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Examiners' Report
June 2012

GCSE Chemistry 5CH1H 01

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Introduction

This was the third 5CH1H paper to be offered following those set in March 2012 and November 2011. This question paper assessed the specification items included in unit 1 'Chemistry in our world', which is designed to establish the foundations of a chemistry course for GCSE, and to prepare candidate for further study as a precursor to the Additional Science C2 course and the separate chemistry topics C3 course.

In common with all the other science GCSE examination papers for the current specification, this was a one hour, 60 mark paper. Like the previous papers, the paper contained six questions based largely around one of the topics in the specification. The last two questions each contained an extended writing element worth 6 marks.

It appeared that centres are using the previous papers as practice for the candidates. This is a positive move as candidates are prepared, and know how to answer the various types of questions encountered on the paper. Balanced equations will be tested on this paper and if a word equation is given instead, this will not score marks.

Successful candidates:

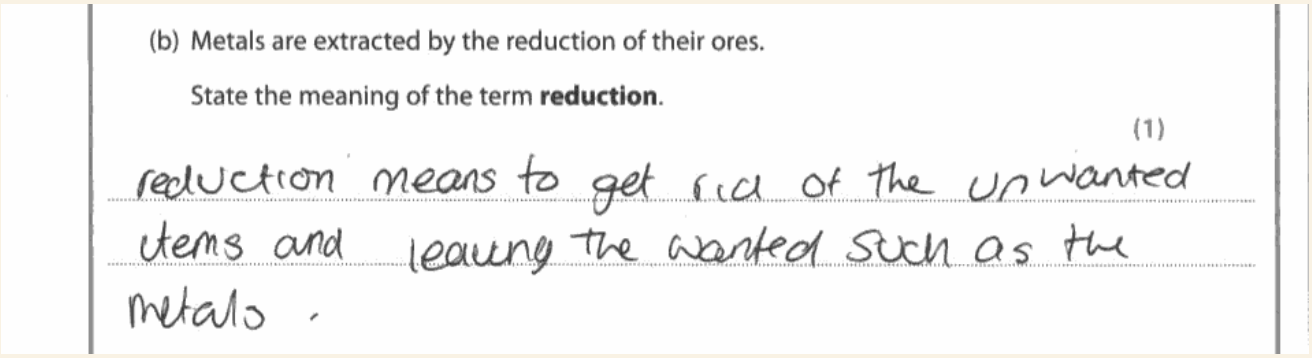
- Used correct scientific explanations and terminology.
- Were able to write and balance chemical equations.
- Focused their attention on what was required to answer the question.

Less successful candidates

- Focused more on rewriting the question rather answering it.
- Did not pay attention to the number of marks the question was worth.
- Were unable to write balanced equations.
- Wrote incorrect chemical formulae e.g. CO^2.
- Wrote word equations where balanced equations were asked for.

Question 1 (b)

Just over half the candidates managed to express themselves sufficiently well to score the mark. Reduction at this stage is confined to loss of oxygen, although candidates would have been awarded the mark with more sophisticated answers such as 'gain of electrons'. The less able candidates tended to answer in terms of lowering the amount of something, such as 'reducing oxygen' which was often used rather than 'removing oxygen'. However, it was clear that many candidates thought that reduction was specific to the removal of oxygen from a metal ore, rather than a general chemistry term.



(b) Metals are extracted by the reduction of their ores.

State the meaning of the term **reduction**.

(1)

reduction means to get rid of the unwanted items and leaving the wanted such as the metals.

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Examiner Comments

This answer is too vague in terms of what is being removed, and as a result did not score.

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Examiner Tip

Learn the meanings of specific terms such as reduction and oxidation.

Question 1 (c)

This question was generally well answered, with many scoring one of the two marks available. Few managed to express themselves well enough with a new idea to score the second mark.

The majority were able to score the first marking point, with 'aluminium is more reactive…' or 'iron is less reactive….'. Very rarely were references seen to the idea of stability. A small percentage of the candidates made some comment about electrolysis, but with reference to aluminium, and not to its position in the reactivity series requiring a more powerful means of extraction, or that a cheaper method of extracting iron is available rather than the more expensive electrolysis method.

The scientific words required seemed to be missing in most cases. Vague references to 'heating with carbon' and 'extracting with carbon' were typically seen in weaker responses, effectively just repeating the stem of the question, without the correct reference to reduction. A few responses mentioned oxygen being removed from iron oxide. It was noted that few candidates seemed to know that electrolysis is a method of reduction.

(c) Aluminium is extracted by the electrolysis of a molten mixture of its ore (bauxite) and cryolite.
Iron is extracted by heating a mixture of its ore and carbon.

Explain why electrolysis is used to extract aluminium but is not used to extract iron.

(2)

Aluminium cannot be extracted using carbon as it is higher than carbon in the reactivity series, where as iron can be as it is lower than carbon in the reactivity series.

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Examiner Comments

This candidate has made a comment about reactivity of the metals relative to carbon and so scores only 1 mark. There was no comment made about why electrolysis is used to extract aluminium.

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Examiner Tip

Focus on what the question is asking you to do.

Question 1 (d)

This was not well answered on the whole, with the majority of candidates failing to score even 1 of the 2 marks available. Many were able to show their understanding of the way in which a second different size atom affects the strength of an alloy, and how this stopped the other atoms from sliding. In a very few cases, more able candidates were able to articulate their ideas to include a description of how the second atom disrupted the crystalline structure, and how this prevented the **layers** of atoms from sliding over each other. However, a few drew very clear labelled diagrams to demonstrate regular layer structure and accessed the mark this way.

