Questions matter

GCSE

Combined Science: Trilogy

8464/C/1H Combined Science: Trilogy Chemistry Paper 1H

Report on the exam

Published: August 2025

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Overview

This paper is one of the six examined components for Combined Science: Trilogy. All of these papers follow a similar structure and test the same assessment objectives.

This paper has 70 marks available to students and is made up of seven questions.

- Approximately 40% of marks assess AO1; 40% of marks assess AO2; and 20% of marks assess AO3.
- Approximately 40% of marks target Standard demand, 40% of marks target Standard/High demand and 20% of marks target High demand.

Questions 1 and 2 on this paper and questions 6 and 7 on the Foundation Tier paper are common. These questions are identical and are targeted at Standard demand.

Questions are set at three levels of demand for this paper:

- **Standard demand** questions are designed to broadly target grades 4–5.
- **Standard/High demand** questions are designed to broadly target grades 6–7.
- **High demand** questions are designed to broadly target grades 8–9.

A student's final grade is based on their attainment across all six papers.

Summary of overall performance

The questions that were common with the Foundation tier were generally well answered.

Students had several opportunities to demonstrate use of correct chemical terminology and understanding of chemical processes (**03.4**, **03.7** and **06**). Knowledge of the electrolysis of aluminium was not well demonstrated.

Less than 10% of students gained full marks in any of these recall questions (AO1) at standard/high demand (**03.4**, **03.7**, **04.2** and **04.7**) although these questions did discriminate well.

Generally, students found application (AO2) and analysis (AO3) questions more challenging and many of these questions were not well answered (e.g. **04.3-04.6**, **06** and **07.2-07.3**).

The questions assessing maths skills in this paper (**01.4** and **01.7**) and graph plotting (**01.2**) which were at standard demand) were generally answered well, as was the bond energy calculation (**05.5**) at standard/high demand. Students found the pH question involving standard form (**05.2**) and the moles ratio (**06.5**) which were at standard/high and high demand more challenging.

Some questions about practical techniques proved more difficult than others. Students were better at describing different steps taken in required practicals than suggesting improvements or interpreting results (**01** and **02.3**).

In the extended response question (**07.4**), students were better at describing bonding than structure.

Question 1 (Standard demand)

01.1 The most common response of reducing the risk of harm from chlorine gas was 'wear a mask' which was insufficient to gain credit, as was 'face mask', when what was required was the use of 'a gas mask'. Conducting the experiment 'in a fume cupboard' was a less commonly seen correct response as was ventilation which was well-remembered from the required practical.

01.2 The majority of students were able to plot the six points. Drawing a line of best fit remains slightly more problematic: lines failed to go through the points, lines between the points were drawn with a ruler or double lines are drawn, lines were stopped and restarted and many were drawn with a thick pen or blunt pencil that was more than half a small square thick. Numerous students drew a straight line, despite the points clearly indicating a curve and some drew both a straight line and a curve.

01.3 This question was well answered. Some students referred to the graph for their answer, when the question demanded that they use the results from Table 1. The results show that as time increased in 60 second intervals the mass of the negative electrode increased but at a decreasing rate until 300 seconds when the mass remained constant. Rather than stating 'increase/changes in mass' in their responses, some students referred to 'it'; this was ambiguous and did not gain credit. The most common correct answer was that the mass was constant after 300 sec. Using two correctly determined <u>changes</u> in mass was creditworthy, but simply quoting numbers from the table was insufficient.

> **0 1 . 3** A student made the hypothesis:
>
> 'The negative electrode will increase by a constant mass every 60 seconds.'
>
> How do the results in **Table 1** show that the hypothesis is **not** correct?
>
> **[1 mark]**
>
> It does not increase by the same amount each time
>
> An example of a response where 'it' was been used; this was ambiguous and was not creditworthy.

