AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.1.2.5

Group 1

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**4**
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.

5.1.2.5 Group 1

Answer 01 · Mark scheme

Question	Answers	Mark	AO / Spec. Ref.
07.1	**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	AO3
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	AO1 AO2
	No relevant content	0	
	Indicative content: A is sodium oxide B is phosphorus oxide C is magnesium oxide D is silicon dioxide **linked statements:** A is sodium oxide because it has highest pH **or** pH = 14 **or** is a strong alkali B is phosphorus oxide because it has lowest pH **or** pH = 3 **or** is an acid C is magnesium oxide because it has 2nd highest pH **or** pH = 9 **or** is a (weak) alkali D is silicon dioxide because it is neutral **or** pH = 7 **or** A and B are sodium oxide **or** phosphorus oxide because both soluble **or** no solid remains C is magnesium oxide because it will be the colourless solution with solid remaining D is silicon dioxide because it will be the colourless liquid with solid remaining for **level 3** the solids must be correctly identified		5.1.2.3 5.4.2.4

5.1.2.5 Group 1

Answer 01 · Mark scheme

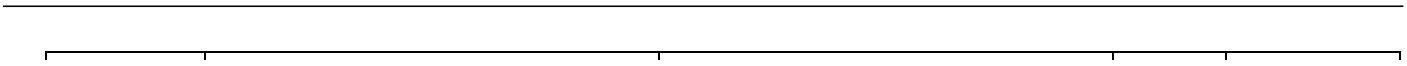
June 2018 | 8464/C/1H | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2		an answer of (pH=) 5 gains **2** marks		
	dilution by a factor of 100	allow pH changes by 1 when solution is diluted by factor of 10 **or** allow pH changes by 2	1	AO1 5.4.2.5
	(pH=) 5		1	AO3 5.4.2.5
Total			**8**	

5.1.2.5 Group 1

Answer 01 · Mark scheme

June 2018 | 8464/C/1H | Original Q7



5.1.2.5 Group 1

Answer 02 · Mark scheme

November 2020 | 8464/C/1H | Original Q7

07.1		max **3** marks if reference to incorrect particles / bonding / structure		
	caesium atom loses one electron		1	AO1 5.1.2.5 5.2.1.2
	(and) oxygen atom gains two electrons		1	
	(so) two caesium atoms react with one oxygen atom	allow (to produce) Cs_2O	1	
	any **one** from: • (to form) Cs^+ and O^{2-} • (to form) caesium ion(s) and oxide ion(s) • (to form) ions with full outer shells / levels		1	

5.1.2.5 Group 1

Answer 02 · Mark scheme

07.2		allow converse for sodium		
	(caesium has) more energy levels **or** (caesium has) more shells		1	AO2
	(so the) outer electron / shell is further from nucleus **or** outer electron / shell is more shielded		1	AO1
	(so) weaker attraction between nucleus and outer electron / shell		1	AO1
	(so) outer electron is more easily lost	allow (so) less energy needed to remove outer electron	1	AO1 5.1.2.3 5.1.2.5

07.3	early periodic tables were arranged with elements in order of their atomic weights	ignore atomic mass	1	AO1
	iodine has a lower atomic weight than tellurium	allow converse for tellurium	1	AO1
	(so) Mendeleev placed iodine with elements with same / similar properties **or** (so) Mendeleev placed tellurium with elements with same / similar properties	allow F / Cl / Br for elements allow O / S / Se for elements	1	AO2 5.1.2.2

Total			**11**

5.1.2.5 Group 1

Answer 03 · Mark scheme

June 2023 | 8464/C/1H | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	$4\,Na + O_2 \rightarrow 2\,Na_2O$	allow multiples	1	AO2 5.1.1.1 5.1.2.5 5.3.1.1 5.4.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	sodium atom loses one electron		1	AO1 5.1.1.7 5.1.2.3
	(and) oxygen atom gains two electrons		1	5.1.2.5 5.2.1.2
	(so) two sodium atoms to one oxygen atom		1	
	any **one** from: • (to form) Na^+ **and** O^{2-} • (to form) sodium ion(s) **and** oxide ion(s) • (to form) ions with full outer shells / levels.		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	yellow flame	allow orange flame	1	AO1 5.1.2.5
	any **one** from: • sodium melts • white smoke / solid / powder		1	

