AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.1.3

National and global energy resources

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**6**
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.

6.1.3 National and global energy resources

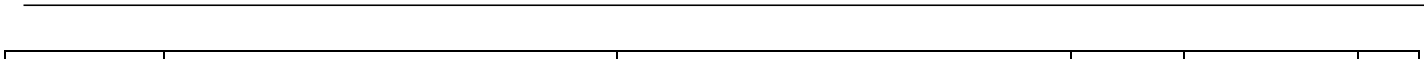
Answer 01 · Mark scheme June 2019 | 8464/P/1H | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
03.1	an energy resource that cannot be replenished as it is used	allow an energy resource that will run out ignore cannot be re-used	1	AO1.1 AO1 in isolation 6.1.3	E
03.2		an answer of 30 (A) scores **4** marks		AO2.1 6.2.4.1	E
	6.9 k(W) = 6900 (W)		1		
	6900 = 230 × I	allow correct substitution of an incorrectly/not converted value for power	1		
	$I = \frac{6900}{230}$	allow a correct transformation using an incorrectly/not converted value for power	1		
	I = 30 (A)	allow a correct calculation using an incorrectly/not converted value for power	1		
03.3	direct potential difference is always in the same direction	allow direct current is always in the same direction	1	AO1.1 6.2.3.1	E
	alternating potential difference changes direction	allow alternating current changes direction	1		
03.4	lower potential difference across the cable	allow lower power/energy dissipation	1	AO1.1 6.1.2.2	E
	it is more efficient **OR** (lower resistance gives) a greater current (for the same potential difference) (1) so the car battery can charge faster (1)	allow it won't get as hot	1	6.2.4.1	
Total			**9**		

6.1.3 National and global energy resources

Answer 01 · Mark scheme

June 2019 | 8464/P/1H | Original Q3



6.1.3 National and global energy resources

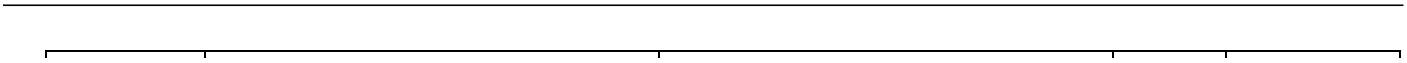
Answer 02 · Mark scheme November 2020 | 8464/P/1H | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	a renewable biofuel		1	AO1 6.1.3
04.2	any two from • burning wood causes air pollution • burning wood may lead to de-forestation • destruction of habitats • burning wood is carbon-neutral	 allow creates smoke ignore cutting down trees allow does not contribute to global warming or the greenhouse effect or climate change	2	AO1 6.1.3
04.3	the chemical store of energy of the wood decreases the internal/thermal store of energy of the pipe increases the internal/thermal store of energy of the water increases	both the store of energy and what happens to the store are required	1 1 1	AO1 6.1.1.1
04.4	energy is dissipated (to the surroundings) at the same rate that energy is transferred to the water	allow energy is transferred/lost to the surroundings	1 1	AO2 6.1.2.1
Total			**8**	

6.1.3 National and global energy resources

Answer 02 · Mark scheme

November 2020 | 8464/P/1H | Original Q4



6.1.3 National and global energy resources

Answer 03 · Mark scheme

November 2021 | 8464/P/1H | Original Q3

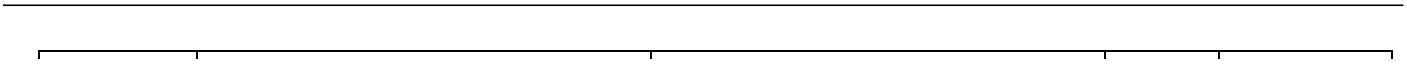
Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	solar	allow biofuel / biodiesel allow wave power	1	AO1 6.1.3
03.2	sometimes there is no wind (but the battery can still be charged using the generator) when there is wind less fuel is burned	allow if the generator breaks then the turbine can still generate electricity allow a disadvantage of burning fossil fuel	1 1	AO1 6.1.3
03.3	carbon dioxide increases global warming **OR** sulfur dioxide or NOx emissions (1) increases acid rain (1) **OR** particulates or NOx emissions (1) can harm living organisms (1)	 allow increases the greenhouse effect	1 1	AO1 6.1.3

03.4	81 kJ = 81 000 J $81000 = 0.5 \times 8000 \times v^2$ $v = \sqrt{\frac{81\,000}{0.5 \times 8000}}$ v = 4.5 (m/s)	allow a correct substitution using an incorrectly/not converted value of energy allow a correct re-arrangement using an incorrectly/not converted value of energy allow a correct calculation using an incorrectly/not converted value of energy	1 1 1 1	AO2 6.1.1.2
03.5	$19600 = 8000 \times 9.8 \times \Delta h$ $\Delta h = \frac{19\,600}{8000 \times 9.8}$ Δh = 0.25 m		1 1 1	AO2 6.1.1.2
Total			**12**	