01.4 This calculation was well done. Many students were able to convert $25\,cm^3$ to $0.025\,dm^3$ for 1 mark. Some attempted the unit conversion but either divided by 100 or multiplied by 100 or 1000. Numerous students laid out their working clearly, giving units throughout, although few used words e.g. 'concentration ='. Those who didn't quote an equation for concentration occasionally went on to get mass and volume the wrong way up or multiplied them.

01.5 More than three quarters of students knew that when potassium chloride solution is electrolysed hydrogen gas was given off at the negative electrode because hydrogen is less reactive than potassium. The reverse statement hydrogen is more reactive than potassium was the most popular incorrect distractor.

Question 2 (Standard demand)

02.1 The specification definition for an 'exothermic' reaction was not well known as students rarely stated that energy or heat was released or transferred '*to the surroundings*'. However, more than three-quarters of students gained this mark. Answers were mostly general explanations, describing how energy or heat were 'given off' or 'released'. Common non-creditworthy responses referred to energy or heat being 'produced', the idea of heat or energy being 'lost' or references to an increase in temperature. Some answers stated that 'oxygen' or 'a gas' was given off by the reaction.

02.2 This question was well answered. The majority of students understood the use of brackets in a formula and used the subscript 2 correctly so evidence of 32 was common. There were some different variations on the use of 16 and 74 such as 74+16, 74-16 or 74÷16.

> **0 7 . 2** The formula of calcium hydroxide is $Ca(OH)_2$
>
> Calculate the percentage by mass of oxygen in calcium hydroxide.
>
> Relative atomic mass (A_r): O = 16
>
> Relative formula mass (M_r): $Ca(OH)_2$ = 74
>
> **[3 marks]**
>
> $\frac{16}{74} \times 100 = 21.621$
>
> Percentage = 21 %
>
> This response (from a Foundation tier paper) has not accounted for 2 oxygen atoms in the formula so does not gain MP1. However, MP2 is awarded for the correct mathematical expression (using an incorrectly determined mass of oxygen) but then truncate their answer. Had they rounded correctly to 22 or 21.6 or left their answer as 21.621 they would have been awarded MP3 (correctly rounded to at least 2 significant figures).

02.3 This was an 'extended response' style of question. Such questions are marked holistically. There are overall generic descriptions for the three levels of response at the top of the mark scheme, giving a hierarchy of response. Within each level there are 2 marks.

Students were asked to plan a method to investigate how changing the mass of calcium oxide affects the temperature change of the reaction when calcium oxide is added to water. The indicative content includes 5 key steps and the control variable, along with some additional information.

At Level 1, students needed to identify some relevant steps. To enter Level 2, three key steps, or two with the control variable, were required. To achieve marks in Level 3, all 5 key steps and the control variable were needed. Only a minority of students were able to obtain 6 marks.

Most students added calcium oxide to water but many omitted either volume (of water) or mass (of solid) although ‘amount’ was creditworthy for both here. Numerous students then took the ‘initial’ temperature (but this was often after they had added solid to water). Many were less clear on when and how the subsequent temperature or temperatures were to be taken. Too frequently it was stated that the ‘temperature change’ was to be measured which is not creditworthy, as this requires a calculation. The need for a control variable, whilst rarely stated as such, was often found in a Level 2 response due to the students realising that the volume of water needed to be fixed along with the experiment being repeated in some way. An indication of how the temperature change was to be determined was rarely seen.

0 7 . 3 When solid calcium oxide is added to water, the temperature of the reaction mixture changes.

Plan a method to investigate how changing the mass of calcium oxide affects the temperature change of the reaction mixture.

[6 marks]

Step 1 - Measure out the calcium oxide, place into a conical flask

Step 2 - Measure out 100ml of water, and place into the same conical flask

Step 3 - record the before temperature, using a thermometer

Step 4 - Place stopper and let reaction occur.

Extra space Step 5 - Record after temperature, and measure + calculate the change in temperature.

