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Examiners' Report
June 2015

GCSE Chemistry 5CH1H 01

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Introduction

The amount of space provided for the answers to the two extended writing questions was increased this year. This was designed to reduce the need for extra paper for those candidates who write at length on such questions where the quality of the candidates' written communication is also assessed.

The unit is assessed through a one hour, 60 mark, written examination containing a mixture of question styles, including objective questions, short answer questions and extended writing questions.

As in the past few examinations, there were some excellent answers seen from the more successful candidates. Many candidates are making use of the past papers to revise and are much more proficient at answering the long answer question. Very few blank spaces where written answers should be were seen.

Less successful candidates:

- showed a lack of precision in language e.g. clear instead of colourless, spare bonds instead of double bonds, atoms instead of molecules,
- could not write balanced chemical equations, or wrote word equations instead,
- do not know the difference between an observation and an interpretation as in Q4c(ii),
- do not check their answers to see if they had actually answered the question,
- focused more on rewriting the question (which does not gain credit) rather than answering it.

Question 1 (a)

Many excellent answers were seen but several omitted important details such as' fall to the sea bed' if they just referred to 'dead animals'.

Many candidates appreciated that sedimentary rocks were made from sediments but often candidates did not describe the nature of the sediments.

The idea of layering was well known and typically candidates referred to layers of sediments.

Candidates mostly referred to compaction or the sediment being squeezed or put under pressure but only rarely was there a description that included cementation.

There was some confusion between igneous and metamorphic rocks with some stating 'heat and pressure' to describe the process of forming the rock from the sediment.

Many candidates appreciated the timescale, but for some the vague terms 'over time' or 'over a long time' enabled them to score this point.

Only a small proportion of the candidates referred to the time-scale as 'millions of years'.

Overall, marks were mainly lost through omission rather than factual errors and there were a few examples of igneous or metamorphic rock formation seen by the examiners.

(a) Describe how sedimentary rocks, such as limestone, are formed.

(3)

Limestone is formed from shells of seacreatures which have been crushed between layers underground to form sediments ~~over~~ over hundreds of years.

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Examiner Comments

This answer had just sufficient for 3 marks. 'crushed' was enough for the under pressure mark; 'layers' scored a mark as did 'sediments'. Note 'over hundreds of years' was insufficient for the time mark - ideally 'over millions of years' is a better answer.

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Examiner Tip

Make sure you know how the three rock types are formed.

(a) Describe how sedimentary rocks, such as limestone, are formed.

(3)

formed over millions of years, with dead animal shells that use calcium carbonate in their shells

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Examiner Comments

Only 1 mark here for the use of 'formed over millions of years'.

Question 1 (b)

The majority of the candidates gave the answer 'metamorphic' as the type of rock formed , but several gave the answer as 'marble' which was given in the question probably without realising that the rock type was needed for the answer.

Question 1 (c) (i)

Nearly all the candidates carried out a correct calculation here but there were just a few who added or divided the numbers. Some were obviously unsure how to determine the mass of the gas given off.

mass of calcium carbonate before heating = 3.75 g
mass of calcium oxide remaining after heating = 2.10 g

(i) Calculate the mass of gas that was given off.

(1)

3.75×2.10=7.875

mass of gas given off = 7.875 g

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Examiner Comments

An incorrect calculation of the mass, but it can be seen how the answer was achieved.

mass of calcium carbonate before heating = 3.75 g
mass of calcium oxide remaining after heating = 2.10 g

(i) Calculate the mass of gas that was given off.

(1)

3.75 - 2.10 = 1.65

mass of gas given off = 1.65 g

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Examiner Comments

A typical answer shown by the majority of candidates.

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Examiner Tip

Always show the calculation as here: 3.75 - 2.10.

Question 1 (d)

Many candidates obtained both marks here with the most frequent answer of 'they neutralise acidic soils'. The best answers referred to the compounds being bases so that they neutralised acid soils.

