AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.10.2.2

Ways of reducing the use of resources

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**2**
Available paper years	**2021–2025**

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.

5.10.2.2 Ways of reducing the use of resources

Answer 01 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	production of copper is increasing at an increasing rate		1 1	AO2 5.10.1.1
04.2	increase in population / demand	allow more uses for copper	1	AO3 5.10.1.1
04.3	any **one** from: • more use of recycling • copper is a finite resource and may run out • alternative metals may be used in future	ignore only an estimate	1	AO3 5.10.1.1
04.4	**B**, **D**, **C**, **A**, **E**		1	AO1 5.10.1.4
04.5	any **two** from: • (phytomining is) slower to produce copper • large area of land required • insufficient yield to meet demand	ignore reference to cost ignore references to carbon dioxide ignore references to global warming allow plants grow slowly	2	AO3 5.10.1.4

5.10.2.2 Ways of reducing the use of resources

Answer 01 · Mark scheme

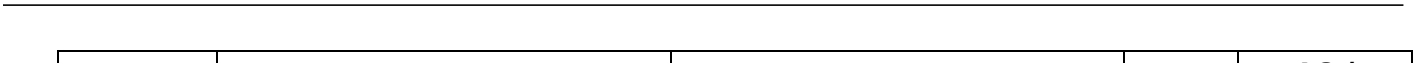
November 2021 | 8464/C/2H | Original Q4

04.6	(energy use through recycling = $27.2 \times 8.89 \times 10^9 \times \frac{41}{100}$) $= 9.914 \times 10^{10}$ (energy use through extraction = $70.4 \times 8.89 \times 10^9 \times \frac{59}{100}$) $= 3.693 \times 10^{11}$ (total consumption today = $9.914 \times 10^{10} + 3.693 \times 10^{11}$) $= 4.6844 \times 10^{11}$ (energy use if only recycling used = $27.2 \times 8.89 \times 10^9$) $= 2.418 \times 10^{11}$ (energy saving = $4.6844 \times 10^{11} - 2.418 \times 10^{11}$) $= 2.27 \times 10^{11}$ (MJ)	 allow correct use of an incorrect energy use determined in MP1 and/or MP2 allow an answer correctly calculated to 3 significant figures which uses the values in the question	 1 1 1 1 1	AO2 5.10.2.2
Total			**12**	

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5.10.2.2 Ways of reducing the use of resources

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	(mass in one phone =) $1.73 \times 10^{-4} \times 197$		1	AO2 5.3.2.1 5.10.1.1
	= 0.034081 (g)		1	
	(total mass =) $0.034081 \times 2.48 \times 10^{6}$	allow (total mass =) $0.034081 \times 2\,480\,000$ allow correct use of an incorrectly determined mass in one phone	1	
	= 84520.88 (g)		1	
	(conversion 84520.88 g =) 84.5 (kg)	allow 84.52088 (kg) correctly rounded to at least 2 significant figures allow conversion at MP2, MP3 allow correct conversion of an incorrectly determined mass using all numbers from the question	1	
	alternative approach			
	(total moles =) $1.73 \times 10^{-4} \times 2.48 \times 10^{6}$ (1)	allow (total moles =) $1.73 \times 10^{-4} \times 2\,480\,000$		
	= 429.04 (1)			
	(total mass =) 429.04 × 197 (1)	allow correct use of an incorrectly determined total moles		
	= 84520.88 (g) (1)			
	(conversion 84520.88 g =) 84.5 (kg) (1)	allow 84.52088 (kg) correctly rounded to at least 2 significant figures allow correct conversion of an incorrectly determined mass using all numbers from the question		

5.10.2.2 Ways of reducing the use of resources

Answer 02 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	1.04×10^{20}		1	AO2 5.3.2.1 5.10.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	uses bacteria		1	AO1 5.10.1.4 5.10.2.2
	to produce leachate / solutions containing gold compounds		1	
	from which gold is obtained by displacement / electrolysis		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	any **two** from: • high-grade ores still available • land not available • phytomining takes a long time • very small yields produced • new technology		2	AO3 5.10.1.4

Total Question 6	**11**

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Question 4 (standard, standard / high and high demand)

Most students were successfully able to describe the general trend in the graph and account for the changes. In question 04.1, however, many failed to gain the second mark point as they did not recognise that the increase was not the same throughout the graph.