In this response (from a Foundation tier paper) the student has stated a valid volume of water but omitted ‘mass’ of calcium oxide. In step 3 they record the ‘before’ temperature but this is after both reactants have been added to the conical flask so is not credited with taking the initial temperature. They have not stated when the subsequent temperature is measured nor described how the temperature change is determined. Had the student ‘repeated the experiment with different masses of calcium oxide’ they would have been credited with the control variable as this would imply fixing the volume stated. The student uses a thermometer which is a valid point in the mark scheme.

Only one key step is stated with some additional information (correct use of a thermometer) so this is a Level 1 response and is awarded 1 mark.

0 7 . 3 When solid calcium oxide is added to water, the temperature of the reaction mixture changes.

Plan a method to investigate how changing the mass of calcium oxide affects the temperature change of the reaction mixture.

[6 marks]

- Place water in a polystyrene cup with a thermometer and lid
- ~~Add in~~ measure out different masses of calcium oxide
- add smallest mass to cup, place lid on top and measure maximum temperature and temperature change
- repeat with increasing masses of calcium oxide
- repeat previous steps to make sure investigation is accurate
- ~~measure~~ find the mean temperature

Extra space of each reaction of increasing calcium oxide mass and water.

In this response (from a Foundation tier paper) the student has omitted volume of water but stated mass of calcium oxide. The initial temperature is not recorded but the maximum temperature is. They repeat for accuracy and then repeat with different masses of calcium oxide. They have not stated how the temperature change is determined nor that they need to use the same volume of water when repeating. The student uses a suitable container (an insulated cup) and a thermometer which are valid ideas from the mark scheme.

There are three key steps with some additional information (thermometer and insulated cup) so this is a Level 2 response and is awarded 3 marks.

| 0 | 2 | . | 3 | When solid calcium oxide is added to water, the temperature of the reaction mixture changes.

Plan a method to investigate how changing the mass of calcium oxide affects the temperature change of the reaction mixture.

[6 marks]

1. Measure $25cm^3$ of water using a measuring cylinder and pour into a polystyrene cup.
2. Place the cup into a beaker and measure initial temperature using a thermometer
3. Measure 4g of calcium oxide using a balance
4. Add the calcium oxide and ~~~~ put on a lid
5. Once the temperature has come to a stable point take final temperature reading using a thermometer
6. Calculate temperature change by doing final temp - initial temp
7. Repeat steps 1-6 with different masses of calcium oxide e.g 6g, 8g. and compare results.

(for more accurate results use cotton wool in the beaker as an insulator and use a digital thermometer)

In this response, the student has stated a valid volume of water and mass of calcium oxide. The initial temperature (before the solid is added) and final temperature are recorded. They repeat with different masses of calcium oxide and are using the same volume of water so are credited with having a control variable. They have shown how the temperature change is determined. The student uses a measuring cylinder, suitable container (an insulated cup), balance and a thermometer which are additional valid points in the mark scheme.

There are all five key steps, a control variable, how the temperature change is determined with lots of additional information, so this is a Level 3 response and is awarded 6 marks.

Question 3 (Standard and Standard/High demand)

03.1 Just under half of students gave the two correct conclusions of the alpha particle scattering experiment as atoms have a charged nucleus and the mass of an atom is concentrated in the nucleus. The most popular incorrect distractor was electrons orbit the nucleus at specific distances.

03.2 Overall this question was well attempted with very few failing to offer an answer. The two most common incorrect responses were ‘number of protons not equal to the number of electrons so X is an isotope’ and ‘protons should be the same as neutrons’.

03.3 Just than half of students used the number of subatomic particles to correctly deduce that particle X was ${}^{79}_{35}Br^{-}$. The most popular incorrect distractor was ${}^{79}_{35}Se^{-}$

03.4 Students found this question difficult with very few achieving 3 marks, and many failing to score. The most commonly awarded mark was MP1 which was related to the size of the atom. A large number of students answered in terms of reactivity rather than the physical property of boiling point, so references relating to the distance from the nucleus to the outer shell or outer electrons were common which were incorrect in this context. Linking boiling point to the ease of gaining electrons was another common response, together with incorrect references to electrostatic forces of attraction between the nucleus and electrons, again confusing reactivity and boiling points. There was also a significant number of students who used ‘forces’ and ‘bonds’ inconsistently and therefore could not be awarded marks as it was not clear what they meant.