5.1.2.5 Group 1

Answer 03 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	(potassium) (burns with a) lilac flame	allow (burns with a) different colour flame	1	AO1 5.1.2.5
	burns faster	allow more vigorous reaction	1	

Total Question 3	9

5.1.2.5 Group 1

Answer 04 · 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

5.1.2.5 Group 1

Answer 04 · 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 =) $\frac{750}{215}$ = 3.49 (hectares) (conversion = 3.49 × 10 000 =) 34 900 (m^2) **alternative approach** (conversion = $\frac{215}{10000}$ =) 0.0215 (kg/m^2) (1) (area =) $\frac{750}{0.0215}$ (1) = 34 900 (m^2) (1)	 allow 3.488372093 correctly rounded to at least 2 significant figures allow 3.49 × 10^4 (m^2) allow a correct conversion of an incorrectly determined area allow correct use of an incorrect conversion	1 1 1	AO2 5.10.1.4

Total Question 6	15

5.1.2.5 Group 1

Answer 01 · Examiner comments

Question 7 (standard / high & high demand)

07.1 In this 'extended response' question many students used the information effectively and gave very good explanations. 73% of students were able to achieve at least one mark, while 18% of students gave answers sufficient enough to meet the demands of the level 3 descriptor.

Some misunderstood the solubility data and gave SiO_2 as the most soluble. Many understood how pH related to acid, alkali and neutral. Although a common error was the confusion between whether sodium oxide was alkaline or acidic so many gave C and D correct from the solubility data but A and B incorrect.

In long descriptions, students would often contradict chemical identification or properties due to a lack of organisation within their response. A number gave the identity of the substances as elements instead of oxides. Some did not link the letters with any of the four substances listed in the question, choosing others compounds.

07.2 Students struggled with the concept that is if an acid is diluted by a factor of 10 then the pH increases by 1. Very few showed any attempt at the correct method, with 12% of students achieving one or two marks. Most students simply multiplied the 3 by 100 to give an answer of 300.

5.1.2.5 Group 1

Answer 03 · Examiner comments — June 2023 | 8464/C/1H | Original Q3

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

03.1 Nearly three-quarters of the students correctly balanced the equation for the reaction of sodium with oxygen to produce sodium oxide.

03.2 This question was a good discriminator. Most students understood the processes involved in this question, but poor use of chemical language meant they often did not achieve the marks. Students often referred to sodium and oxygen, rather than sodium atoms and oxygen atoms and many incorrect terms such as ‘atoms sharing electrons to form ionic bonds’, ‘metal ions losing electrons’ and ‘non-metal ions gaining electrons’ were seen. Formation of O^- was a common misconception, rather than recognising that two sodium atoms each lose one electron, and both electrons are gained by one oxygen atom to form an oxide ion (O^{2-}). A common error was for students to write oxygen ion instead of oxide ion.

Answer 03 · Examiner comments — June 2023 | 8464/C/1H | Original Q3

03.3 Students found this question very challenging and instead of giving observations tried to explain what was happening in the reaction. Ver few students gave two observations for burning sodium in oxygen. A yellow flame was a common answer for those who gained one of the marks although ‘flame’ was insufficient. If students wrote ‘smoke’ they often did not state the colour and so did not achieve the mark. Many referred to the reaction of sodium with water so bubbles was a common incorrect response.

03.4 Again very few students gave two differences comparing burning potassium with sodium in oxygen. Most students did not know that potassium burns with a lilac flame. Students did not tend to write ‘burns faster’ for MP2 but they did achieve this mark by making a comparison of the two reactions, for example, by writing the reaction was more vigorous.