A significant minority incorrectly described the particles as 'molecules' with regard to the first marking point. Many candidates did not make reference to 'layers / sheets /rows' of particles sliding over one another, and so failed to score on the second marking point. In the weaker responses seen, many went on to discuss other properties, such as boiling and melting point and chemical properties of some named metals.

Explain why the aluminium alloy is stronger than pure aluminium.

(2)

Alloys have a different structure of molecules. They have some bigger particles which stop the "layers" from sliding. This process makes it much more stronger than pure Aluminium.

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Examiner Comments

The incorrect use of the word 'molecule' at the end of the first line sadly loses the first mark. The second point was scored for the bigger particles stopping the layers from sliding.

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Examiner Tip

Take care with the use of 'atoms' and 'molecules'.

Explain why the aluminium alloy is stronger than pure aluminium.

(2)

The aluminium alloy is stronger because when it is mixed with [illegible] the magnesium the different sized atoms make it harder and they can't slide over each other.

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Examiner Comments

The first mark was scored for the different sized atoms in the alloy, but it wasn't clear what cannot slide, so the second mark was not awarded.

Question 1 (e)

The majority of candidates were able to balance the equation.

Question 2 (a)

A generally well answered question. The vast majority of responses scored on the first marking point only, with reference to there being 'nobody there' or similar. A sizeable minority were able to score the second marking point, by making reference to limited evidence (or similar) / no records / no measurements made. Very few scored on the third marking point. Unfortunately, many discussed ice core data, but were unable to score since they did not refer to the data not being old enough.

(a) Explain why it is difficult to be precise about the composition of the Earth's early atmosphere.

(2)

because there was nobody around at the time so there are no records of what the atmosphere was like and we can only estimate

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Examiner Comments

Both marks were scored in this very succinct answer.

(2)

It is diffucult because there was no scientists around to record what was going on.

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Examiner Comments

It isn't just scientists who can record information. Both marks were, however, awarded.

Question 2 (b)

The majority of the candidates scored the mark here, with most making reference to a drop in the amount of water vapour. However, the mark was not awarded if the answer indicated that **all** the water vapour of carbon dioxide was removed from the atmosphere.

The few errors that did occur centred around the idea of plants growing in the oceans and then giving out oxygen, or that the ocean absorbed a different gas altogether (e.g. nitrogen was mentioned several times here).

(b) As the Earth cooled, oceans formed.

How did this affect the composition of the atmosphere?

(1)

CO_2 went into the oceans and mixed to make oxygen and calcium carbonate which makes shells for animals and animals were

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Examiner Comments

This candidate gave too much information, some of which was incorrect and so did not score the mark.

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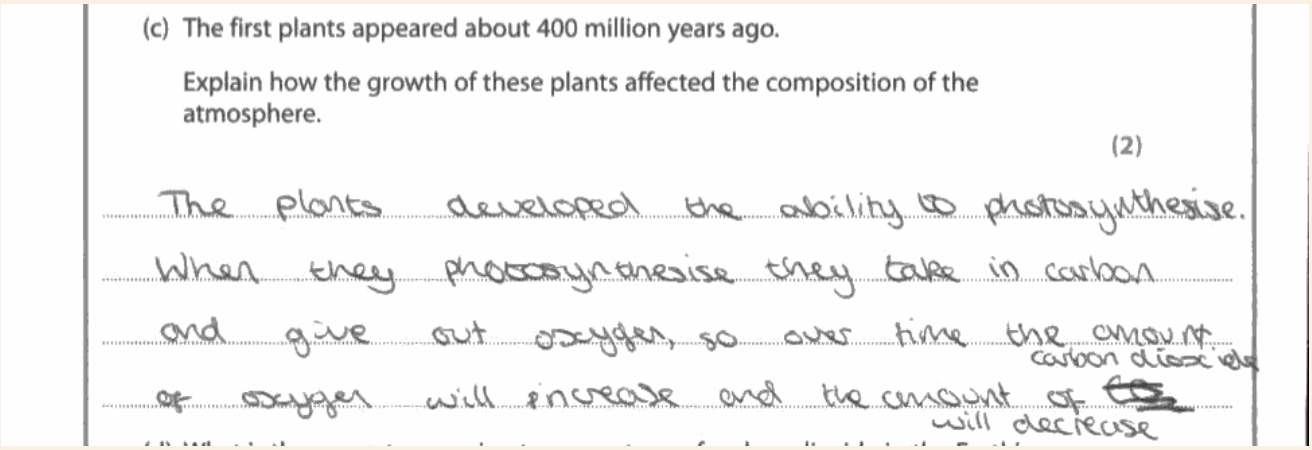
Examiner Tip

Incorrect information will cause marks not to be awarded.

Question 2 (c)

This was a high scoring question with the overwhelming majority scoring 2 marks. Photosynthesis is well known, with mention of the correct gases being absorbed and released. As a result, many candidates scored by referring correctly to all three marking points.

The main error seen was mistaking respiration for photosynthesis. Some candidates incorrectly suggested that photosynthesis took carbon dioxide out of the atmosphere and then respiration released oxygen.



(c) The first plants appeared about 400 million years ago.

Explain how the growth of these plants affected the composition of the atmosphere.

