AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.1.3

National and global energy resources

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**9**
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.

6.1.3 National and global energy resources

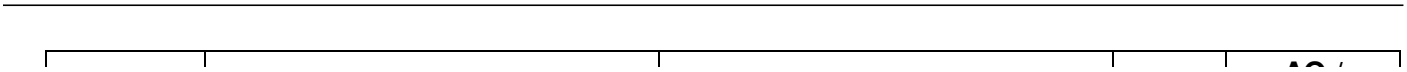
Answer 01 · Mark scheme June 2018 | 8464/P/1F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	biofuel geothermal		1 1	AO1 6.1.3
01.2	it is predictable		1	AO1 6.1.3
01.3	2.8 MW		1	AO2 6.1.3
01.4	any **two** from: • visual pollution • noise pollution • dangerous to birds • may lower house prices		2	AO1 6.1.3
01.5	**Level 2:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.		3–4	AO3 6.1.3
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.		1–2	
	No relevant content		0	
	Indicative content • less fossil fuel burnt • more nuclear fuel used • more renewables used • gas remained the same • less carbon dioxide released • less greenhouse gases • less global warming • less acid rain • less environmental pollution • more hazardous waste produced (nuclear) • the percentage generated by coal has decreased 8% • the percentage generated by renewables has increased by 6% • the percentage generated by nuclear has increased by 2%			
Total			**10**	

6.1.3 National and global energy resources

Answer 01 · Mark scheme

June 2018 | 8464/P/1F | Original Q1



6.1.3 National and global energy resources

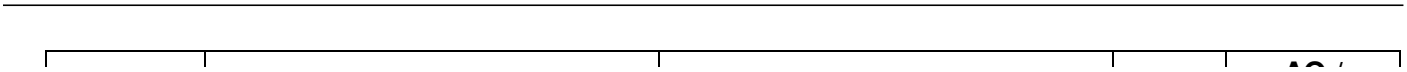
Answer 02 · Mark scheme June 2018 | 8464/P/1F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	gamma		1	AO1 6.4.2.1
05.2	alpha		1	AO1 6.4.2.1
05.3	gamma		1	AO1 6.4.2.1
05.4	<table><tr><th>isotope</th><th>number of neutrons</th><th>number of protons</th></tr><tr><td>uranium-238</td><td>146</td><td>**92**</td></tr><tr><td>thorium-234</td><td>**144**</td><td>90</td></tr></table>		1 1	AO2 6.4.1.2
05.5	$\Delta\theta = 80$ °C $E = 150 \times 4200 \times 80$ $E = 50\,400\,000$ (J)	an answer of 50 400 000 scores **3** marks allow 50 000 000 (J) allow **max 2** marks for correct calculation using incorrect value of $\Delta\theta$ allow **1** mark for correct calculation using $\theta = 20$ **or** $\theta = 100$	1 1 1	AO2 6.3.2.2
Total			**8**	

6.1.3 National and global energy resources

Answer 02 · Mark scheme

June 2018 | 8464/P/1F | Original Q5



6.1.3 National and global energy resources

Answer 03 · 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

6.1.3 National and global energy resources

Answer 03 · Mark scheme

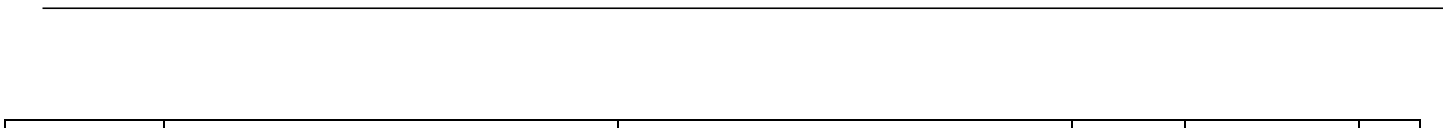
June 2019 | 8464/P/1F | Original Q2

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

6.1.3 National and global energy resources

Answer 03 · Mark scheme

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



6.1.3 National and global energy resources

Answer 04 · Mark scheme November 2020 | 8464/P/1F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	it can be replenished as it is used		1	AO1 6.1.3
03.2	biomass – renewable nuclear – Non-renewable natural gas – Non-renewable Energy resource / Renewable / Non-renewable Biomass / ✓ / Nuclear / / ✓ Natural gas / / ✓	all 3 correct allow 1 mark for two correct answers	2	AO1 6.1.3
03.3	kinetic chemical	answers must be in the correct order	1 1	AO2 6.1.1.1
03.4	less energy is needed to heat the house the roof is a better insulator		1 1	AO3 6.1.2.1
03.5	E = 26 000 × 30 780 000 (J)		1 1	AO2 6.1.1.4 6.2.4.2
03.6	efficiency = $\frac{\text{useful power output}}{\text{total power input}}$		1	AO1 6.1.2.2