The disadvantages of phytomining compared to traditional mining tended to focus on pollution, carbon dioxide emissions and global warming as a result of the combustion of the plants. This did not gain credit as traditional mining methods also lead to a similar increase in the gas.

Students approached the calculation in question 04.6 using a variety of methods, which is to be encouraged. A significant number merely calculated the difference in mass rather than energy. Marking point 5 was awarded for an answer to a calculation using the data provided, given to 3 significant figures.

Answer 02 · Examiner comments June 2025 | 8464/C/2H | Original Q6

Question 6 (Standard/High and High demand)

06.1 Students found the format the numbers were presented in difficult, and often incorrectly used figures such as 1.73 and 2.48, rather than 1.73×10^{-4} and 2 480 000
Many students were unable to carry out the full calculation, but most gained some credit for successfully multiplying by 2.48 million.
Of the students who successfully carried out the calculation many did not complete the correct conversion from grams to kilograms correctly, often using a factor of 100, rather than 1000.

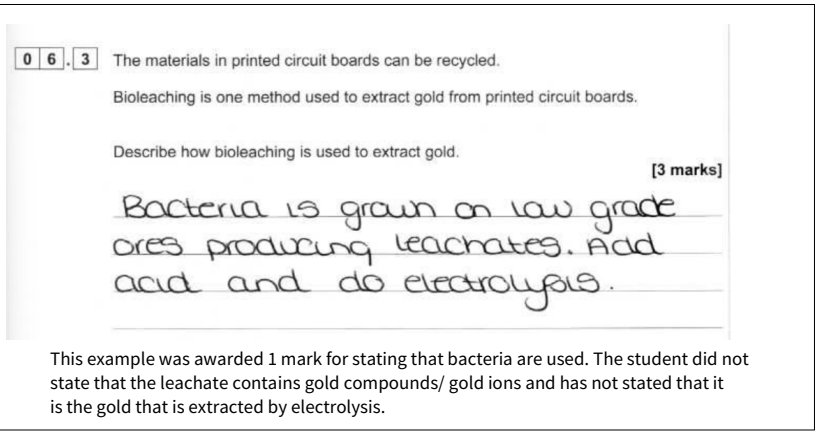
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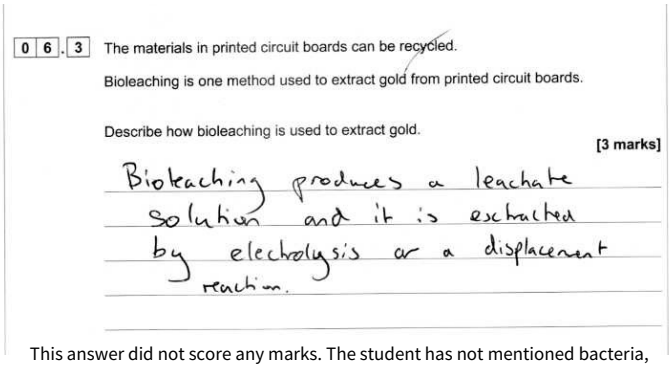
Answer 02 · Examiner comments June 2025 | 8464/C/2H | Original Q6

06.2 By selecting 1.04 x 10^{20}, the majority of students answered correctly.

06.3 The process of bioleaching was not well known.
Of the students that gained credit in this question many did so as they were able to identify that bacteria were involved.
Although some students were able to make a link to the idea of a leachate or solution, very few were able to explain that the leachate or solution contained gold compounds or gold ions.
When methods of extraction were included in a response they were often correctly identified.



This example was awarded 1 mark for stating that bacteria are used. The student did not state that the leachate contains gold compounds/ gold ions and has not stated that it is the gold that is extracted by electrolysis.



This answer did not score any marks. The student has not mentioned bacteria, does not state that the leachate solution contains gold compounds/gold ions, and the 'it' actually refers to the leachate solution not gold.

06.4 Many students understood that phytomining is a time-consuming process and when marks were credited this was by far the most common correct response.

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Some students were aware that only small yields were produced and that a lot of land is needed but these ideas were not always clearly expressed using the correct terminology. Amount is not equivalent to yield, and lots of space is not equivalent to lots of land, for example.
Many students gave the answer of being expensive or damaging to the environment which are not specific to the process of phytomining.

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Answer 02 · Examiner comments

Contact us

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