AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.10.1.2

Potable water

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**6**
Available paper years	**2018–2024**

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.

5.10.1.2 Potable water

Answer 01 · Mark scheme

June 2018 | 8464/C/2H | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	16(.0)		1	AO2 5.10.1.2
03.2	advantage: more accurate result	do **not** accept reliable	1	AO3 5.10.1.2
	disadvantage: takes a long(er) time, more energy needed (to heat more water)	ignore expensive	1	
03.3		a clear comparative statement referring to solutes gains the mark		AO1 5.8.1.1 5.10.1.2
	pure: no dissolved solids / impurities **or** no (dissolved) chlorine	allow only water / H_2O ignore safe to drink	1	
	and potable: has dissolved solids / impurities **or** has (dissolved) chlorine	ignore safe to drink		
03.4	groundwater: • filtered	allow acceptable method of filtration	1	AO1 5.10.1.2
	• sterilised	allow acceptable method of sterilisation	1	
	seawater: • distilled **or** reverse osmosis	allow desalination ignore salt removed ignore boiling alone ignore filtering do **not** accept fractional distillation	1	

5.10.1.2 Potable water

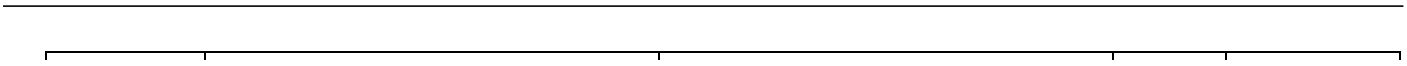
Answer 01 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	$\frac{2.2}{100} \times 6.50$ (=) 0.143 (g)	an answer of 0.143 (g) **or** 0.14 (g) scores **2** marks	1 1	AO2 5.10.1.2
Total			**9**	

5.10.1.2 Potable water

Answer 01 · Mark scheme

June 2018 | 8464/C/2H | Original Q3



5.10.1.2 Potable water

Answer 02 · Mark scheme June 2019 | 8464/C/2H | Original Q1

01.1	potable		1	AO1.1 5.10.1.2	A

01.2		allow boils at 100°C for **2** marks		AO2 5.8.1.1	E
	boil (water)	ignore heat do **not** accept filter do **not** accept incorrect test	1		
	(boils) at 100°C		1		
		alternative approach freeze (water) (1) (freezes) at 0°C (1) if no other mark awarded, allow 1 mark for evaporate or distil water **and** no solid left			

01.3	**Level 2:** The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	3–4	AO1.1 5.10.1.2 10.2.13	E
	Level 1: The design/plan would not necessarily lead to a valid outcome. Some steps are identified, but the plan may not be logically sequenced.	1–2		
	No relevant content	0		
	Indicative content • weigh container. • measure volume (100 cm^3) of water into container. • evaporate / heat until dry. • weigh container and remaining solids. • determine mass of dissolved solids To access Level 2 there should be an indication of using a known volume of water, heating until dry and determining the mass of solid.			

5.10.1.2 Potable water

Answer 02 · Mark scheme

June 2019 | 8464/C/2H | Original Q1

01.4	(conversion of cm^3 to dm^3) (250 cm^3 =) $\frac{250}{1000}$ or 0.25 (dm^3)	an answer of 0.031 (g) scores **4** marks	1	AO2 5.3.2.5 10.2.13	E
	(conversion of mg to g) (125 mg =) $\frac{125}{1000}$ or 0.125 (g)		1		
	(0.25 × 0.125) = 0.03125	allow correct calculation from incorrect attempt(s) at conversion	1		
	=0.031 (g)	allow an answer correctly rounded to 2 significant figures from an incorrect calculation that uses the values in the question	1		

01.5	$\frac{44}{500} \times 100$ = 8.8 (%)	an answer of 8.8 (%) or 9 (%) scores **2** marks allow 9 (%)	1 1	AO2 5.10.1.2 10.2.13	E