6.1.3 National and global energy resources

Answer 03 · Mark scheme

November 2021 | 8464/P/1H | Original Q3



6.1.3 National and global energy resources

Answer 04 · Mark scheme

June 2022 | 8464/P/1H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	16 500(GW) **and** 30 000 (GW) read from graph		1	AO3 6.1.3
	percentage = $\frac{16500}{30000}$ (×100%)	allow a correct substitution using a value of 15300 or 18000 for gas	1	
	percentage = 55 (%)	allow an answer consistent with a value of 15300 or 18000 for gas	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	coal and gas		1	AO1.1 6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	the national grid		1	AO1 6.2.4.3

6.1.3 National and global energy resources

Answer 04 · Mark scheme

June 2022 | 8464/P/1H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	potential difference increases current is reduced so there is less / low energy loss (to the surroundings)	allow large potential difference allow small current allow less / low heating in the transmission cables ignore resistance do **not** allow no energy loss	1 1 1	AO1 6.2.4.3

Total Question 1		**8**

6.1.3 National and global energy resources

Answer 05 · 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

Answer 05 · 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

6.1.3 National and global energy resources

Answer 06 · Mark scheme

June 2025 | 8464/P/1H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	any **two** from • chemical store (of the fuel) decreases • thermal store (of engine / gases / surroundings) increases • kinetic energy (of the engine / car) increases		2	AO2 6.1.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	biofuel	allow a named biofuel allow biogas allow wood ignore fossil fuels	1	AO1 6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	(by a) battery **or** (by) electricity	allow (by an) electric motor	1	AO3 6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	the amount of fossil fuel that is burned to generate electricity each year has decreased		1	AO3 6.1.3

6.1.3 National and global energy resources

Answer 06 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	many generators are required **or** lots of resources are required so it is expensive	allow named device such as wind turbines for generators ignore unreliable if no other mark awarded allow **1** mark for lack of political will	1 1	AO3 6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	*hydro-electric power* loss of habitat *wind power* negative visual impact	 allow dangerous for birds allow noise pollution	 1 1	AO1 6.1.3

Total Question 1	**9**

6.1.3 National and global energy resources

Answer 01 · Examiner comments June 2019 | 8464/P/1H | Original Q3

Question 3 (Standard/high demand)

03.1 Just over 70% of students described a non-renewable resource correctly, as either a resource which is not replenished as it is used, or as a resource which is finite and will run out.

03.2 Slightly more than 40% of students gained full marks on this question. Around one in seven students gained 3 marks, mostly for failing to convert 6.9 kW into watts, or for making an incorrect conversion. Around 35% of students gained no marks on this question.

03.3 About a third of students gained 2 marks on this question but over half the students gained 0 marks. Answers describing current or potential difference were accepted, but a proportion of students incorrectly described direct current as what happens in a series circuit, and alternating as what happens in a parallel circuit. Other misconceptions included students who suggested that direct potential difference takes a constant value but alternating potential difference changes value. While this may be true, it does not explain the difference between direct and alternating.

Answer 01 · Examiner comments June 2019 | 8464/P/1H | Original Q3

03.4 Just under half of students scored 1 mark, with around a further 15% of students gaining both marks. Many students gave answers in terms of the risk of electrocution or safety, which did not gain credit. Many students wrote of more electricity going through a lower resistance cable, which was not sufficient: they needed to either mention a lower potential difference across the cable, or a greater current in the cable for the same potential difference.

6.1.3 National and global energy resources

Answer 03 · Examiner comments November 2021 | 8464/P/1H | Original Q3

Question 03 (Standard/high demand)

03.1 Slightly over half of students answered correctly. The most common incorrect answer was to suggest that the boat could utilise tidal power.

03.2 It appeared that some students did not assimilate all of the information in the question, with answers stating that the boat can move using the generator. It was also fairly common for students to describe why using wind power is beneficial, but not to give reasons why it is useful to have both a wind turbine and a generator. Approximately 15% of students gained both marks, with nearly 60% gaining at least 1 mark.

03.3 This question proved to be accessible to all students, and differentiated well between them. Approximately a third of students gained both marks, a third gained one mark, and a third of students gained no marks.

03.4 Many students did not convert 81 kJ into J. Re-arranging the kinetic energy equation to give *v* also caused problems for a fair proportion of students. Roughly one in four students gained at least 3 marks. Over half the students gained no marks at all.

Answer 03 · Examiner comments November 2021 | 8464/P/1H | Original Q3

03.5 This calculation was carried out correctly by just over a third of students, with about 50% of students gaining no marks.

Answer 04 · Examiner comments

Question 01 (Standard demand)

01.1 Just under half the students gained all three marks on this question, with just over 40% failing to score any marks.

Errors were made reading the graph, with a fair number of students misreading the scale to obtain an incorrect peak value for gas, leading to a maximum mark of 2 on this question. It was common for students to think that the peak value of demand was the maximum value on the y-axis, which prevented any marks from being scored. Some students tried to determine the peak demand by adding the total supply and demand at 6 pm, which resulted in no marks being awarded. A small proportion of students gave an answer greater than 100%.