0 3 . 4 **Table 2** shows the boiling points of some Group 7 elements.

Table 2

Element	Boiling point in °C
Fluorine	−188
Chlorine	−35
Bromine	59
Iodine	184

Explain the increase in the boiling points of the Group 7 elements going down the group.

[3 marks]

AS you go down group 7 the boiling point increases this is because of ~~to~~ the Molecules get larger and the intermolecular forces get Stronger which requires more energy to break.

This response gained 3 marks. Size, force and energy are all correctly described.

03.5 More than three quarters of students deduced that the bonding in the compound ClF_3 was covalent as two non-metals had combined. Ionic and metallic were common incorrect responses.

03.6 The majority of students added sodium chloride and bromine to complete the word equation. The most common error was the mixing up of bromine with bromide and chlorine with chloride.

03.7 Students found this question difficult with very few achieving 3 marks, and many failing to score. Common errors for MP1 were students stating that the ‘elements’ have more shells or ‘more outer shells’. A common error for MP2 was not mentioning the ‘outer shell electrons’ or referenced attraction between the nucleus and the ‘outer shell’ which was insufficient for the mark. The most commonly awarded mark was MP3 which related to the difficulty of gaining of an electron. References to attracting electrons were common but this was not creditworthy as it does not necessarily suggest electrons being gained. There were many students who were very close to 3 marks but scored 0 due to these incorrect or incomplete statements.

0 3 . 7 Explain why Group 7 elements become less reactive going down the group.

[3 marks]

Group 7 elements become less reactive because as you go down a group, the number of shells increases so ~~they~~ the strength of the attraction between the positive nucleus and negative electrons is weaker as the distance is greater, this means the nucleus is less likely to be able to attract another electron for its outer ~~lea~~ layer .

This response gained 0 marks. MP1 was not awarded as ‘atoms’ (have more shells) is missing. MP2 was not awarded as ‘outer’ (electrons) is omitted. MP3 is not gained as attracting electrons does not necessarily suggest an electron is gained. This is an example of answers that were very close to each of the 3 marks but scored 0 due to incomplete statements for each one.

Question 4 (Standard, Standard/High and High demand)

04.1 Many correctly stated iron can be extracted by reduction with carbon because iron is less reactive than carbon. The converse statement was the most common incorrect response.

04.2 Very few students were able to achieve both marks on this question as the idea that the melting point of the mixture is lower, was rarely seen. Many responses incorrectly stated that it is the melting point of the aluminium oxide or aluminium that is lowered. A large majority of students gained marking point 2 by stating that less energy is used. However, those who qualified this by saying that less energy is needed for the 'reaction' were not awarded the mark. Many students thought that cryolite was a catalyst.

> **0 4 . 2** Explain why a mixture of aluminium oxide and cryolite is used as the electrolyte instead of only aluminium oxide.
>
> **[2 marks]**
>
> Aluminium oxide has a very high melting point. Cryolite is added to reduce the melting point. This makes it cheaper and means less energy is needed.
>
> This response gained 1 mark. MP1 was not awarded as it is the melting point of the <u>mixture</u> is lower not the melting point of the aluminium oxide. MP2 was credited.

04.3 Students found writing the half equation at the positive electrode to show the oxidation of oxide ions very challenging. Many students could not give the formula for the oxide ion (O_2^- was common), oxygen or electron (e either with a + charge or no charge was common). One mark was infrequently scored, since identifying the correct reactants and not the balancing appeared to be the problem.

04.4 Few students identified the species being reduced. Chromium, a product of the reaction, was a common incorrect answer.