Total			**13**

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID

5.10.1.2 Potable water

Answer 03 · Mark scheme

November 2021 | 8464/C/2H | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	add water to anhydrous copper sulfate	allow a description of heating hydrated copper sulfate to produce anhydrous copper sulfate, followed by addition of water	1	AO2
	colour changes from white		1	AO1
	to blue		1	AO1 5.6.2.1
03.2	a single element or compound	allow an element or compound not (mixed) with any other substance ignore only one type of substance	1	AO1 5.8.1.1
03.3	(% impurity = $\frac{0.6}{0.12}$) = 5		1	AO2 5.8.1.1
	(mass impurity =) $\frac{5}{100}$ × 250		1	
	= 12.5 (g)		1	
03.4	heat salty water	allow boil salty water	1	AO1 5.10.1.2 RPA13
	(so) water evaporates (as water vapour)		1	
	cool the (water) vapour		1	
	(which) condenses to form potable / liquid water		1	

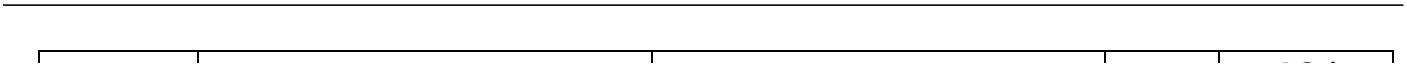
5.10.1.2 Potable water

03.5	distillation requires energy (to boil salty water) (but) ground water only needs filtering **and** sterilising	allow distillation requires fuel (to boil salty water)	1 1	AO1 5.10.1.3 RPA13
Total			**13**	

5.10.1.2 Potable water

Answer 03 · Mark scheme

November 2021 | 8464/C/2H | Original Q3



5.10.1.2 Potable water

Answer 04 · Mark scheme

Question 2

<table>
<tr><th>Question</th><th>Answers</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td rowspan="3">02.1</td><td>Level 2: Scientifically relevant features are identified, the way(s) in which they are similar / different is made clear and (where appropriate) the magnitude of the similarity / difference is noted.</td><td>4–6</td><td rowspan="3">AO1
5.10.1.3</td></tr>
<tr><td>Level 1: Relevant features are identified and differences noted.</td><td>1–3</td></tr>
<tr><td>No relevant content</td><td>0</td></tr>
<tr><td></td><td>Indicative content
<table>
<tr><th>ground water</th><th>waste water</th></tr>
<tr><td>easier to obtain</td><td>more difficult to obtain</td></tr>
<tr><td>fewer processes</td><td>more processes</td></tr>
<tr><td>takes less time</td><td>takes more time</td></tr>
<tr><td>filtered through filter beds

to remove insoluble particles</td><td>screening and grit removal

to remove large particles</td></tr>
<tr><td></td><td>sedimentation

to produce sewage sludge and effluent</td></tr>
<tr><td></td><td>aerobic biological treatment of effluent

to reduce solid waste</td></tr>
<tr><td>sterilised

using chlorine, ozone or uv light

to kill bacteria</td><td>and then sterilised

using chlorine, ozone or uv light

to kill bacteria</td></tr>
<tr><td></td><td>sludge is anaerobically digested

by specific bacteria

to remove organic matter</td></tr>
</table></td><td></td><td></td></tr>
</table>

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	distillation		1	AO1 5.10.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	(conversion) $(\frac{150}{1000} =) 0.15 (dm^3)$ (concentration =) $\frac{2.40}{0.15}$ $= 16 (g/dm^3)$ **OR** (conversion) $\frac{1000}{150}$ (1) = 6.67 (1) (6.67 × 2.4) $= 16 (g/dm^3)$ (1) **OR** (concentration =) $\frac{2.4}{150}$ (1) = 0.016 (1) (conversion) (0.016 × 1000) $= 16 (g/dm^3)$ (1)	allow correct use of incorrect / no conversion	1 1 1	AO2 5.3.2.5

Total Question 2		10

5.10.1.2 Potable water

Answer 05 · Mark scheme

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	heat the evaporating basin and contents to constant mass	allow heat until all of the water has evaporated	1	AO3 5.10.1.2 RPA13

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	(mass **X** =) [0.29 × 3] – [0.30 + 0.26] = 0.31 (g)	allow 0.87 – 0.56 allow $\frac{0.3 + \mathbf{X} + 0.26}{3} = 0.29$	1 1	AO2 5.10.1.2 RPA13

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	(test) determine the boiling point (result) (pure water) boils at 100 °C **OR** (test) determine the freezing point (1) (result) (pure water) freezes at 0 °C (1)		1 1	AO2 5.8.1.1 5.9.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	reversible reaction	allow a reaction that can go both ways	1	AO1 5.6.2.1