Several candidates obtained the mark for realising the need for the compounds because the soils were acidic but used the less specific term 'treat' and consequently scored only the one mark. A few candidates gave such answers as 'act as a fertiliser', 'help plants to grow', 'for the healthy growth of plants' and did not score. A small number thought one of the compounds was an acid and the other was a base.

(d) Calcium carbonate and calcium hydroxide are both used by farmers to treat some soils.

Explain why calcium carbonate and calcium hydroxide are used in this way.

(2)

Because they both act as fertilizers for the farmers crops and they offer nutrients.

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Examiner Comments

The two calcium compounds neither act as fertilizers nor 'offer nutrients' that are essential for plant growth. A sizeable number of candidates gave a similar answer, but failed to score.

(d) Calcium carbonate and calcium hydroxide are both used by farmers to treat some soils.

Explain why calcium carbonate and calcium hydroxide are used in this way.

(2)

Calcium carbonate and calcium hyaroxide would be used to treat soils that are acidic.

(Total for Question 1 = 8 marks)

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Examiner Comments

A mark was given for 'soils that are acidic', but 'treat' was seen as a poor alternative to 'neutralise' or 'react with' and so this answer did not score that mark.

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Examiner Tip

Try to use technical language in your answers.

Question 2 (a) (i)

Many candidates only scored one mark as they just explained the meaning of 'unsaturated' and did not include the meaning of hydrocarbon in their answer.

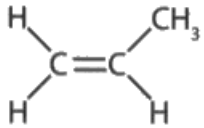
As a result the typical answer only stated it was a compound or a molecule with a double bond.

Although some candidates attempted to explain 'unsaturated' in terms of the presence of a double bond, this mark was not awarded where it was stated that a double bond existed between carbon and hydrogen or between 'carbon molecules'.

Many candidates also wrote about the reaction between bromine water and an unsaturated compound, but that could not score here. Some mentioned 'spare bonds' instead of double bonds so did not score the mark. Examiners reported seeing fewer 'mixtures' or 'molecules' of hydrogen and carbon this year.

Propene

2 The structure of a molecule of propene is



(a) Propene is an unsaturated hydrocarbon.

(i) Explain what is meant by **unsaturated hydrocarbon**.

(3)

An unsaturated hydrocarbon is a molecule made only of hydrogen and carbon and has a double bond.

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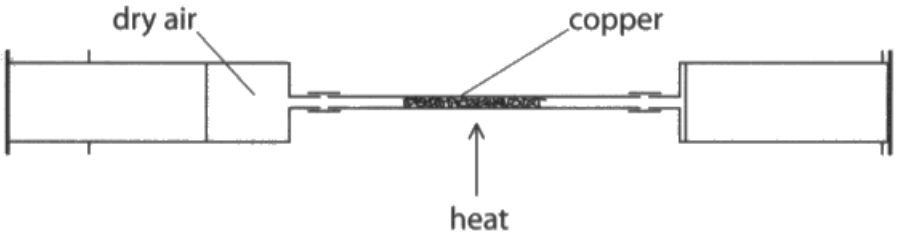
Examiner Comments

An excellent answer and one that was not seen that often. Many candidates did not explain both words in the term 'unsaturated hydrocarbon'; most focussed their answers on 'unsaturated'.

(b) In an experiment, dry air is passed backwards and forwards over hot, excess copper in the apparatus shown.

The oxygen in the air reacts with the hot copper to form copper oxide, CuO.



(i) Write the balanced equation for the reaction of copper with oxygen.

(3)

$2Cu + O_2 \rightarrow 2CuO$

Cu x 2 ✓ Cu x 2 ✓

O x 2 ✓ O x 2 ✓

ResultsPlus
Examiner Comments

Like the majority of the candidates, this answer just focussed on 'unsaturated' and forgot about the 'hydrocarbon' part.