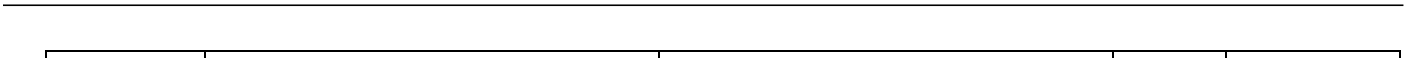
Answer 04 · Mark scheme

03.7	$0.15 = \frac{\text{useful power output}}{26000}$ useful power output = 26000 × 0.15 useful power output = 3900 (W)		1 1 1	AO2 6.1.2.2
03.8	sometimes it is not sunny/windy so there's more chance of electricity being generated at any time **OR** more electricity is generated (1) which reduces the running costs (of the eco-home) (1)	if no other mark scored, allow a reference to reduced greenhouse gas emissions or reduced global warming for 1 mark	1 1	AO3 6.1.3
Total			**15**	

6.1.3 National and global energy resources

Answer 04 · Mark scheme

November 2020 | 8464/P/1F | Original Q3



6.1.3 National and global energy resources

Answer 05 · 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

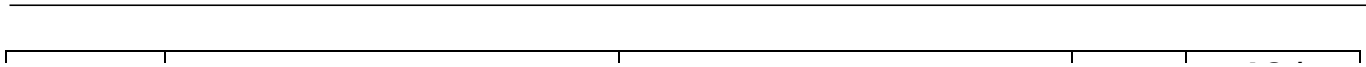
6.1.3 National and global energy resources

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**	

6.1.3 National and global energy resources

Answer 05 · Mark scheme

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



6.1.3 National and global energy resources

Answer 06 · Mark scheme

June 2022 | 8464/P/1F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	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.
05.2	coal and gas		1	AO1.1 6.1.3

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	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 5		**8**

6.1.3 National and global energy resources

Answer 07 · Mark scheme

June 2023 | 8464/P/1F | Original Q5

Question 5

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	36×10^9 J		1	AO2 6.1.3

Question	Answers	Mark	AO / Spec. Ref.
05.3	**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 6** • 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 7** • 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 • and 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 5	8

Answer 08 · Mark scheme

June 2024 | 8464/P/1F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	a renewable energy resource that uses hot rocks underground		1	AO1 6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	$\Delta E = 15 \times 3800 \times 9.0$ 513 000 (J)		1 1	AO2 6.3.2.2 6.1.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	9600 (J)		1	AO2 6.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	1 W		1	AO1 6.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	height = $\frac{196}{5.0 \times 9.8}$ 4 (m)	 allow 4.0 (m)	1 1	AO2 6.1.1.2

6.1.3 National and global energy resources

Answer 08 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	ignore references to pollution **EITHER** releases carbon dioxide		1	AO1 6.1.3
	which contributes to global warming	allow climate change for global warming allow which is a greenhouse gas allow which contributes to the greenhouse effect	1	
	OR releases sulfur / nitrogen dioxide (1)	allow other oxides of nitrogen		
	which causes acid rain (1)			
	OR releases soot (1)	allow carbon for soot allow particulates		
	which can cause global dimming (1)	allow reduces air quality allow causes smog		

Total Question 2	9

6.1.3 National and global energy resources

Answer 09 · Mark scheme

June 2025 | 8464/P/1F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	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.
05.2	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.
05.3	(by a) battery **or** (by) electricity	allow (by an) electric motor	1	AO3 6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	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 09 · Mark scheme June 2025 | 8464/P/1F | Original Q5

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	*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 5	**9**

Answer 03 · 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 05 · 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.

6.1.3 National and global energy resources

Answer 05 · 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 06 · Examiner comments

June 2022 | 8464/P/1F | Original Q5

Question 05 (Standard demand)

05.1 About 15% of students gained all three marks on this question, with around 80% failing to score any marks. Nearly a fifth of students did not attempt this question.

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 total supply and demand at 6 pm, which resulted in no marks being awarded.

05.2 Over half the students chose the correct energy resources.

05.3 Just over one in ten students recalled the name of the national grid. Nearly a quarter of students did not attempt this question.