(2)

The plants developed the ability to photosynthesise. When they photosynthesise they take in carbon and give out oxygen, so over time the amount of carbon dioxide oxygen will increase and the amount of ~~CO2~~ will decrease

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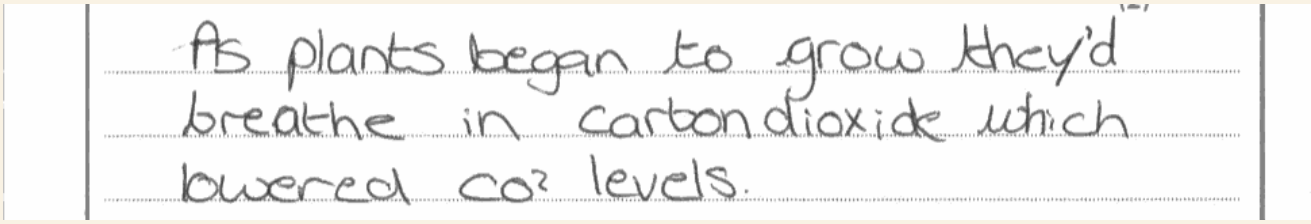
Examiner Comments

Although the candidate erroneously missed out the word 'dioxide' after carbon at the end of the second line, the answer still scored 2 marks - one for the process of photosynthesis, one for releasing oxygen.



As plants began to grow they'd breathe in carbon dioxide which lowered CO^2 levels.

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Examiner Comments

This answer highlights two misconceptions:

1. Plants do not 'breathe'.
2. Formulae given as CO^2 are not acceptable.

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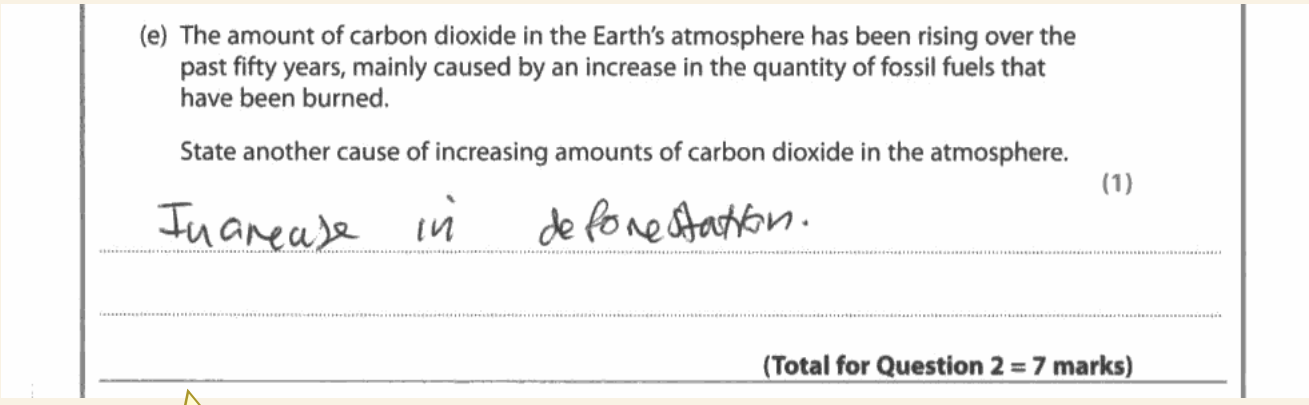
Examiner Tip

Use correct notation for chemical formulae.

Question 2 (e)

This was another high scoring question with the majority answering in terms of deforestation. The least common correct answer seen was the idea of increased global temperatures.

The main error was about the use of cars/factories (which was already mentioned in the question) via the burning of fossil fuels.



(e) The amount of carbon dioxide in the Earth's atmosphere has been rising over the past fifty years, mainly caused by an increase in the quantity of fossil fuels that have been burned.

State another cause of increasing amounts of carbon dioxide in the atmosphere.

(1)

Increase in deforestation.

(Total for Question 2 = 7 marks)

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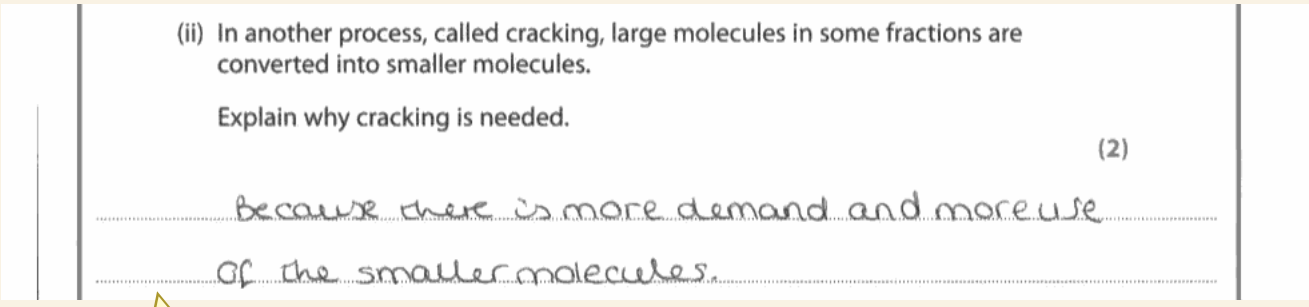
Examiner Comments

The most common answer seen.

Question 3 (a) (ii)

Although the majority of candidates scored 1 mark on this question, less than a third of the candidates could express themselves well enough to score the second mark. Candidates were good at either identifying that long chained hydrocarbons were less useful, or that short chained hydrocarbons were more useful, with some candidates incorrectly stating that long chained hydrocarbons being 'useless'. The second mark was normally gained by the identification of one of the products being petrol, or an alkene, with fewer candidates identifying the need to meet demand for these products.

Confusion with fractional distillation was also common. Candidates should be advised to read the question very carefully, and use any information presented to their advantage.