ResultsPlus
Examiner Tip

Avoid using the term 'spare' as in 'spare bond' or as here, 'spare atoms', as it will not gain credit. In this type of question, make sure you answer all that is asked.

Question 2 (a) (iii)

There were a variety of colours for bromine water and most who described a colour opted for orange.

Several candidates did not include the initial colour of bromine within their answer.

The perennial problem of the term 'clear' to describe a colourless liquid still persists, but not as frequently as in the past. Those who were unsure gave the non-scoring answer of 'the bromine water changes colour'.

Only an extremely small number of candidates muddled the test and either reversed it going from colourless to orange or stated it stayed orange and some made reference to the mixture fizzing and bubbling and going cloudy. Despite all this, many candidates scored both marks.

(iii) Describe what is seen when a sample of propene is shaken with bromine water.

(2)

Bromine water it self has an orange colour, when propene which is an alkene is shaked with bromine water, it turns the bromine water transparent.

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Examiner Comments

The colour of bromine water here scored a mark, but the change to 'transparent' was ignored, so scored only the one mark.

(iii) Describe what is seen when a sample of propene is shaken with bromine water.

(2)

The bromine water decolourises (turns from a brown-yellow colour to clear) as propene is an alkene, so it has a double-covalent bond meaning that bromine atoms can bond with it, forming a new compound ~~with~~ which is clear, leaving water after on which it is clear.

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Examiner Comments

The candidates gave an acceptable colour for bromine water, but then described the change in colour as 'decolourised' which was acceptable. Note the use of 'clear' was ignored.

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Examiner Tip

Solutions could be colourless, pink, blue or even yellow, and they would all be 'clear' - that is, you can see through them. A solution or liquid that has no colour is described as being 'colourless' - 'clear' is not acceptable as a description here.

Question 2 (b) (ii)

A wide range of properties were possible here given the material and the situation. The most popular was non-biodegradable, tough and strong. The most common misconceptions involved referring to strong bonds rather than the bulk property of strong, referring to the polymer as malleable or ductile, and describing the polymer as stretchy rather than flexible.

State a property of poly(propene) that makes it suitable for use as ropes on boats.

(1)

It is joined by strong bonds.

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Examiner Comments

Only properties of the poly(propene) were credited. 'Strong bonds' is not a property of poly(propene).

State a property of poly(propene) that makes it suitable for use as ropes on boats.

(1)

It's strong

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Examiner Comments

Strength was a valid property

ResultsPlus
Examiner Tip

In a question of this type, think about how the article is being used. So in this case, think about suitable properties of ropes where they will be wet at times.

Question 2 (b) (iii)

Many candidates scored here with the idea of poly(propene) not being biodegradable. Other answers in terms of the poly(propene) not decomposing or taking a long time to decompose were also acceptable. Some candidates turned the question around by answering in terms of the polymer being burnt or polluting the environment by harming wildlife – these did not score the mark. The most common misconception was the idea of formation of toxic gases. A very small proportion of the candidates did not understand the meaning of biodegradable and thought it meant that a polymer would not rot.

(iii) State a problem caused by the disposal of poly(propene) ropes in landfill sites.

(1)

Gases given off from burning them are harmful to the environment.

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Examiner Comments

Unfortunately this candidate did not answer the question. This question was about disposal in a landfill site - not about burning polymers.

ResultsPlus
Examiner Tip

Read the question carefully.

(iii) State a problem caused by the disposal of poly(propene) ropes in landfill sites.

(1)

A problem caused by the disposal of poly(propene) in land fill sites is that if left in a land fill site for a long time, ether waste gases might start to form

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Examiner Comments

This candidate wasted much space and time rewriting the question which gained no credit. The candidate ran out of room and tried to cram the answer in a tiny space.

ResultsPlus
Examiner Tip

There is no point in rewriting the question - it gains no credit and uses up your time during the examination.