04.5 This AO3 question required students to use data to give a reason for the difference in the cost of extracting aluminium and iron. Most provided a comparative, which was good, but many chose to compare reactivity or to state what the extraction methods of the metals were rather than comment on the energy implication.

04.6 Another AO3 question looking for a difference in the cost of extracting aluminium and chromium. Few students answered this correctly. Common answers referred to the rarity or difficulty of extracting chromium ores from Earth.

04.7 Just under half of students gained 1 or more marks. Students should know that pure metals are soft so are mixed with other metals to make alloys, which are harder. Those who gained one mark usually referred to the difference in the sizes of the atoms and the second most common mark was for layers not being able to slide. Layers are distorted was less frequently given. Many students gave good descriptions why metals are soft but their answers for alloys were less accurate. Many referred incorrectly to intermolecular forces.

Question 5 (Standard/High and High demand)

05.1 The state symbols for hydrogen chloride gas and water were well known but aqueous for hydrochloric acid was not. Some students mixed up l and aq. Most students correctly use lower case letters.

05.2 Few students gained this high demand mark. Those students who gained the mark often wrote down a few words next to the values given in the question, e.g. ‘add 1, divide by 10’ or ‘concentration increases by factor of 10, pH decreases by 1’. Numerous students multiplied by 10 rather than dividing and many struggled to evaluate data in standard form.

05.3 More than half of students gained two marks for completing the dot and cross diagram. When 1 mark was gained it was usually for 1 pair of electrons in both overlaps with extra non-bonding electrons on hydrogen or incorrect numbers of non-bonding electrons on the oxygen atom and/or the chlorine atom.

05.4 Very few gained both marks. Students had to explain why a weak acid has a higher pH than a strong acid of the same concentration. Most answers were in terms of a pH comparison. Lots of students did not achieve MP1 by not using the full definition including <u>in aqueous solution</u>. For MP2 many students said there were less H^+ ions omitting reference to concentration or number per unit volume.

05.5 Many students were able to calculate the energy changes for bonds broken and for bonds made and then subtracted the latter value from the former. The value of bonds broken was less than bonds made so the overall energy change was a negative number. Those students who miscounted the bonds broken or made, could not gain MP1 and/or MP2 but were still able to access MP3 by evaluating their own figures correctly.

0 5 . 5 Hydrogen chloride is produced in the reaction between methane and chlorine.

Figure 6 represents the equation for the reaction.

Figure 6

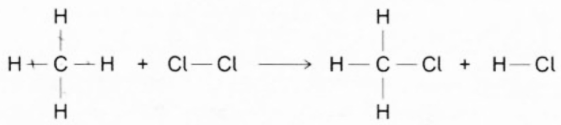


Table 4 shows the bond energies.

Table 4

Bond	C — H	Cl — Cl	C — Cl	H — Cl
Bond energy in kJ/mol	413	243	346	432

Calculate the overall energy change for the reaction.

[3 marks]

reactants	Products
413×4=1652	1x 346 = 346
243×2=486	413x 3=1239
total=1652+486=	432x1=432
2138−2017=121	total = 346+1239+432
	= 2017

Overall energy change = 121 kJ/mol

This student has broken 2× Cl—Cl bonds (not 1×) for the reactants so is not awarded MP1. They then correctly subtract the correct value for bond making (2017) so MP2 and MP3 are credited.

Question 6 (Standard, Standard/High and High demand)

06.1 The reason why the student used a Bunsen burner instead of a water bath is that the Bunsen burner reaches a higher temperature. Common responses which were not creditworthy made no reference to a temperature comparison or stated that a Bunsen burner gives more heat.

06.2 The question asked students to explain the trends in the graph for the first 3 minutes. The trends of magnesium increasing in mass or magnesium carbonate decreasing in mass were described well. Many students who attempted to support their trends with data misread the graph scale so did not gain MP1 and/or MP2; 0.82 g and 0.22 g were common incorrect starting masses, similar errors were made at 3 minutes and others referred to the common mass of 0.4 g at 4 minutes. Reasons for these changes namely magnesium gaining oxygen and carbon dioxide being released from magnesium carbonate were frequently omitted.