5.10.1.2 Potable water

Answer 05 · Mark scheme

June 2023 | 8464/C/2H | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	shifts towards the left hand side		1	AO3 5.6.2.3 5.6.2.4 5.6.2.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	(test) damp litmus paper (result) litmus paper bleached	 allow litmus paper turns white ignore litmus paper turns red	 1 1	AO2 AO1 5.8.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	the dissolved solids pass through filter paper (because) the dissolved solid (particles) are very small		1 1	AO2 5.10.1.2 RPA13

Total Question 4	**11**

5.10.1.2 Potable water

Answer 06 · Mark scheme

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	large amounts of energy required	ignore references to time and/or cost	1	AO1 5.10.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	reverse osmosis using membranes	ignore desalination	1 1	AO1 5.10.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	(heat) until the mass is constant to ensure that all the water has evaporated		1 1	AO3 5.10.1.2 RPA13

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	(mass =) $\frac{77.8}{100} \times 3.50$ = 2.72 (g)	 allow 2.723 (g)	1 1	AO2 5.10.1.2 RPA13

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	displacement using (scrap) iron electrolysis		1 1	AO1 5.10.1.4

5.10.1.2 Potable water

Answer 06 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	plants are harvested and burned to produce ash (that contains metal compounds)		1 1 1	AO1 5.10.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.7	(area =) $\frac{750}{215}$		1	AO2 5.10.1.4
	= 3.49 (hectares)	allow 3.488372093 correctly rounded to at least 2 significant figures	1	
	(conversion = 3.49 × 10 000 =) 34 900 (m^2)	allow 3.49 × 10^4 (m^2) allow a correct conversion of an incorrectly determined area	1	
	alternative approach (conversion = $\frac{215}{10000}$ =) 0.0215 (kg/m^2) (1)			
	(area =) $\frac{750}{0.0215}$ (1)	allow correct use of an incorrect conversion		
	= 34 900 (m^2) (1)			

Total Question 6	15

5.10.1.2 Potable water

Answer 01 · Examiner comments

June 2018 | 8464/C/2H | Original Q3

Question 3 (standard & standard / high demand)

03.1 76% of students correctly calculated the mass as 16. Some students incorrectly calculated the mass to be 14.

03.2 56% of students achieved at least one mark; 16% achieved both. Incorrect responses describing the length of time 'for the solids to dissolve' were regularly seen. Marks were awarded more often for students who correctly gave a disadvantage of using a larger volume of water than those who attempted to give an advantaged by creating a list of reasons, for example reliable, accurate and precise.

03.3 27% of students correctly described the difference between pure water and potable water. 'Dissolved' was omitted from the majority of descriptions about potable water having chemicals, minerals or even vitamins and nutrients 'in it'. A number of students answered in terms of the pH of the two waters.

03.4 70% of students achieved at least one on this question. 25% gave responses that gained either all three marks or two marks. Students failed to separate out their answers highlighting the differences in the treatment methods to produce potable water from ground water and seawater. 'The water' was filtered, sterilised and distilled to produce potable water was a common response. The higher-attaining students gave clear, succinct responses using the correct terminology.

03.5 56% of students achieved full marks on this question. The most common mistake was not converting 2.2 into a percentage (0.022 or 2.2 ÷ 100) when multiplying by 6.50 to calculate the mass of dissolved solids.

5.10.1.2 Potable water

Answer 02 · Examiner comments June 2019 | 8464/C/2H | Original Q1

Question 1 (standard demand)

01.1 About 91% of students gained this mark. ‘Filtered’ water was the most common incorrect response.

5.10.1.2 Potable water

Answer 02 · Examiner comments

01.2 Just under a third of students gained some credit for being able to describe the test and result for pure water. 'Boil' was often given as the test but '100 °C' was often omitted from their response for the result. Many students answered in terms of evaporation or distillation of the water, stating that no solid would remain, which was credited with one mark. The use of pH indicator, litmus paper and anhydrous copper sulfate were common incorrect responses.

01.3 Students were asked to describe a method to determine the mass of dissolved solids in a 100cm^3 sample of river water.

About 17% of students gained full marks on this question and a further 13% of students achieved marks in level 2. To access level 2, students were expected to give a logical plan that would lead to the production of valid results, as stated in the generic level descriptor in the mark scheme.

Just under half of the students gained marks in level 1 by providing a plan that would not necessarily lead to valid results.