Question 3 (a) (i)

The most frequent answer seen was 'water vapour condensed' with many qualifying that by adding 'to form oceans'. A few thought that carbon dioxide condensed as well or instead of the water vapour. Several candidates added to an already correct answer that carbon dioxide dissolved in the oceans; a few candidates had the carbon dioxide condensing to give oceans.

(i) State how cooling changed the composition of the Earth's atmosphere.

(1)

CO_2 and oxygen cooled and formed seas

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Examiner Comments

This candidate was not alone in thinking that carbon dioxide condensed to form the oceans.

(i) State how cooling changed the composition of the Earth's atmosphere.

(1)

water vapour condensed to form oceans.
decreasing the amount of water vapour.

ResultsPlus
Examiner Comments

An almost text-book answer.

ResultsPlus
Examiner Tip

Make sure you learn the stages the changes taking place in the evolution of the atmosphere.

Question 3 (a) (ii)

Most candidates scored both marks by indicating that the level of carbon dioxide decreased and the level of oxygen increased as a result of photosynthesis.Several just mentioned what happened to the level of one gas; some just stated that carbon dioxide changed into oxygen (without explaining what happened to their amounts in the atmosphere).For these two possibilities, only one mark was awarded. A small number of candidates got the two gases the wrong way round and a few involved nitrogen in this process.The best answers gave a simple summary at the end of their answer, 'so oxygen levels rose and carbon dioxide levels fell'.

(ii) Explain how photosynthesis changed the composition of the Earth's atmosphere.

(2)

plants absorb carbon dioxide ~~in~~ through photosynthesis and release oxygen, so the oxygen increased and the carbon dioxide decreased.

ResultsPlus
Examiner Comments

A good clear answer explaining the changes that took place in the composition of the atmosphere as a result of photosynthesis.

(ii) Explain how photosynthesis changed the composition of the Earth's atmosphere.

(2)

Because there are more plants today then in the early atmosphere so more carbon dioxide is being taken in and changed to oxygen in the atmosphere.

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Examiner Comments

The candidate explained what happened during photosynthesis, but did not explain how it changed the composition of the atmosphere.

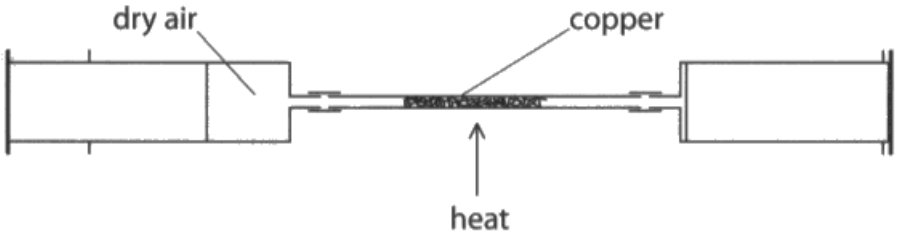
ResultsPlus
Examiner Tip

Pick out the key words in the question and make sure your answer fits the question.

Question 3 (b) (i)

Many correct answers were seen. It was disappointing to see some give an incorrect formula for copper oxide when it is given in the question. There were still quite a few who used O for the formula of oxygen gas. A small number wrote inaccurate formulae such as CUO or Cuo. Candidates should be advised to take more care when writing formulae as they will be penalised for such carelessness. As in previous years, a few candidates wrote a word equation and this will not score in such a question even if completely correct. It is expected that even on this paper, candidates should be able to write and balance equations using correct formulae of substances used in the specification. Candidates would be well advised to practice this skill.

The oxygen in the air reacts with the hot copper to form copper oxide, CuO.



(i) Write the balanced equation for the reaction of copper with oxygen.

(3)

$2Cu + O_2 \rightarrow 2CuO$

Cu x 2 ✓ Cu x 2 ✓

O x 2 ✓ O x 2 ✓

ResultsPlus
Examiner Comments

A nicely balanced equation. It was good to see that this candidate had checked to see all atoms were balanced judging by the working beneath the answer.

