AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.2.4.3

The National Grid

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**3**
Available paper years	**2023–2025**

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.

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Answer 01 · Mark scheme June 2023 | 8464/P/1H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	geothermal		1	AO1 6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	36×10^9 J		1	AO2 6.1.3

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Answer 01 · Mark scheme

June 2023 | 8464/P/1H | Original Q1

Question	Answers	Mark	AO / Spec. Ref.
01.3	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO3
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	AO1
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	AO2
	No relevant content	0	
	Indicative content **Figure 1** • the power output from wind increased • because more wind turbines were built • the power output from solar increased • because more solar panels were built • power output from wind and solar may have increased due to climate change For 2015 and 2016 • wind power was lower in 2016 than in 2015 • because 2016 was less windy than 2015 **Figure 2** • for most of the year the electricity generated from wind is greater than from solar. • the electricity generated from wind is greater in winter than in summer • because winter is windier than summer • the electricity generated from solar is greater in summer than in winter • because hours of sunlight are longer in summer • because the intensity of sunlight is greater in summer to access Level 3, the answer should describe trends in both graphs, and in solar power and wind power, and give some explanation for changes.		6.1.3

Total Question 1	8

Answer 02 · Mark scheme

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	potential difference is increased (and) current decreases (so) energy/power losses in the transmission cables decrease	allow transformer **X** is a step up transformer allow (so) there is less heating in the transmission cables	1 1 1	AO1 6.2.4.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	$11\,000 \times I_s = 400\,000 \times 660$ $I_s = \frac{400\,000 \times 660}{11\,000}$ $I_s = 24\,000$ (A)		1 1 1	AO2 6.2.4.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	the street lamps are connected in parallel		1	AO3 6.2.2

Answer 02 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	resistance (of the LDR) increases	allow resistance (of the circuit) increases	1	AO1
	(so) the current decreases	allow so the LDR has a greater (share of the) potential difference	1	AO3
	(so) the potential difference across R decreases	dependent on MP1	1	AO3 6.2.1.4 6.2.1.3 6.2.2 6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	20 mA = 0.020 A		1	AO2 6.2.4.1
	$6.0 = 0.020^2 \times R$	allow a correct substitution using an incorrectly / not converted value of current.	1	
	$R = \frac{6.0}{0.020^2}$	allow a correct re-arrangement using their incorrectly / not converted value of current.	1	
	R = 15000 (Ω) **OR** 20 mA = 0.020 A (1) $V = \frac{6.0}{0.020} = 300$ (1) $R = \frac{300}{0.020}$ (1) R = 15000 (Ω) (1)	allow an answer consistent with their incorrectly / not converted value of current	1	

Total Question 3	**14**

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Answer 03 · Mark scheme

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	V (= 5 × 5 × 5) = 125 (m^3)	do **not** allow subsequent marks unless volume is used subsequent marks may be awarded if volume is incorrectly calculated	1	AO2 6.3.1.1
	$4200 = \frac{m}{125}$		1	
	m = 4200 × 125		1	
	m = 525 000 (kg)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	(the greater the density) the greater the mass (for a given volume)		1	AO1
	(so) a greater amount of energy can be stored		1	AO3
	OR			6.1.1.2
	(the greater the density) the smaller the volume (for a given mass) (1)			
	(so) the same amount of energy can be stored (for a smaller volume) (1)			

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Answer 03 · Mark scheme

Question	Answers		Mark	AO / Spec. Ref.
06.3	measure the energy input from the National Grid **and** measure the energy output to the National Grid	allow measure the energy input to the motor **and** measure the energy output from the generator	1	AO3
	(then) use the equation: efficiency = $\frac{\text{energy output}}{\text{energy input}}$	MP2 dependent on MP1	1	AO1 6.1.2.2
	if no other mark awarded, allow **1** mark for: efficiency = $\frac{\text{energy released when lowering the block}}{\text{energy stored when raising block}}$			

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	use a motor with a greater power	allow increase the power of the motor	1	AO1 6.1.1.4
	(so) the cube / weight / mass is lifted more quickly	MP2 dependent on MP1	1	

Total Question 6	10

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Answer 01 · Examiner comments June 2023 | 8464/P/1H | Original Q1

Question 01 (Standard demand)

01.1 Approximately 85% of students identified geothermal as the renewable energy resource.

01.2 About a third of students knew that giga means 10^9.

01.3 Students found this question to be quite accessible, and wrote a fair amount in their answers, with only about 1% omitting any attempt at an answer. Over 40% of students gave answers which included explanations for trends shown in the graphs, which placed their response into level 3.