5.1.2.5 Group 1

Answer 04 · 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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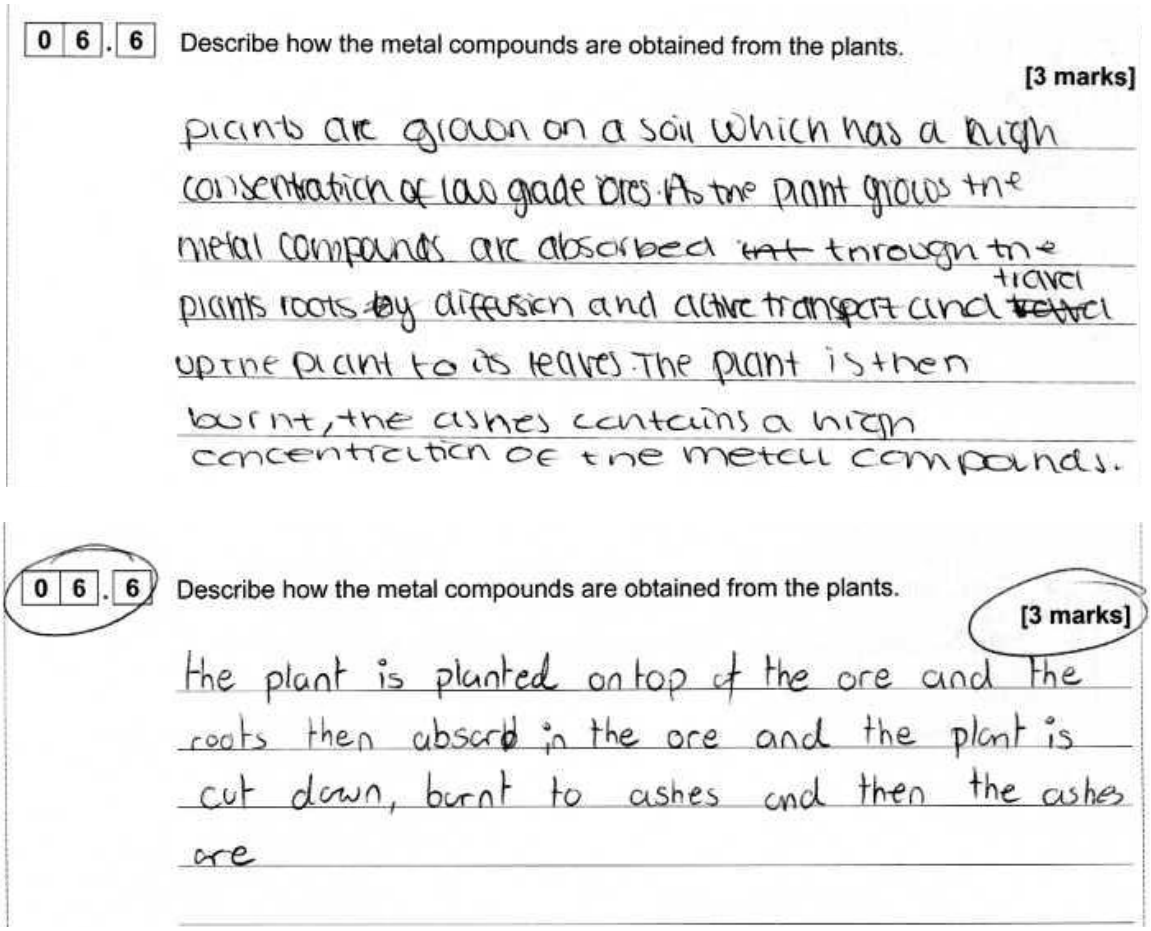
5.1.2.5 Group 1