06.3 Making the link with the equations and graphs made this a demanding question. When students wrote about moles they usually referred to the moles of the reactants being the same rather than the moles of the product.

> **0 6 . 3** **Figure 8** shows that both reactions are complete after 5 minutes. end mass
>
> Why is the final mass of the contents of the crucible the same for both reactions?
> **[1 mark]**
>
> Because they both only contain the same amount of magnesium oxide (MgO).
>
> This response did not score but was a near miss. The student is referring to the product from both reactions but the same amount (of MgO) is not equivalent to the same moles.

06.4 This high-demand AO3 question proved challenging. Students could have either described what happened if the conclusion was correct which would result in a final mass lower than predicted or use the graph to conclude that both lines have the same final mass (0.4 g) so solid cannot have escaped. Responses often failed to include mass.

06.5 Many students were able to calculate the ratio of iron to water but only those who gave the simplest ratio were credited with MP1. Most were unable to make the link between the moles of reagents that reacted and the formula of the product so MP2 was rarely awarded. When writing symbols lowercase letters must be discernibly smaller than upper case letters. Many students gave a balanced equation using their formula for iron oxide; FeO and FeO_2 were common incorrect responses which were then used correctly to access MP3 and MP4. Those students who gave the formula of hydrogen as H were unable to access the final 2 marks.

0 6 . 5 Iron reacts with steam (H_2O) to produce an oxide of iron and hydrogen gas.

0.120 moles of iron reacts with 0.160 moles of steam.

Determine the balanced equation for the reaction.

You should determine:

- the simplest whole number mole ratio of Fe : H_2O
- the formula of the iron oxide produced.

[4 marks]

0.12 mol : 0.16 mol

12 : 16 mol

Simplest mole ratio of Fe : H_2O = 12 : 16

Formula of the iron oxide = FeO_2

Balanced equation for the reaction:

$Fe + 2H_2O \rightarrow FeO_2 + 2H_2$

This response was awarded 2 marks. The student has not evaluated the simplest ratio and the formula is incorrect. However, they gave a balanced equation using their formula for iron oxide (FeO_2) so gain MP3 and MP4.

Question 7 (Standard, Standard/High and High demand)

07.1 Very few students gained full credit in this question. The most common creditworthy statement was 'A shows the 2D arrangement' or 'B shows the 3D arrangement'. Many referred to atom, molecule or subatomic particle instead of ion; some students thought that the + and – charges meant the spheres were protons and electrons. There were many descriptions of what the models showed rather than a comparison of how they represented ionic bonding. Relative size of the ions seems to be a difficult concept; some wrote about not seeing the actual size of the particles in A whereas you could in B.

07.2 Very few knew how to construct a formula from the constituent ions. Those who were successful in writing the formula of aluminium sulfate either used the lowest common multiple or 'swap and drop' methods. Many answers placed the two ions together and reported the remaining charge, rather than forming a neutral formula. $AlSO_4$ was the most common incorrect answer.

07.3 Many students recognised that 'more delocalised electrons' was why aluminium metal conducts electricity better than sodium metal. However, this answer needed 'per atom' to be creditworthy. Some students answered in terms of properties, bond strength and reactivity.

07.4 This was an 'extended response' style of question. Such questions are marked holistically. There are overall generic descriptions for the two levels of response at the top of the mark scheme, giving a hierarchy of response. Within each level there are 2 marks.

Students were asked to compare the structure and bonding of silicon dioxide and poly(ethene). In the indicative content the first 4 black bullet points in the 'differences' relate to bonding, the last 2 to structure.

At Level 1, students needed to identify some relevant features. To enter Level 2 a comparison, reference to magnitude and reference to the structure and bonding of silicon dioxide or poly(ethene) were required.