Many students were not clear in their use of English. A fair proportion of students stated that there was more wind than sun to explain why power output from wind turbines often exceeds power output from solar panels, which was ignored. Many students also wrote about the demand for electricity over time increasing because more electronic devices were used so more electricity was needed. Statements such as this were also ignored when marking this question.

Some students attempted to explain the increase in power output from solar panels in the middle of the year by referring to temperature or to hotter months, rather than attributing this increase to greater light intensity or more daylight hours.

Answer 02 · Examiner comments June 2023 | 8464/P/1H | Original Q3

Question 03 (Standard/high and high demand)

03.1 Just over half of all students gained at least one mark on this question. Many students seemed to think that greater efficiency means that energy is transferred at a greater rate. It was also common for answers to suggest that the transformer either increases or decreases resistance, which was ignored.

03.2 Slightly less than 60% of students gained full marks on this calculation. Many students who did not score anything attempted to use $V=IR$ for the primary coil and then the secondary coil. Students who used the correct equation but gained or lost a zero in their answer at some point could score a maximum of 2 marks.

03.3 Only about 25% of students answered this multiple-choice question correctly. This was the third most common answer, with more students selecting that current is dissipated to the surroundings, and that the cables have electrical resistance.

03.4 About a quarter of students scored at least one mark, but very few gained more than this. Some thought that the LDR was an LED, suggesting that as it gets darker the LDR needs to emit more light so the current must increase, for example. Some thought that the total resistance of the circuit must remain constant, so as the resistance of the LDR decreased, the resistance of the fixed resistor must increase. Many students struggled to express themselves, finding it difficult to

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Answer 02 · Examiner comments June 2023 | 8464/P/1H | Original Q3

express which potential difference they were writing about – the potential difference across the battery, the fixed resistor or the LDR.

03.5 Approximately a fifth of students gained all 4 marks, with about half of all students scoring 3 marks on this calculation. Many students did not attempt to convert mA to A, and of those who did many conversions were incorrect. Of the students scoring 0 marks, it was reasonably common for them to neglect to square the current when using $P = I^2 R$.

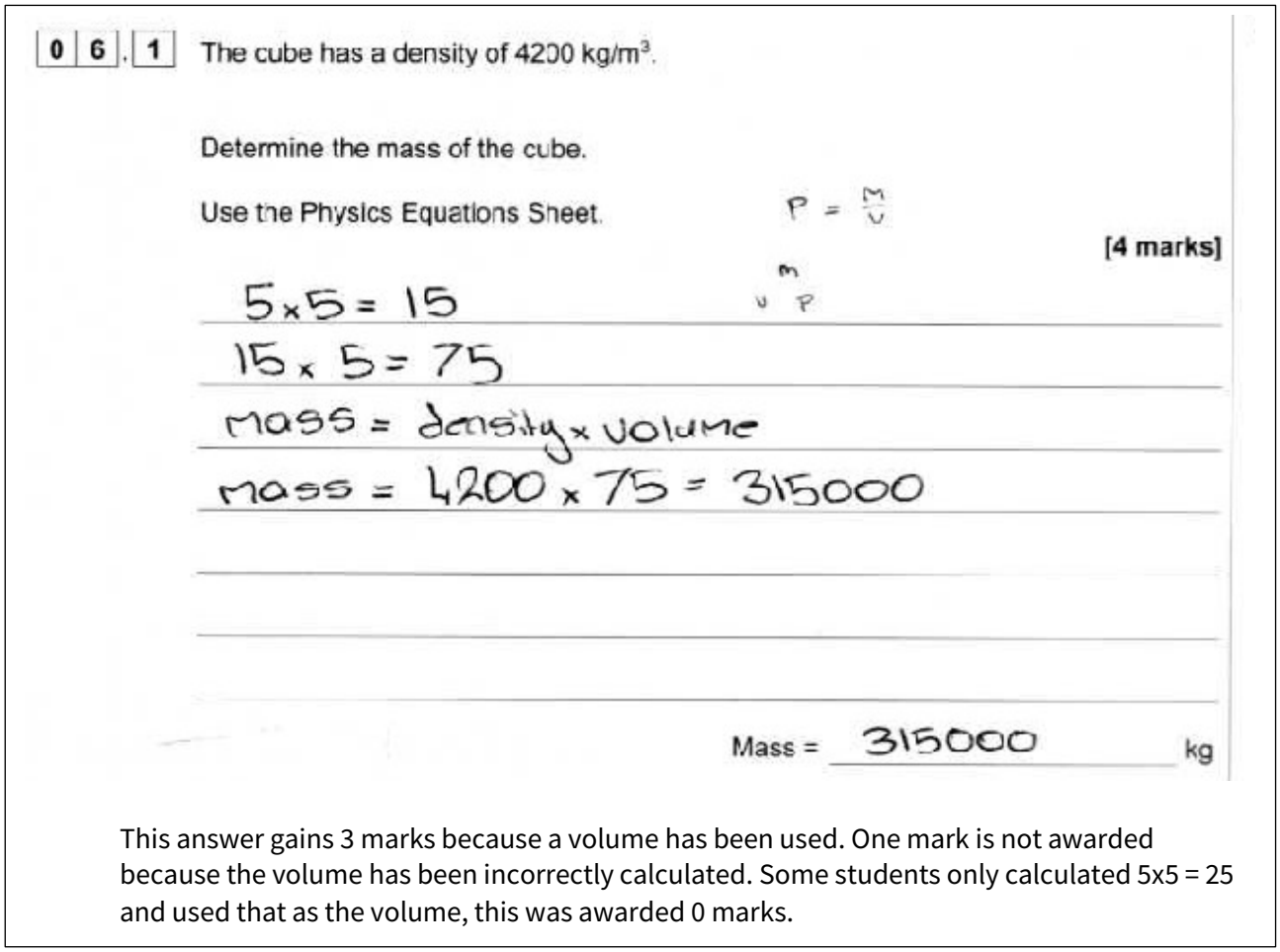
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Answer 03 · Examiner comments