ResultsPlus
Examiner Tip

Make sure you use correct formulae in balanced equations. Some formulae may be given to you as in this question.

(i) Write the balanced equation for the reaction of copper with oxygen.

(3)

Cu + O → CuO

Copper + Oxygen = Copper oxide

ResultsPlus
Examiner Comments

This equation was only awarded one mark for the copper oxide being in the correct position. The = sign is an allowed alternative to '→'.

ResultsPlus
Examiner Tip

Remember that most gases have two atom in their formulae eg O_2, Cl_2.

If a balanced equation is asked for in the question, writing a word equation will gain no credit.

Practice writing and balancing equations for a variety of reactions.

Question 3 (b) (ii)

Many candidates obtained the correct answer of 39.5 cm usually by finding 21% of 50 and then taking that away from the 50 cm to give the final answer. For the more astute candidates, they just worked out 79% of 50 cm to obtain the final answer. Some scored just the one mark for carrying out a simple step by working out 21% of 50 cm. There were those with incorrect answers which showed they did not know how to use the percentage as they wrote 21 x 100 /50 = 42 cm. Some candidates over-complicated the simple maths involved. Some responses stopped at the 10.5 rather than subtracting this number from the 50 cm of air.

The initial volume of dry air in the apparatus was 50 cm^3, measured at room temperature and pressure.
During the experiment the volume of gas in the apparatus decreased.

Calculate the final volume of gas remaining in the apparatus after allowing it to cool to room temperature.
(percentage of oxygen in dry air is 21%)

(2)

50 cm^3

$\frac{50}{100} \times 21$

50 - Ans.

final volume of gas remaining in apparatus = 39.5 cm^3

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Examiner Comments

This was spot-on for the working and clear in the process.

The initial volume of dry air in the apparatus was 50 cm^3, measured at room temperature and pressure.
During the experiment the volume of gas in the apparatus decreased.

Calculate the final volume of gas remaining in the apparatus after allowing it to cool to room temperature.
(percentage of oxygen in dry air is 21%)

(2)

50 x 0·21 = 10·5

final volume of gas remaining in apparatus = 10·5 cm^3

ResultsPlus
Examiner Comments

An answer seen from many candidates. Just calculating the percentage of oxygen in the original sample of air scored one mark.

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Examiner Tip

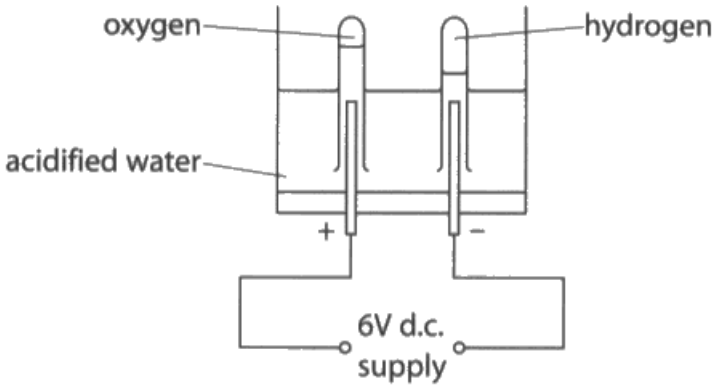
Always show the method calculation. It may take a few seconds more to write it down, but marks are awarded for the method of calculation even if the final answer is incorrect.

Question 4 (a) (i)

Most candidates scored the mark with 'electricity' (or a variation such as 'electrical'). There were a few giving 'thermal', 'chemical', 'kinetic' as energy sources which did not score, as did those who copied '6V d.c. supply' from the diagram.

Electrolysis and acids

4 (a) Water, acidified with a small amount of dilute sulfuric acid, can be decomposed by electrolysis using the apparatus shown.



squeaky

(i) State the form of energy used to carry out the electrolysis.