Answer 04 · 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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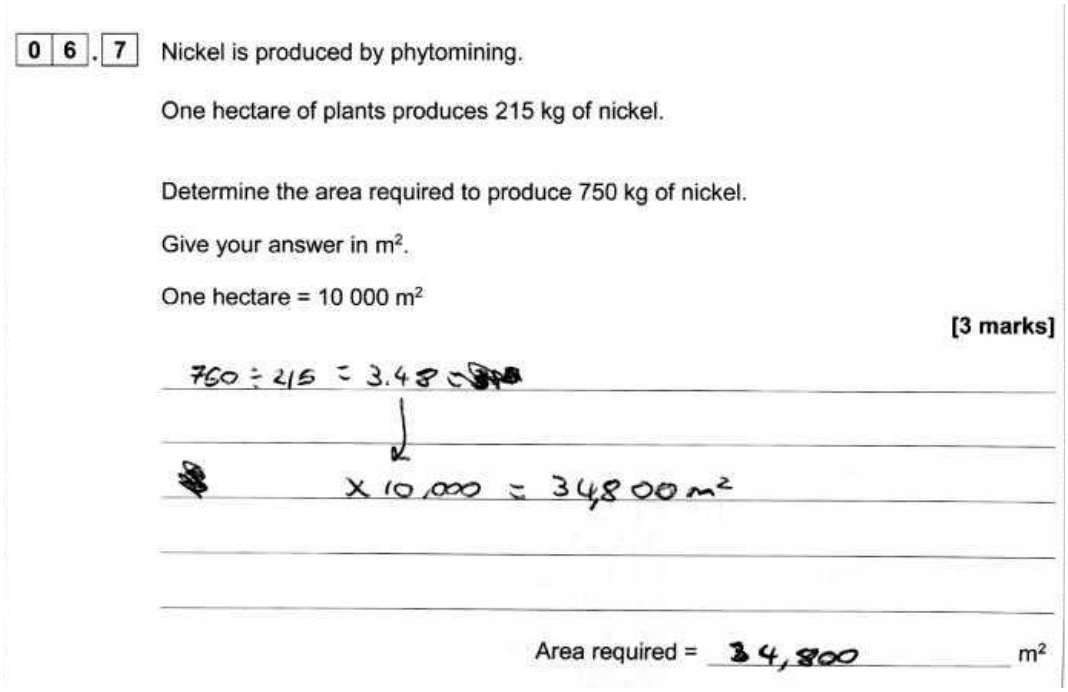
5.1.2.5 Group 1

Answer 04 · Examiner comments



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.

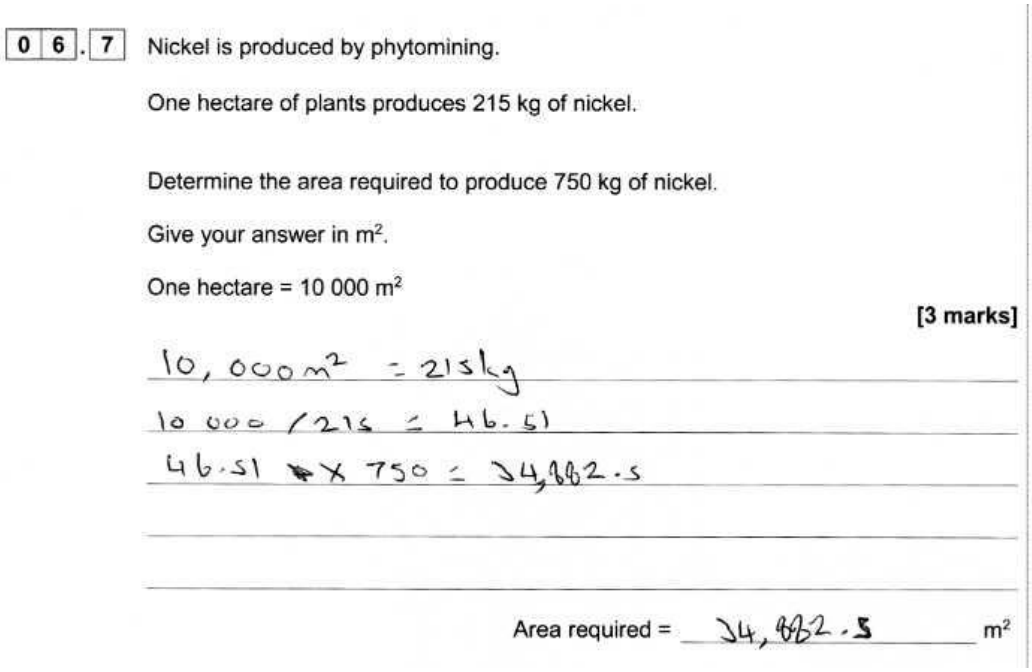
One hectare = 10 000 m^2

[3 marks]

750 ÷ 215 = 3.48

X 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 X 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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5.1.2.5 Group 1

Contact us

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