(ii) In another process, called cracking, large molecules in some fractions are converted into smaller molecules.

Explain why cracking is needed.

(2)

because there is more demand and more use of the smaller molecules.

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Examiner Comments

The candidate has only made comment about there being more demand for the smaller molecules.

ResultsPlus
Examiner Tip

Explain your answers carefully - this answer would have benefited from an explanation that there is less demand for the larger fractions.

Question 3 (c) (ii)

This was one of the poorest scoring questions on the paper. Less than a fifth of the candidates were able to score a mark – usually for giving the formula of the polymer. Few scored both marks.

Where displayed formulae were attempted, often the double bond remained in the polymer structure. It was clear that this aspect was obviously not known or understood.

A common error was missing the 'n' on the left hand side of the equation. A few candidates lost marks for incorrectly omitting continuation bonds.

(ii) Ethene can be converted into poly(ethene).

Write a balanced equation for this reaction.

(2)

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Examiner Comments

A perfect answer showing the formation of the polymer chain from the monomer. Continuation bonds are also shown on either side of the repeating unit.

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Examiner Tip

'n' indicates a large number. This shows that a large number of small molecules join together to form a continuous chain of the small molecules now joined together.

Question 3 (d) (i)

The majority of candidates managed to score at least 1 mark here. Mostly, it was for the second marking point by indicating that the increasing amount of carbon dioxide in the atmosphere was leading to global warming and / or climate change. Many understood that carbon dioxide is a 'greenhouse gas'.

There were still a significant minority of responses linking global warming with the ozone layer, or that the atmosphere trapped UV radiation (from the sun) which was causing global warming.

Question 3 (d) (ii)

Examiners had thought that this would have been a straightforward question for candidates to answer, but about one-third managed only 1 mark (usually for describing an effect of acid rain) and a similar number for stating that sulfur dioxide was responsible for forming acid rain. Far too often candidates referred to sulfur forming acid rain rather than sulfur dioxide, and so failed to score the mark.

Most responses failed to score on either the first or second marking points, since 'sulfur dioxide' was not mentioned explicitly. Many frequently tried to explain acid rain using 'sulfur impurities' or 'sulfur monoxide', showing some confusion with the incomplete combustion of fossil fuels.

(ii) Some hydrocarbon fuels can contain sulfur impurities.

Explain how the product of combustion of these sulfur impurities affects the environment.

(2)

Because the combustion releases carbon dioxide and water which increases the amount of greenhouse gases and contributes to global warming / climate change

(Total for Question 3 = 11 marks)

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Examiner Comments

This candidate has misread the question. They focused on the combustion of the hydrocarbon fuels and forgot about the sulfur impurities.

ResultsPlus
Examiner Tip

Read the question carefully, highlighting what has to be answered.

Question 4 (b) (i)

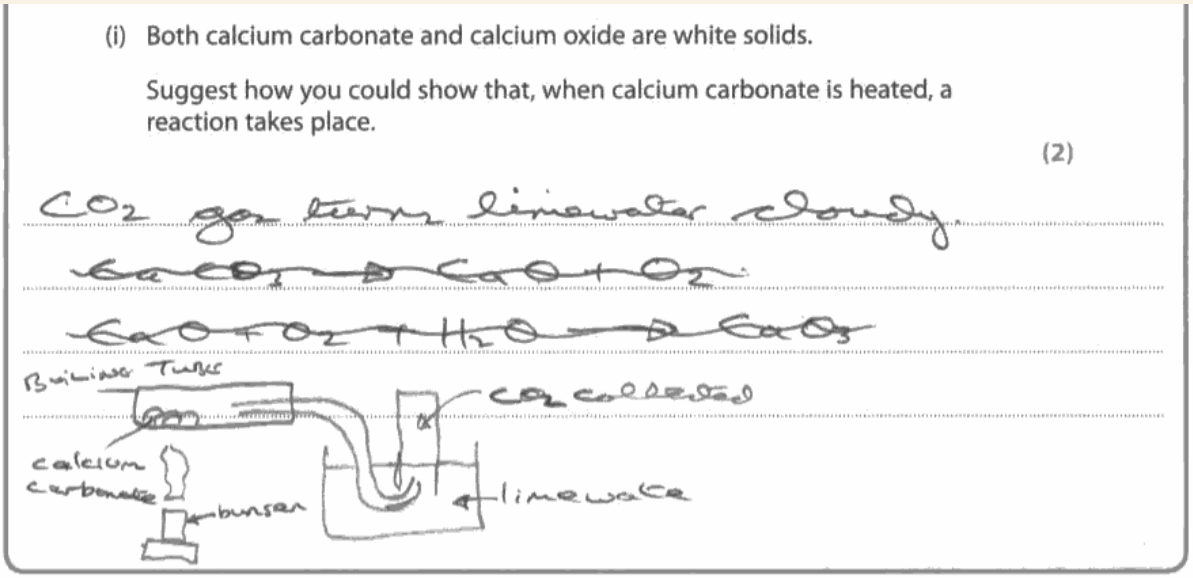
Disappointingly few candidates scored both marks for this question. Very few candidates mentioned change in mass as a method. However, it was clear that the few who did score full marks must have been able to relate this to a practical lesson. Of those that referred to the limewater test for CO_2, many lost a mark by omitting to state how the CO_2 entered the limewater.

Despite knowing the correct result for the test for carbon dioxide, many did not also mention passing the gas into the limewater. A few simply talked about 'water' becoming cloudy. Some candidates talked about the equation for the reaction, or state symbols, as showing that a reaction had occurred.