(1)

Thermal energy.

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Examiner Comments

Most candidates gave a correct answer, but some had an incorrect form of energy as their answer.

(i) State the form of energy used to carry out the electrolysis.

(1)

~~electricity~~ ~~electrical~~ electrical

ResultsPlus
Examiner Comments

Eventually this candidate decided on a final answer. There was a big clue in the diagram that several either chose not to use or did not understand its significance.

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Examiner Tip

Make sure you know the process of electrolysing a solution.

Question 4 (a) (ii)

This gas test is known by all candidates but there are still some who fail to score for a variety of reasons. Some omitted to state a **lighted** splint or incorrectly tested with a glowing splint. A few just stated 'the squeaky pop test' and did not describe how to carry out the test so did not score any marks. On this specification, candidates need to identify the correct test first and then state the result of that test in order to obtain the marks.

(ii) During the electrolysis, hydrogen is formed at one of the electrodes.

Describe a test to show that this gas is hydrogen.

(2)

put get a test tube that has hydrogen in it and get a lit splint then put the lit splint into the test tube and it should ~~put~~ make a 'squeeky pop' noise.

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Examiner Comments

For many candidates this was a straightforward question. Describing a test will always involve the correct test itself and the positive result.

(ii) During the electrolysis, hydrogen is formed at one of the electrodes.

Describe a test to show that this gas is hydrogen.

(2)

When testing to see if a gas is hydrogen. You will have to add a current to the electrolyte which which cause it to decompose. If you hear a squeaky pop ~~that~~ it means your test for hydrogen gas was successful.

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Examiner Comments

The correct test has to be given before a mark is awarded for the positive result.

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Examiner Tip

Make sure you know the tests for the gases hydrogen, oxygen and chlorine.

Question 4 (b)

Many candidates gave the raw material as 'salt', 'rock salt', 'salt solution', 'sodium chloride', 'sea water' or sodium chloride solution'. Many candidates gave the answer 'hydrochloric acid', which would be fine, but the question asked 'Name a raw material .....' and hydrochloric acid is not a raw material. There were several odd answers such as named elements.

Question 4 (c) (ii)

This question was generally poorly answered. The majority scored a mark for some mention of fizzing/bubbles etc. but responses mentioning the solid disappearing were rare. A few mentioned there would be a colour change but did not state the colour. Some thought it would change from green to black – possibly thinking about heating copper carbonate to form copper oxide. Only a minority of candidates scored two marks and finding an answer containing the correct colour of the final solution was indeed a rarity. Many candidates thought they could name the substances formed as their answer e.g. 'Carbon dioxide would be formed'.

Describe what you would **see** when copper carbonate powder is added to dilute sulfuric acid.

(2)

Bubbles and the copper carbonate would dissolve (disappear).

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Examiner Comments

Marks were obtained for bubbles (1) and the copper carbonate disappearing (1). The majority just made comment about bubbles or fizzes.

(ii) Acids can also be neutralised by metal carbonates.

Dilute sulfuric acid is neutralised by copper carbonate as shown in the word equation.

copper carbonate + sulfuric acid → copper sulfate + carbon dioxide + water

Copper carbonate is a green powder.

Describe what you would **see** when copper carbonate powder is added to dilute sulfuric acid.

(2)

It would turn from green to blue and it would also fizz

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Examiner Comments

Marks were given for the correct colour seen - blue (1) and for fizz (1). Only a very small number wrote that a 'blue solution' forms.

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Examiner Tip

Questions like this ask for observations that are made. Look at the information that is given in a question. Giving the names of substances that are formed (eg carbon dioxide) will not gain credit.