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Question 6 (High demand)

06.1 Students that could not calculate the volume of the cube struggled to gain marks. When using the density equation students had to substitute a volume, or no marks are awarded. Some students used an area and not a volume. 80% of students gained a mark on this question but only 55% gained all 4 marks.



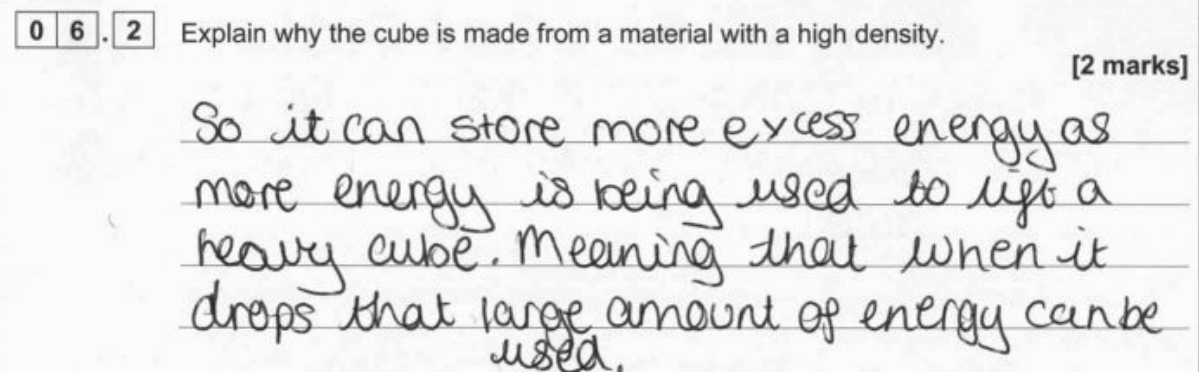
This answer gains 3 marks because a volume has been used. One mark is not awarded because the volume has been incorrectly calculated. Some students only calculated 5x5 = 25 and used that as the volume, this was awarded 0 marks.

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06.2 26% of students gained a mark for identifying the either this meant the cube had a greater mass or that it can store more energy. Less than 5% of students made both statements.



This answer gains 1 mark for stating that more energy can be stored. There is the idea that the cube would be heavy, but the correct scientific terms must be used, so it must state that the mass will be large.

06.3 This high demand question performed as expected with only a small percentage of students gaining any marks. For marks to be awarded answers had to refer to the overall efficiency of the entire system, just quoting the efficiency equation from the equations sheet was insufficient.

06.4 This high demand question performed as expected with only a small percentage of students gaining any marks. The most common incorrect answer only stated that you should lift it faster.

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Contact us

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