(i) Both calcium carbonate and calcium oxide are white solids.

Suggest how you could show that, when calcium carbonate is heated, a reaction takes place.

(2)



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Examiner Comments

This candidate clearly demonstrated that the thermal decomposition produced carbon dioxide and how it could be bubbled through the limewater. The collection of the gas is not relevant and does not negate anything from the answer.

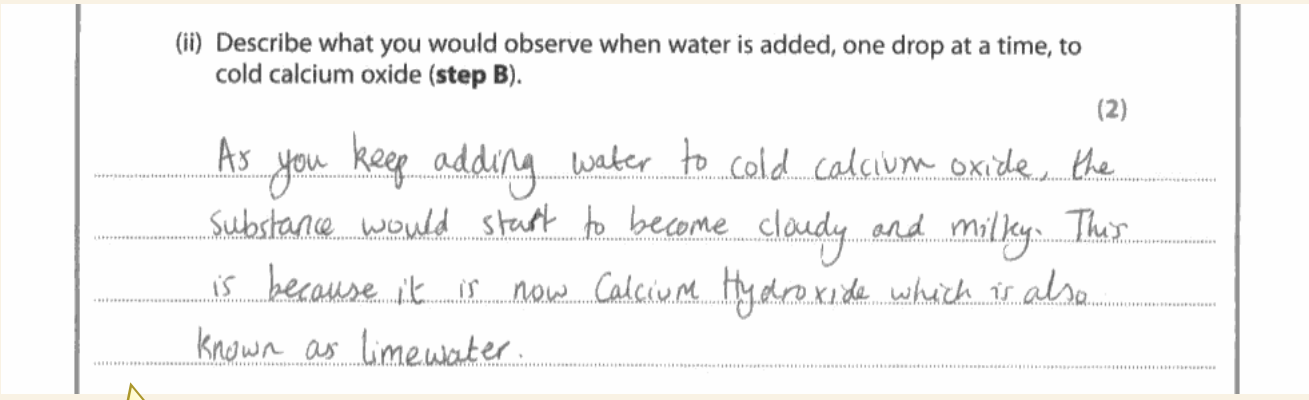
ResultsPlus
Examiner Tip

Sometimes a simple diagram can help illustrate an idea and help to answer the question.

Question 4 (b) (ii)

This was another question that examiners thought to be very straightforward for candidates to answer, however, this proved not to be the case. Only a quarter of the candidates scored a mark. Most candidates were failing to describe an observation. Of those that did, a relatively few were able to go on and give a second correct observation for the second mark. Where correct responses were seen, the main answers given were 'fizzing' and/or 'heating up', although occasionally references to 'steam' or the idea of solid crumbling were seen.

The main error seen was the misunderstanding of the question. Many candidates wrote answers like 'we would observe what the temperature changed by and whether there was a colour change' or discussing changes of state. The majority of incorrect responses appeared to refer to dissolving or forming a solution.



(ii) Describe what you would observe when water is added, one drop at a time, to cold calcium oxide (**step B**).

(2)

As you keep adding water to cold calcium oxide, the substance would start to become cloudy and milky. This is because it is now Calcium Hydroxide which is also known as limewater.

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Examiner Comments

The effect of heat on limestone and the addition of water to the calcium oxide are in the specification. Candidates will be expected to know what happens. This answer was one of many that suggested they had not carried these reactions out.

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Examiner Tip

Observation are what you **see**. In this answer 'cloudy and milky' is the same observation. 'it is now calcium hydroxide which is also known as limewater' is not an observation.

Question 4 (b) (iii)

The majority just scored 1 mark, usually awarded for the correct reactants. Fewer candidates achieved the mark for the correct products.

The most common error here was failure to include H_2O as a product of the reaction. Many candidates lost marks for not representing the formulae correctly – the main mistake being on the carbon dioxide, by either using a lower case O for the oxygen, or not using a subscript '2', or for adding incorrect balancing.

(iii) Write the balanced equation for the reaction of calcium hydroxide with carbon dioxide (**step C**).

(2)

$Ca(oh)_2 + Co^2 \rightarrow CaCO_3$

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Examiner Comments

A lower case 'h' for hydrogen is not accepted.

The superscript '2' on carbon dioxide is also not accepted.

The 'a' in $CaCO_3$ is just about acceptable, but it's the missing product which is obvious by its absence.

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Examiner Tip

Chemical formulae have certain rules concerning how they should be written. Remember them!

Balancing this equation will reveal the missing product of the reaction.

Question 4 (b) (iv)

Just over half the candidates gave the correct answer of limewater. Many lost the mark by including 'slaked lime' as part of their answers, or instead of limewater.

Question 4 (c)

The most common answer that scored both marks was for 'neutralises acidic gases'. Neutralisation on its own scored a single mark.

Many said calcium carbonate was an alkali, but the idea of neutralisation was sufficiently well established in the rest of their responses to score. There might have been some confusion caused amongst some candidates, although not many, by the use of 'why' in the question stem. These candidates gave 'environmental' reasons for why the acidic gases had to be removed, instead of answering the intended question.

(c) Explain why calcium carbonate removes acidic gases from emissions in power station chimneys.

(2)

Because calcium carbonate reacts with acids so when the emissions are paved through the chimney, the acidic gases are removed as they react and get trapped by calcium carbonate

(Total for Question 4 = 10 marks)

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Examiner Comments

This candidate scored 1 mark for the 'calcium carbonate reacts with the acids', but did not explain **why** it behaves in this way.