Students who gained level 2 marks based their responses around the work undertaken in Required Practical Activities; either heating the water in a suitable container to dryness with a Bunsen burner or water bath or alternatively distilling the river water and subsequently weighing the mass of solid that remained in the flask.

Students who gained marks in level 1 often omitted to state in their method:

- the volume of water that they would use
- evaporating the river water until dryness
- the recording of weighings at appropriate times.

Many student responses give simple filtration as the method used to collect the dissolved solids and weighed what was on the filter paper. Some students were experimenting to see how much solid would dissolve in the river water and a few students gave detailed descriptions of water treatment processes.

Some students were able to provide a logically sequenced method, clearly based on the practical work they had previously undertaken.

01.4 A minority of students gained full marks but many students gained some credit for their calculation. The two conversions (mg to g and cm^3 to dm^3) were a problem for many students, multiplying by 10 or 100 was regularly seen. Some students did not convert the figures at all whilst other students divided one number by the other. The common answers that gained 3 marks were 31, (only one conversion) or 0.03125, (not converting their calculation into 2 significant figures). The most common answers that gained 2 marks were 310 (mass × volume, with incorrect conversions but an answer given to 2 significant figures) or 31000 (mass × volume to 2 significant figures). Some students chose to divide the mass by the volume as a density calculation.

01.5 Almost three quarters of students gained full marks on this question. The most common mistake was subtracting 44mg from the maximum 500mg permitted, then converting into a percentage (91.2%) to calculate the mass of dissolved solids.

5.10.1.2 Potable water

Answer 03 · Examiner comments — November 2021 | 8464/C/2H | Original Q3

Question 3 (standard, standard / high and high demand)

It is insufficient to simply state that a pure substance is only made up of one type of substance. Answers need to indicate that it is a single element or compound.

The principles of distillation were well known. Many students successfully described how water could be separated from the solution but often did not go on to explain how the water vapour was changed into a liquid. Cooling of the water vapour to bring about condensation was rarely seen. Many students did not link question 03.4 with question 03.5 to explain why obtaining potable water from salty water is more expensive than from ground water. No credit was given the latter being an easier process or taking less time. Some students were able to recognise that costs were linked to energy consumption. Ground water needed to be both filtered and sterilised to gain the second marking point in question 03.5

Answer 04 · Examiner comments — June 2022 | 8464/C/2H | Original Q2

Question 2

The topic of water purification was generally not well known.

02.1 Over 50% of students were able to score at least 3 marks comparing the methods of treatment of ground and wastewater to make potable water. This was for simple statements that both waters need to be filtered and/or sterilised, and that ground water is easier to treat than wastewater. The idea that both waters need to be distilled was very commonly seen, mistaking this with sea water.

02.2 About 70% of students were able to identify distillation to desalinate sea water. The most common incorrect response was filtration.

02.3 Over half of students were able to score two marks on this item, with the conversion of cm^3 to dm^3 being the most likely mark missed. 1 in 5 students gained 3 marks here.

5.10.1.2 Potable water

Answer 05 · Examiner comments — June 2023 | 8464/C/2H | Original Q4

Question 4

04.1 Only one in ten students could give the improvement in the method. Common insufficient responses included heat for longer, whilst giving no reasoning, heat for shorter time, or put a lid on.

04.2 An alternative approach to a mean calculation proved to be straightforward as nearly four in five students gained both marks.

04.3 Fewer than a quarter of students gained at least one mark for this question. It relied on students recognising that pure substances boil (or melt) at a fixed temperature. Some students realised this but did not go on to measure and quote the boiling point. A few students did approach it from the melting / freezing point but still did not refer to measuring the value.

04.4 Over four in five recognised that the symbol was for a reversible reaction or for a description of a reversible reaction. The most common insufficient response was for saying that the reaction was at equilibrium, which it may be but in industry often is not.

04.5 Around half of students correctly identified the correct direction of movement. The opposite change was most often given as the incorrect response.

04.6 Fewer than a quarter of students identified the correct gas test for chlorine for both marks. It was essential for the award of both marks that the litmus paper was damp.

Answer 05 · Examiner comments — June 2023 | 8464/C/2H | Original Q4

However, if just litmus paper was given, one mark could be credited for being bleached or turning white.

04.7 Just over one in ten students gained both marks for the idea that dissolved particles are too small and pass through the filter paper. One in five gained one mark, with similar numbers achieving both marking points.