Many students thought that the question was referring to a wifi signal, a mobile phone signal, or the internet. In many cases this led them to try to answer question **05.4** by also writing about mobile phone networks or wifi 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.

05.4 Only slightly over 5% of students gained any marks at all on this question. Over a quarter of students did not attempt the question.

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. 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 **05.3** about mobile phone networks or Wi-Fi networks.

6.1.3 National and global energy resources

Answer 07 · Examiner comments June 2023 | 8464/P/1F | Original Q5

Question 05 (Standard demand)

05.1 Approximately 60% of students identified geothermal as the renewable energy resource.

05.2 Only about a fifth of students knew that giga means 10^9.

05.3 Many students found this question to be quite accessible, and wrote a fair amount in their answers, although about 1 in 10 students did not attempt this question. About a third of all students' responses were in level 1, giving answers which tended to describe trends in the graphs but not give any attempt to explain the trends or begin to suggest any reasons for the trends. About a third of students gained marks in level 2, giving answers which were better than simple descriptions of the graphs, but tended not to give full explanations for any trends. Just over 10% scored marks in level 3, for giving explanations of trends shown in the graphs.

Many students were not clear in their use of English, and it was common to see statements such as "It is windier than it is sunny," which were ignored. It was also relatively common for students to think that the *y*-axes represented the number of people using wind power or solar power, rather than the power output.

Statements that solar power output increases in the hotter months were ignored. However, an answer that referred to solar output increasing in sunnier months was heading towards an explanation and could lift an answer to a higher level.

Answer 08 · Examiner comments

June 2024 | 8464/P/1F | Original Q2

Question 2 (low demand)

02.1 Just under two-thirds of students correctly identified geothermal energy as a renewable energy resource that uses hot rocks underground.

02.2 This calculation question was answered well, with almost 90% of students gaining both marks. A small minority of students incorrectly converted the mass from kilograms to grams as part of their calculation.

02.3 Some students were confused by the unit of m^2 and decided that the 120 should also be squared. The correct value of energy was given by approximately 65% of students.

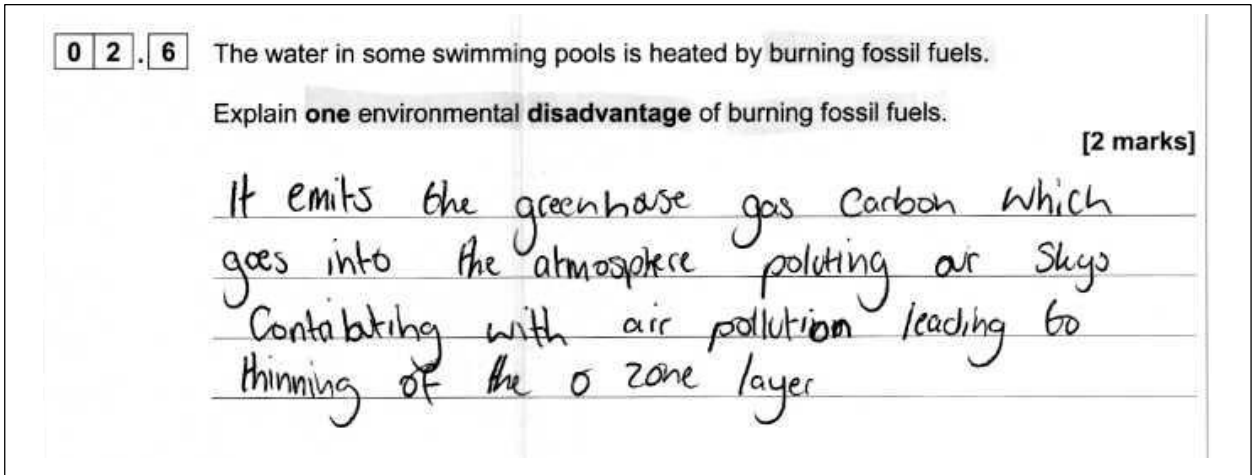
02.4 Around 55% of students correctly identified that 1 J/s is equivalent to 1 W.

02.5 Roughly 70% of students were able to answer this question correctly. Amongst students who did not calculate the correct height, it was relatively common to see substitutions made where brackets should have been used, but were not, eg height = 196 J ÷ 5.0 kg × 9.8 N/kg.

02.6 Almost two-thirds of students gained at least 1 mark on this question, with approximately a fifth of students gaining both marks. Of those who scored both marks, the most common answers referred to a release of carbon dioxide contributing to global warming.