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Examiner Tip

Carbonates and oxides are **bases**. They react with **acids** to form **salts** and water. This type of reaction is called **neutralisation**.

Question 5 (a) (i)

The hazard associated with chlorine was limited to toxic or poisonous. Other descriptions such as harmful or irritant were not credited.

Question 5 (a) (ii)

The test for chlorine now seems to be well known. Most candidates gave a description involving damp blue litmus and the result 'bleaching / turns white'. Common incorrect responses referred to bromine water, or in a very few cases marks were lost for use of 'red' litmus, 'lithium paper', or giving an incorrect colour change associated with a particular indicator.

(ii) Describe a test that can be used to identify a sample of gas as chlorine.

(2)

put damp blue litmus paper near the mouth of a tube, if the litmus paper turns white chlorine gas is present. it turns white because it's bleached, but it may turn red first as chlorine is acidic

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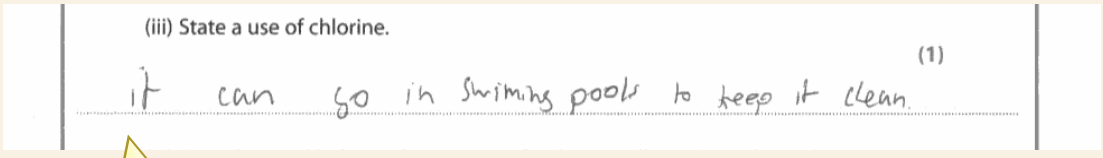
Examiner Comments

The test and result perfectly explained.

Question 5 (a) (iii)

About half the candidates gave one of the correct expected responses in the mark scheme, most commonly 'bleach', or killing bacteria/microbes (in swimming pools)'. References to 'making PVC or making disinfectants' was also credited.

By far the most commonly error seen, was for a response to mention 'cleaning swimming pools' without specific reference to the role of chlorine in killing bacteria. Several responses also simply gave 'PVC' or 'disinfectant' without specific reference to 'in their manufacture/ making' which had to be stated in order for the mark to be awarded.


(iii) State a use of chlorine.

(1)

it can go in shiming pools to keep it clean

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Examiner Comments

Candidates need to be aware of the purpose of chlorine in swimming pools. This answer is typical of the misconception held by many that chlorine 'cleans swimming pools'.

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Examiner Tip

Chlorine is used **to manufacture** PVC. The answer of PVC alone will not score, as a use of chlorine as PVC is incorrect.

Question 5 (a) (iv)

The vast majority of candidates failed to score on this question. Many correctly wrote the left hand side, but were unable to write down the correct products on the right hand side. Gaining 1 mark for this question was very rare, as those students who got the mark for the correct products were also able to balance the equation.

It was quite clear that many candidates did not know that sodium hydroxide was one of the products, many wrote sodium oxide or sodium instead. There were a number of seemingly random products, with carbon dioxide cropping up a number of times, along with water. The main mistake was to forget that chlorine and/or hydrogen are diatomic. Interestingly, quite a high number of candidates remembered that one of them was diatomic, but not the other.

(iv) Complete and balance the equation for the overall reaction taking place when sodium chloride solution is electrolysed.

(2)

..... NaCl + ... H_2O → ..... NaOH + ... Cl + ... H_2

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Examiner Comments

The incorrect formula for chlorine means the second mark for balancing is not accessible.

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Examiner Tip

Gases such as chlorine and hydrogen are **diatomic** and have the formulae Cl_2 and H_2.

Question 5 (b)

Candidates still find analysing data a difficult task. Many were able to make a correct comment about one or more of the trends. It was a different matter when it came to quantifying the trends. The most often correctly used was the constant 2:1 ratio of hydrogen to oxygen that was produced during electrolysis, whilst the least correctly used was the effect that changing the current had on the volume of gases produced. Many candidates simply repeated the data from the table without making a relevant point about the trends. They also often failed to realise that experiment 1 could be compared to both experiments 2 and 3 separately. Many failed to be explicit, with regard to not using comparatives: often stating 'when the time/ current was changed…' or 'when a different time/current…', so often failed to gain credit.

Many were able to quantify the volume trend, often relating this to the ratio of H and O in the formula for water, and identify one other trend qualitatively to score a level 2 answer.

In higher level answers, occasionally, but rarely, the quantitative current volume trend was also described flawlessly by clear reference to the direct proportionality of current and volume, to score a level 3 answer. In terms of the quality of written communication, most candidates were able to express their ideas clearly and use some science. In the main their ideas were well structured and correctly sequenced. Only the least able candidates were unable to articulate their ideas in a clear and structured way.

Use these results of electrolysis to compare the volumes of hydrogen and oxygen formed and to show the effect of changing the time and the current on the volumes of these gases.

(6)

From comparing experiment 2 with experiments 1 and 3, we can clearly see that increasing the time of the electrolysis process means more hydrogen and oxygen is produced. This is because more water is being decomposed, so more of the products are produced. When the time was doubled in exp.2, compared to exp.1, double the amount of hydrogen and oxygen were produced. ($40\ cm^3$ of H_2 and $20\ cm^3$ of O_2 was produced in exp.2).
Increasing the current of the electricity supply also increased the amount of the products produced. Comparing exp.1 and exp.3, we can see that where the current was increased by 50% (from 0.50 amps to 0.75 amps), so was the amount of H_2 ($20\ cm^3$ to $30\ cm^3$) and O_2 ($10\ cm^3$ to $15\ cm^3$) produced.