5.10.1.2 Potable water

Answer 06 · Examiner comments

Question 6 (standard/high & high demand)

06.1 About a quarter of students answered this question correctly. The most common incorrect responses included 'expensive' and 'time consuming'.

06.2 Methods for producing potable water from seawater were not well known.

Few students gave a creditworthy response in this question. By far the most common incorrect responses were a description of filtration or evaporation of the water followed by condensation, a repetition of the method given in question 06.1.

The few students who gave creditworthy responses clearly understood the process of reverse osmosis well and gained both marking points.

06.3 Very few students gained full credit in this question. A common misconception was that the question was asking why any chemical experiment should be repeated. The most common incorrect responses focused on reliability and repeating to find a mean.

Of the responses that did gain credit marking point 1 was achieved most often. Very few students appreciated the idea of heating to constant mass.

06.4 Students approached this question very well, using a variety of methods. Incorrect rounding was uncommon but was the main reason why marking point 2 was not gained following a correct calculation.

06.5 Many students recognised that electrolysis was a suitable method for extracting copper. However, further methods were not well known. Very few gained marking point 1. Those that did state displacement often gave an insufficient answer, not including that this process uses iron or giving an incorrect element such as carbon.

The most common incorrect responses were phytomining and bioleaching.

06.6 A large number of students had good knowledge of the process of phytomining, often gaining 2 of the 3 marks available in this question. Many students spent some time talking about the planting and absorption of the metal ions before getting to the creditworthy aspects of their response or in fact not getting to it at all and therefore not gaining the marks available.

'Burning' was the most common mark point gained. Many students forgot to include that the plants must first be harvested (marking point 1) and some missed marking point 3 by stating that the ashes contained the metal rather than the metal compound.

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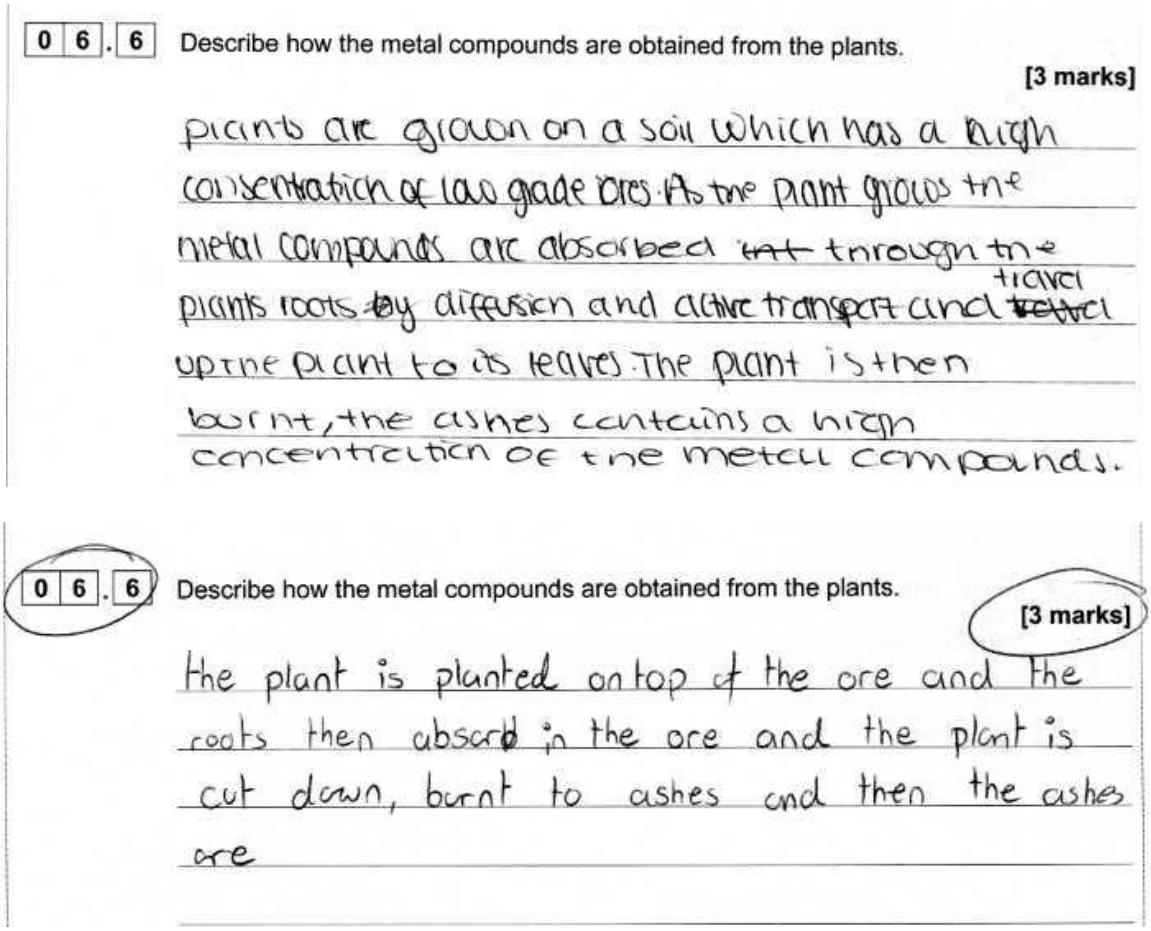
5.10.1.2 Potable water