01.2 Nearly 70% of the students chose the correct energy resources.

01.3 Just over six in ten students recalled the name of the national grid.

Many students thought that the question was referring to a Wi-Fi signal, a mobile phone signal, or the internet. In many cases this led them to try to answer question **01.4** by also writing about mobile phone networks or Wi-Fi signals, which they were unable to do successfully. Some students gave answers such as national power grid, or national electricity grid, which did gain the mark.

01.4 About 10% of students gained all three marks on this question, with approximately 15% gaining two marks, and around a fifth of students gaining just one mark.

The most commonly awarded mark was for identifying that the potential difference is increased by a step-up transformer. However, there was a clear misconception among many students that greater efficiency referred to increased rate of delivery of electricity. It was not uncommon for students to suggest that a step-up transformer increases the speed of the current so that electricity can get to consumers more quickly, for example. Some students thought that a step-up transformer physically lifted the cables up above the ground. It was reasonably common for students to suggest that step-up transformers were positioned high above the ground to ensure better network coverage, or that they give a better signal with fewer connection issues, which seemed to correspond with responses to question **01.3** about mobile phone networks or Wi-Fi networks.

6.1.3 National and global energy resources

Answer 05 · 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 06 · Examiner comments

June 2025 | 8464/P/1H | Original Q1

Question 1 (Standard demand)

01.1 75% of students gained at least one mark on this question. 50% of students gained one mark, mostly for either stating that a thermal store of energy increased or that a kinetic store of energy increased. 25% of students gained 2 marks for making both statements and/or identifying that a chemical store of energy was decreasing.

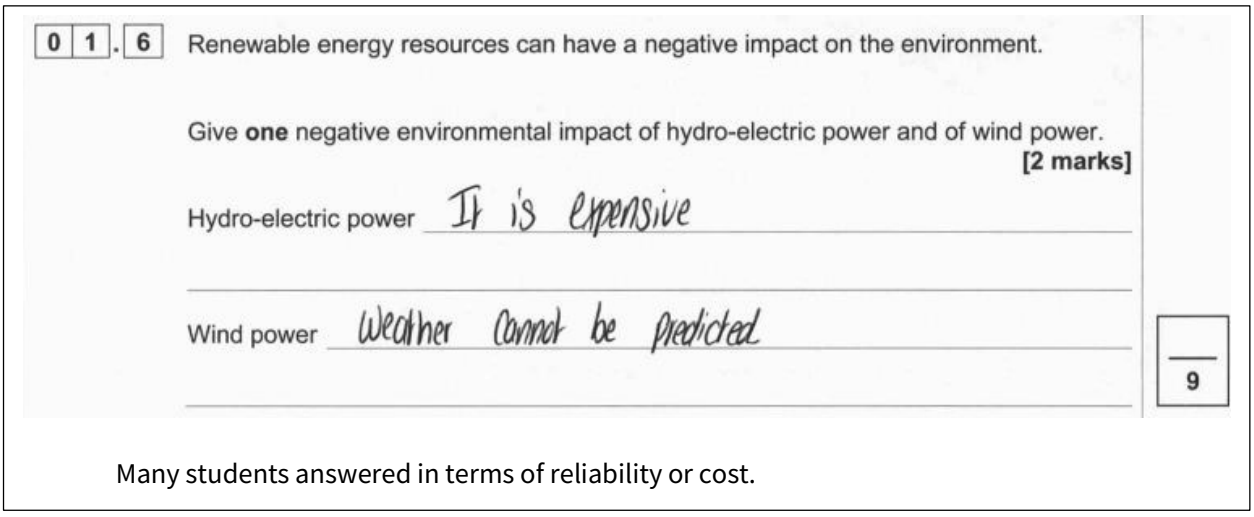
01.2 This question was reasonably well answered, with approximately 50% of students answering correctly.

01.3 This question was very well answered with 95% of students answering correctly by stating that the cars are powered by a battery or by electricity.

01.4 80% of students could correctly analyse the bar chart to conclude that the amount of fossil fuel that is burnt to generate electricity each year has decreased.

01.5 Only a very small number of students gained 2 marks on this question. 40% of students gained one mark for identifying that it is expensive, but the vast majority of those students did not state that *many* generators or resources are required.

01.6 Many students did not give a negative impact on the environment in their answer and described both types of resource as being unreliable. 40% of students were able to gain 1 mark mostly for giving a negative impact on the environment for wind power. Many students suggested that hydro-electric power has a damaging impact on habitats in the sea. 20% of students were able to give a negative impact on the environment for both resources.



0 1 . 6 Renewable energy resources can have a negative impact on the environment.

Give **one** negative environmental impact of hydro-electric power and of wind power.

[2 marks]

Hydro-electric power It is expensive

Wind power Weather cannot be predicted

9

Many students answered in terms of reliability or cost.

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