(Total for Question 5 = 12 marks)

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Examiner Comments

The first part of the answer describes a trend which was then quantified. Further on, another quantified relationship was also identified - this time the effect of current on the volume of gas produced. The candidate used the results to reveal the conclusions, and this answer was worthy of the 6 marks awarded.

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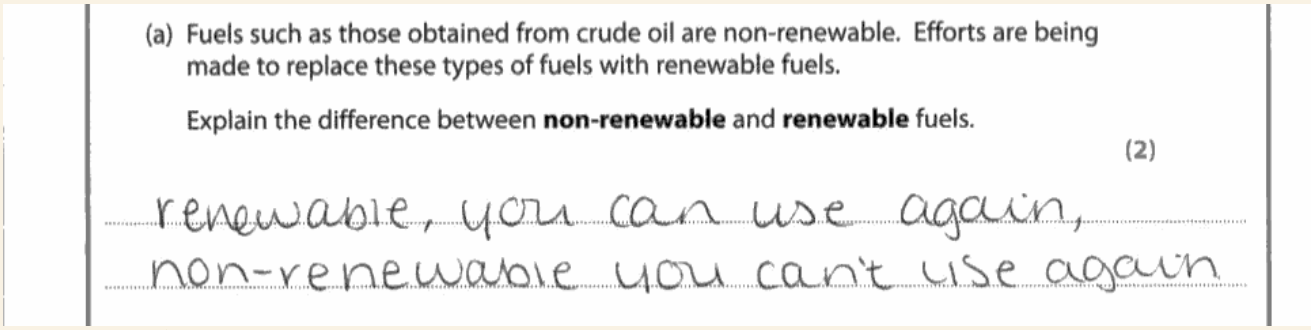
Examiner Tip

Copying the results given in the question does not score. Interpreting the results to see what happens when certain factors are changed does score. The change needs to be described as well as the effect. In this particular case, doubling the time causes the volume of gas formed to be doubled.

Question 6 (a)

The most common incorrect answer here was 'non-renewable fuels can only be used once, but renewable fuels can be used over and over' (or words to that effect). There was also confusion between renewable fuels, e.g. biofuels and renewable energy sources e.g. solar. The majority of responses simply scored 1 mark by reference to the finite supply (of non-renewable fuels)/ idea that they will eventually run out, or scored from a specific example, *viz.* fossil fuels. Very few were able to correctly define a renewable fuel and simply said it was one that will not run out, and so did not score.

The majority of answers seen incorrectly described non-renewable and renewable fuels as 'cannot be used again' or 'can be used again' respectively. It was clear that centres need to stress the correct definitions of renewable / non renewable fuel in terms of being replaceable, or that more can be produced.



(a) Fuels such as those obtained from crude oil are non-renewable. Efforts are being made to replace these types of fuels with renewable fuels.

Explain the difference between **non-renewable** and **renewable** fuels.

(2)

renewable, you can use again,
non-renewable you can't use again

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Examiner Comments

Approximately a third of the candidates produced answers of this type.

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Examiner Tip

Renewable fuels, such as bioethanol, can be produed in a short space of time. Non-renewable fuels take millions of years to form. Solar, wind and tidal are renewable energy sources. They are **not** renewable fuels.

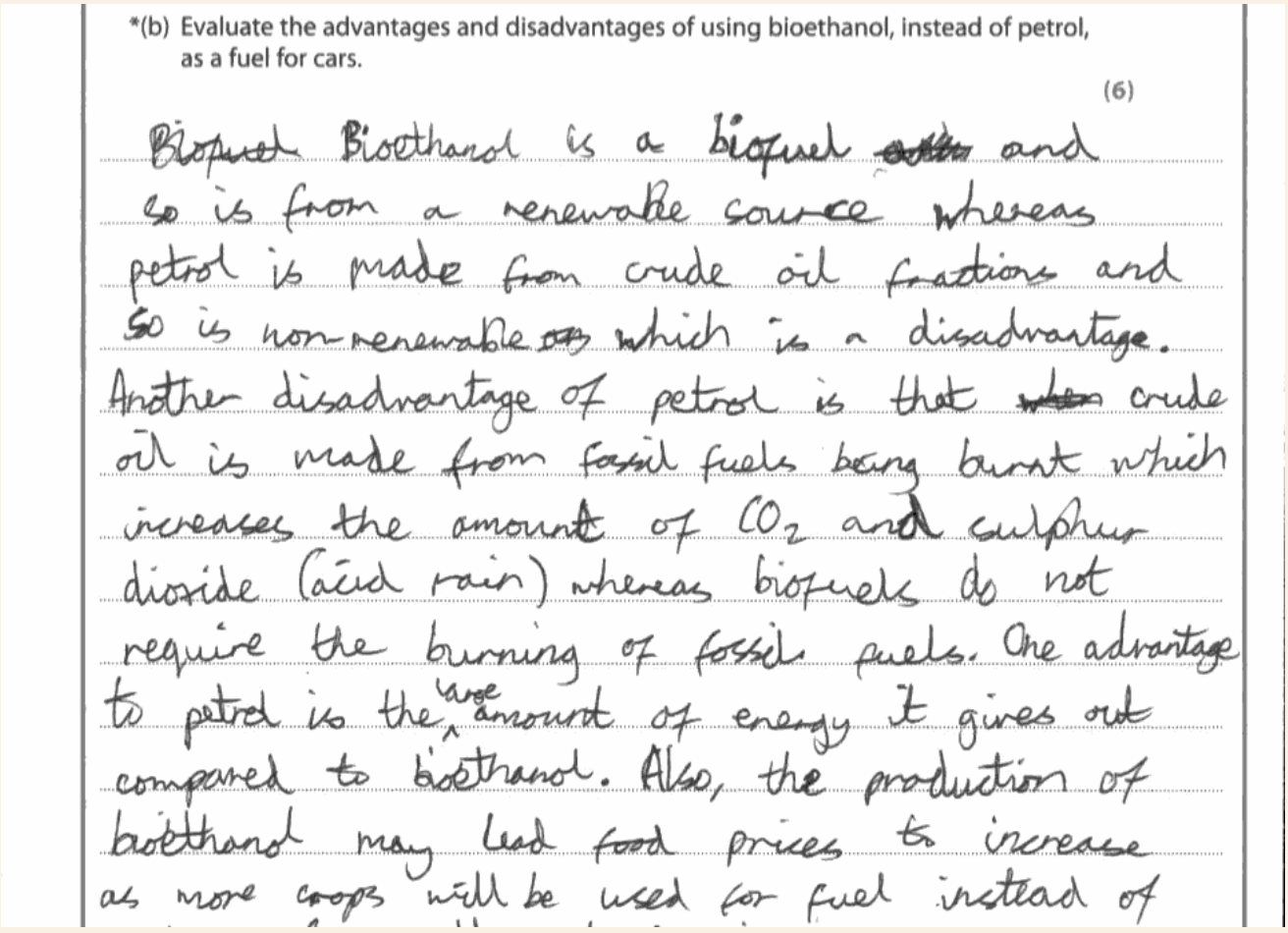
Question 6 (b)