Many students gave vague answers which were not creditworthy, often referring to pollution or toxic chemicals rather than named pollutants. It was also relatively common for students to refer to a 'carbon footprint', which did not prevent marks from being awarded but did not answer the question.

Some students stated that an environmental disadvantage of fossil fuels is that they are non-renewable, which did not score any credit.



0 2 . 6 The water in some swimming pools is heated by burning fossil fuels.

Explain **one** environmental **disadvantage** of burning fossil fuels.

[2 marks]

It emits the greenhouse gas carbon which goes into the atmosphere poluting our Skys Contributing with air pollution leading to thinning of the o zone layer

This student scored marking point 1 for identifying that carbon is released. This scored against the third alternative in the mark scheme, as carbon is equivalent to soot. However, marking point 2 was not awarded, as the environmental disadvantages associated with soot are global dimming, reduced air quality, or smog. There was a small, but noticeable, minority of students who incorrectly linked carbon dioxide with thinning of the ozone layer or holes in the ozone layer.

© 2024 AQA and its licensors. All rights reserved.

Answer 09 · Examiner comments

June 2025 | 8464/P/1F | Original Q5

Question 5 (Standard demand)

05.1 25% of students gained marks on this question. 15% of students gained one mark, mostly for either stating that a thermal store of energy increased or that a kinetic store of energy increased. 10% of students gained 2 marks for making both statements, only a small number of students identified that a chemical store of energy was decreasing.

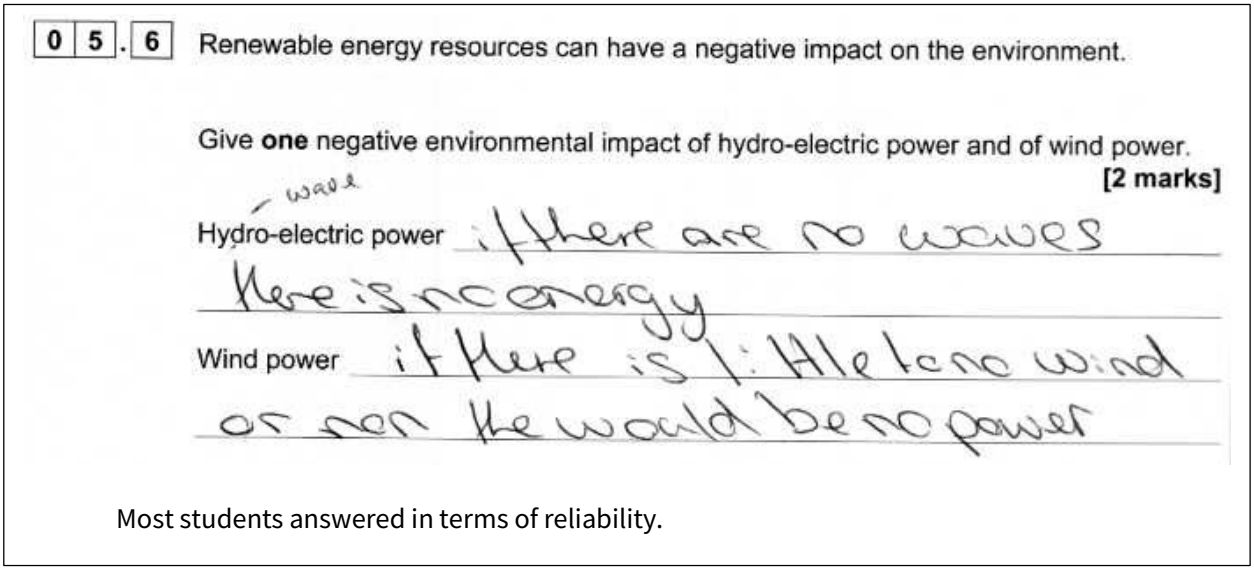
05.2 This question was not well answered, with only approximately 20% of students answering correctly.

05.3 This question was well answered with 85% of students answering correctly by stating that the cars are powered by a battery or by electricity.

05.4 65% of students could correctly analyse the bar chart to conclude that the amount of fossil fuel that is burned to generate electricity each year has decreased.

05.5 Only a very small number of students gained 2 marks on this question. 22% 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

05.6 Most students did not give a negative impact on the environment in their answer and described both types of resource as being unreliable. 30% 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. Very few students gained 2 marks.



0 5 . 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 if there are no waves (wave) there is no energy

Wind power if there is no wind or not the would be no power

Most students answered in terms of reliability.

© 2024 AQA and its licensors. All rights reserved.