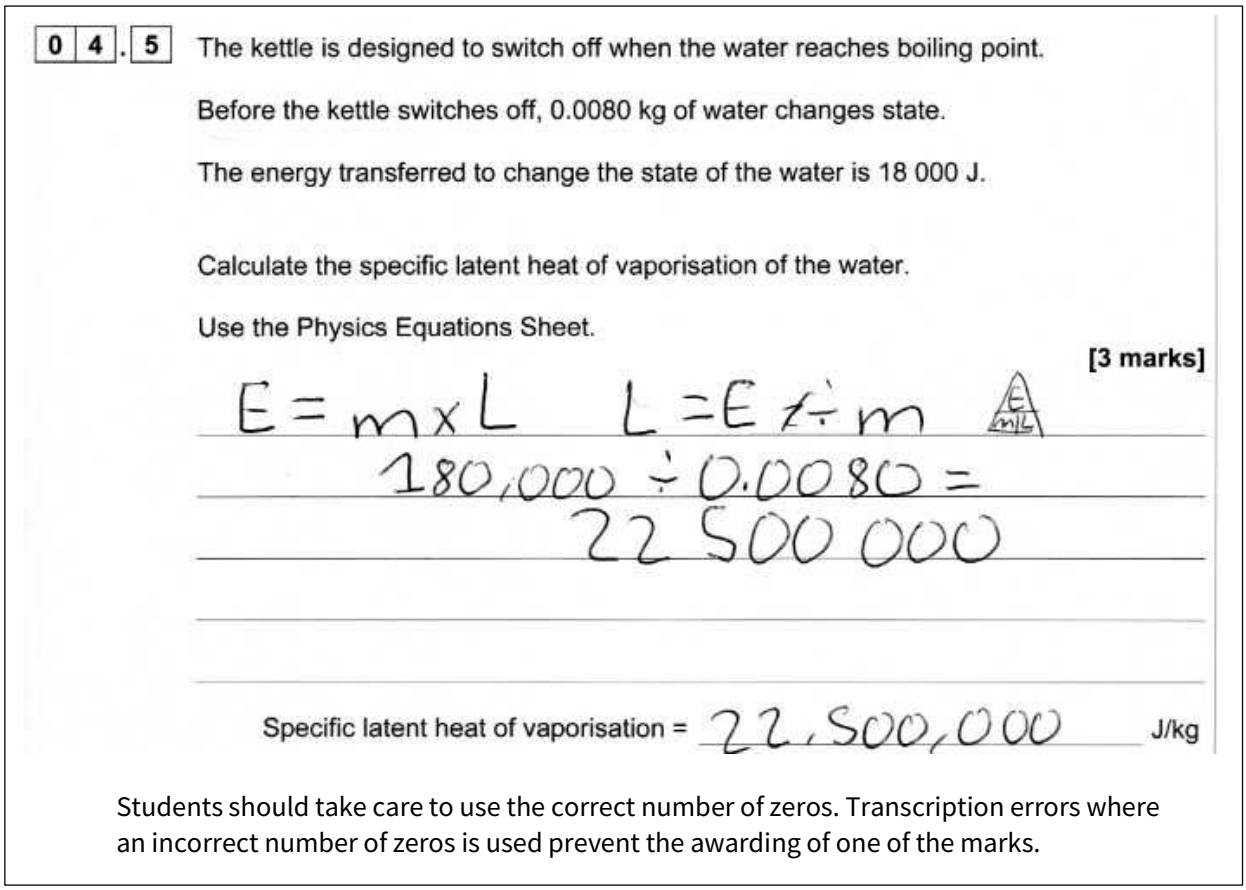
9.13 was a very common answer where students rounded to 2 decimal places and not to 2 significant figures due to not understanding the difference between the two.

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6.1.2.2 Efficiency

Answer 04 · 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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