Answer 06 · Examiner comments June 2024 | 8464/C/2H | Original Q6



0 6 . 6 Describe how the metal compounds are obtained from the plants. [3 marks]

plants are grown on a soil which has a high concentration of low grade ores. As the plant grows the metal compounds are absorbed ~~in~~ through the plants roots by diffusion and active transport and travel up the plant to its leaves. The plant is then burnt, the ashes contains a high concentration of the metal compounds.

0 6 . 6 Describe how the metal compounds are obtained from the plants. [3 marks]

the plant is planted on top of the ore and the roots then absorb in the ore and the plant is cut down, burnt to ashes and then the ashes are

The first example shows the two most common problems that students had with this question. First, a significant amount of the answer is given over to describing how the metal compounds get into the plants. The first four and a half lines of this response are unnecessary. Once the student gets to how to get the metal compounds out of the plants, they miss out harvesting (the most common omission) from the answer. They are awarded 2 marks for burning and using the ashes.

The second student gives a concise account of extracting the metal compounds from the plants. The final marking point is for producing ash. The student begins to continue their answer, but nothing contradictory is written so all 3 marks are awarded.

06.7 Students approached this question very well, with over three-quarters gaining full credit. Of those who incorrectly calculated the area, many were still able to gain marking point 3 by carrying out a correct conversion.

Many students did not achieve full marks due to rounding too soon in their calculation. Although rounding errors are not taken into account until the final answer, if a solution is rounded too soon the answer is incorrect, so full marks cannot be awarded. Students should be encouraged to keep values in calculators for multi-step calculations so unnecessarily missing out on marks can be avoided.

A number of different methods were seen during marking that were not on the mark scheme. However, a correct answer was given full credit.

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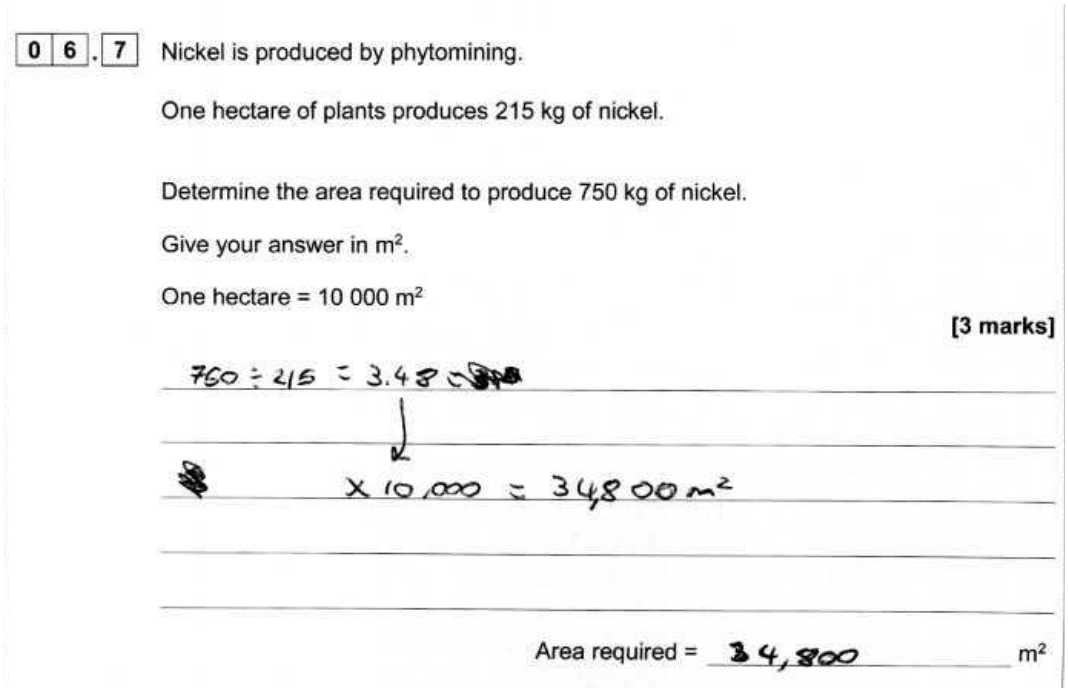
5.10.1.2 Potable water