Students found this question challenging and a significant proportion did not attempt it. Neither the structure nor bonding of these two compounds were well known. Silicon dioxide has a giant structure was common, but some did not state whether this was ionic or covalent. Poly(ethene) contains covalent bonds was common but long chain molecules very rare. Few knew the intermolecular forces were between chains of poly(ethene). There were many contradictions such as giant ionic and giant covalent and many wrote that silicon dioxide contained carbon or carbon dioxide bonded to silicon or formed a simple molecule containing 3 atoms. There were many two-paragraph answers and very few comparisons which would have lifted many responses from Level 1 to Level 2 and lots of references to properties.

Students often contradicted themselves, sometimes seemingly when later adding to their answer. The most common contradiction was correctly stating that silicon dioxide had a giant covalent structure and later stating that it had intermolecular forces. A common expression was 'is a covalent bond'.

0 7 . 4 Silicon dioxide and the polymer poly(ethene) are solid substances.

Compare silicon dioxide with the polymer, poly(ethene).

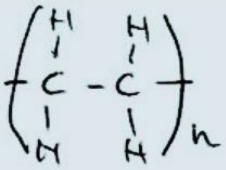
Answer in terms of structure and bonding.

[4 marks]

Silicon dioxide is a allotrope of carbon it is a giant covalent structure. it is held together by strong covalent bonds meaning it has a high melting and boiling point as lot's of energy is needed to break the bonds. Silicon dioxide can transfer electricity as it has delocalised electron.

Poly(ethene) is a Hydrocarbon made up of 2 carbon atoms each bonded to 2 Hydrogen atoms. ~~Carbon~~

Extra space it's a lighter Hydrocarbon which means it has a lower boiling/melting point. It's held together via covalent bonding.



END OF QUESTIONS

This response includes references to magnitude (*giant* structure and *strong* covalent bonds) and sufficient indicative content to access Level 2; strong bonds, both have covalent bonding and giant structure. There are also some incorrect statements. However, there is no comparison (simply a paragraph referring to silicon dioxide and then one for poly(ethene)), so the response does not meet the Level 2 descriptor. They have identified a number of relevant features, so the response was awarded 2 marks, in Level 1.

0 7 . 4 Silicon dioxide and the polymer poly(ethene) are solid substances.

Compare silicon dioxide with the polymer, poly(ethene).

Answer in terms of structure and bonding.

[4 marks]

Both silicon dioxide and poly(ethane) have covalent bonding, silicon dioxide is a giant covalent structure. The polymer is lines of repeated units. Silicon dioxide has hexagonal structures. Silicon dioxide and the polymer both cannot conduct electricity due to having no free electrons. Silicon dioxide has a very high melting + boiling point

In the first two lines of this response there is a reference to magnitude (*giant* structure) and sufficient indicative content; both have covalent bonding and giant structure and a comparison so the response meets the Level 2 descriptor. With a comparison, reference to magnitude and to the structure and bonding of silicon dioxide, this response was awarded 3 marks, in Level 2.

0 7 . 4 Silicon dioxide and the polymer poly(ethene) are solid substances.

Compare silicon dioxide with the polymer, poly(ethene).

Answer in terms of structure and bonding.

[4 marks]

Silicon dioxide is made up of covalent bonds with silicon and oxygen. It has a similar structure to diamond as all silicon atoms are conected to 4 others, covalently bonded with oxygen instead. Polyethane is similarly constructed with covalent bonds, but it is covalently bonded in a ~~chain~~ carbon chain and can be a very long molecule. Silicon can be in a giant lattice structure where as polyethal

Extra space cannot.

This response includes references to magnitude (*giant* structure and *very long* molecule) and sufficient indicative content; both have covalent bonding, very long molecule and giant structure and there is a comparison, so the response meets the Level 2 descriptor. With 2 comparisons, a reference to magnitude and to the structure and bonding of silicon dioxide <u>and</u> of poly(ethene), this response was awarded the maximum 4 marks.

Contact us

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

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