Candidates fared better overall in this question when compared to the other extended writing task in item 5b. In was clear that many candidates confused some advantages or disadvantages of bioethanol with hydrogen. For example, some suggested that bioethanol is a gas and said a disadvantage was that it was 'highly explosive' or 'difficult to store'. Most mentioned bioethanol being 'renewable' (although some said it will "never run out", but did not qualify this by also saying that more plants would have to be planted for this to be true. There was also a misunderstanding regarding the term carbon neutral, with many candidates simply stating that biofuels do not emit carbon dioxide. Another misconception was that biofuels are highly flammable (sometimes more flammable than petrol) represented as a disadvantage.

Many candidates made a vague comment about bioethanol producing 'less pollution' but again, did not qualify this or compare it to petrol. Very few candidates mentioned sulfur dioxide. Many understood the disadvantages well, mainly referring to the idea of more land required / less land available for food crops / the problem of possible decrease in food production / price rises.

However, it was disappointing that some candidates in a few cases failed to include both advantages and disadvantages for bioethanol use, and this restricted otherwise good access to the lower marking levels. More able candidates, often very concisely, gave an advantage and two disadvantages (or vice versa) for bioethanol to easily access level 3.

The examiners found that the quality of written communication was generally very good for this question.



*(b) Evaluate the advantages and disadvantages of using bioethanol, instead of petrol, as a fuel for cars.

(6)

Biofuel Bioethanol is a biofuel ~~also~~ and so is from a renewable source whereas petrol is made from crude oil fractions and so is non-renewable ~~so~~ which is a disadvantage. Another disadvantage of petrol is that ~~when~~ crude oil is made from fossil fuels being burnt which increases the amount of CO_2 and sulphur dioxide (acid rain) whereas biofuels do not require the burning of fossil fuels. One advantage to petrol is the ~~large~~ amount of energy it gives out compared to bioethanol. Also, the production of bioethanol may lead food prices to increase as more crops will be used for fuel instead of

food. So overall, I think bioethanol would be a good alternative to petrol.

ResultsPlus
Examiner Comments

A balanced answer giving advantages and disadvantages of of using bioethanol.

ResultsPlus
Examiner Tip

The answer to this question should focus on bioethanol rather than petrol.

Question 6 (c) (i)

Despite seeing a few flawless responses, most candidates could only give the correct formula of the product, namely water, scoring just one mark. Usually, if marks were gained, it was either one or three marks.

Many candidates remembered the formula for water, and then just put H_2 and O on the reactants side so that they balanced. Many were unable to write the correct formulae of either the oxygen or hydrogen molecules for the reactant mark, often **4H + O_2** was seen. Products of HO_2 were seen quite regularly, as were word equations rather than symbols.

(i) Write the balanced equation for the overall reaction that takes place when the hydrogen reacts with oxygen in the fuel cell.

(3)

$2H_2 + O_2 \rightarrow 2H_2O$ + Energy

ResultsPlus
Examiner Comments

A correctly balanced equation.
This was not seen very often.

ResultsPlus
Examiner Tip

Although the reaction is exothermic, 'energy' is not a product and should not be shown as such in balanced equations.

Question 6 (c) (ii)

Despite seeing a few flawless responses, mainly for correct references to the infrastructure not currently being adequate, in that there are very few hydrogen filling stations, few candidates scored.

A common error was stating that hydrogen had a lower energy content than diesel, so would run out quicker. Others included stating the hydrogen was expensive, or that it would take up a lot of space, as it is a gas. Not surprisingly some thought that the combustion products would be a danger to the environment and equally topical at the time of the examination, some thought that the water produced would cause floods in some parts of the country.

Paper Summary

In order to improve their performance, candidates should:

- Learn to write and balance equations, using correct symbols for the elements and compounds found within the specification.
- Learn to distinguish between atoms and molecules, and not to confuse the two in the situations encountered in the course.
- Learn the meanings of the specific terms used in the course, eg reduction and oxidation.
- Revise the experiments carried out during the course.
- Practice answering the 6-mark questions.

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