Answer 06 · Examiner comments June 2024 | 8464/C/2H | Original Q6



0 6 . 7 Nickel is produced by phytomining.

One hectare of plants produces 215 kg of nickel.

Determine the area required to produce 750 kg of nickel.

Give your answer in m^2.

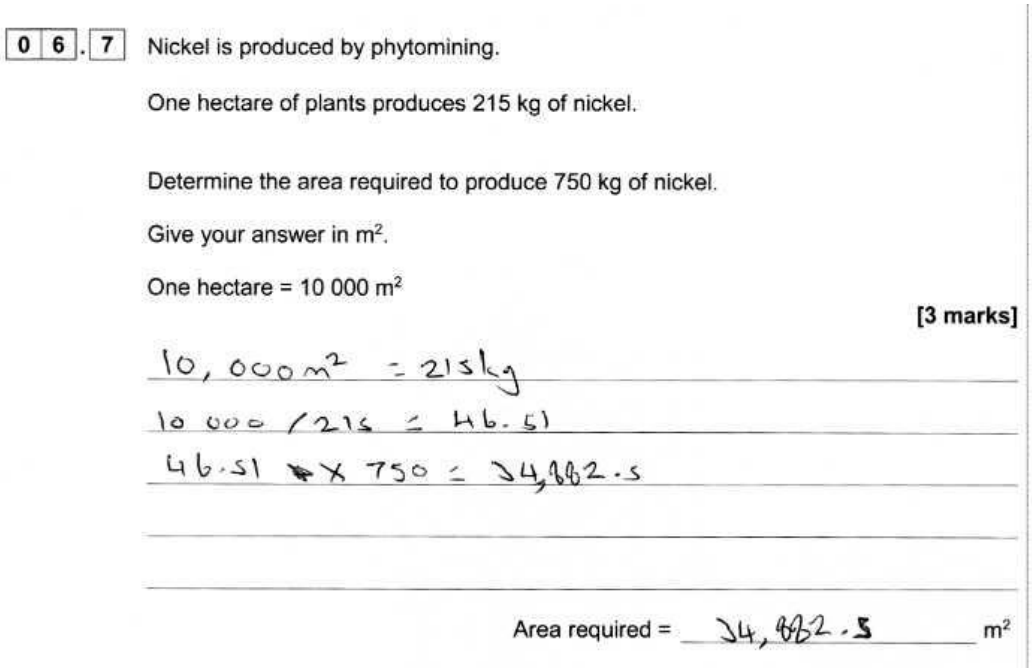
One hectare = 10 000 m^2

[3 marks]

750 ÷ 215 = 3.48

× 10,000 = 34,800 m^2

Area required = 34,800 m^2



0 6 . 7 Nickel is produced by phytomining.

One hectare of plants produces 215 kg of nickel.

Determine the area required to produce 750 kg of nickel.

Give your answer in m^2.

One hectare = 10 000 m^2

[3 marks]

10,000 m^2 = 215kg

10 000 / 215 = 46.51

46.51 × 750 = 34,882.5

Area required = 34,882.5 m^2

In the first example, the student has rounded incorrectly, so even though the method is correct, full marks cannot be awarded because the answer is incorrect.

The second example shows an alternative to the methods on the mark scheme. The student has calculated the area required to obtain 1 kg of nickel and used the answer to calculate the total area required for 750 kg of nickel. However, the student has rounded too early in the calculation, meaning that the final answer is incorrect: 2 marks were awarded in this case.

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5.10.1.2 Potable water

Contact us

Our friendly team will be happy to support you between 8am and 5pm, Monday to Friday.

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