Question 4 (d) (iii)

There were many poor answers here. In (i) many candidates answered the question in terms of rate or time rather than the amount of acid neutralised. Some did not make a comparison and just stated C neutralised 50 cm of acid and did not compare it with the amount neutralised by A and B. For this they scored just the one mark. Many candidates repeated the question in (ii) and just stated that crushed would be faster, rather than referring to the times given in the table. Many answers confused rate and time and were stating 'faster times' which did not score. Some attempted an explanation in terms of increased surface area and collisions, rather than using the information in the table.

(i) Explain, using information from the table, which of the tablets contains the most of the active ingredient to overcome indigestion.

(2)

Tablet C crushed contained the most active ingredient to overcome indigestion as it only takes 44 seconds to react and neutralises 50.0 cm^3 of the acid.

(ii) Explain, using information from the table, whether faster relief of indigestion is achieved by using a given tablet whole or crushed.

(1)

The faster relief of indigestion is achieved by using a crushed tablet as there takes a shorter amount of time to react.

(Total for Question 4 = 10 marks)

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Examiner Comments

Part (i) : One mark given for tablet C, but just stating the information from the table as here did not merit the second mark. There had to be a comparison with the other tablets.

Part (ii) : The mark was given for the 'shorter amount of time' for the crushed tablet.

(i) Explain, using information from the table, which of the tablets contains the most of the active ingredient to overcome indigestion.

(2)

Tablet C because it neutralised the greatest volume of acid, (50.0 cm^3) rather than 25.0 cm³.

(ii) Explain, using information from the table, whether faster relief of indigestion is achieved by using a given tablet whole or crushed.

(1)

Faster relief is achieved through a crushed tablet. It took C 120s whole, but 44s crushed, B 59s whole, and 19 crushed.

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Part (i) : Both marks awarded for a correct answer.

Part (ii) : The mark was given for use of crushed tablets backed up by the comparison of the times for the crushed and whole tablets.

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Examiner Tip

When making comparisons use the data to back up your answer. Time can be shorter or longer, but time cannot be faster or slower.

Question 5 (a)

There were many responses that were worthy of credit but some common incorrect answers included: 'burns for longer', 'cheaper to buy'. Some knew the factors to consider but did not state how that factor makes a good fuel eg 'ease of ignition' instead of 'easy to ignite'. Some candidates referred to the fuel lasting a long time but without a use this is not necessarily a feature of a good fuel.

Fuels and crude oil

5 (a) Some fuels are better fuels than others.

State one factor that makes a good fuel.

(1)

Useable energy produce ~~cheap~~

Produces large amounts of usefull energy without wast

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Examiner Comments

A good choice of factor for a good fuel. Note : 'cheap' was crossed out. Any reference to cost is ignored unless it is backed up in a suitable way.

Fuels and crude oil

5 (a) Some fuels are better fuels than others.

State one factor that makes a good fuel.

(1)

Ease of ignition - the fuel must be easy to ignite.

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Examiner Comments

Ease of ignition alone did not score. This candidates had qualified their answer by indicating that the fuel must be easy to ignite.

Question 5 (b) (i)

Good answers had to include an advantage with a linked explanation. Many candidates just listed several advantages and did not explain them so only scored 1 mark. Bioethanol is renewable because more sugar beet can be grown' was the most common 2 mark answer. Many candidates made the observation that bioethanol is (nearly) 'carbon neutral', but several thought that petrol produced carbon dioxide on burning, but bioethanol did not. Some candidates referred to fuels being able to be used again rather than they can be renewed.

(b) Bioethanol is a fuel that can be obtained from the plant, sugar beet.

(i) Bioethanol and petrol can both be used as fuels.

Explain one advantage of using bioethanol produced from sugar beet, rather than petrol produced from crude oil.

(2)

Bioethanol is carbon neutral, as the CO_2 released from burning is counteracted by the CO_2 absorbed by photosynthesis when the plant was growing. Petrol releases lots of CO_2, in comparison.

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Examiner Comments

A good answer explaining the advantage of using bioethanol in terms of it being 'carbon neutral' and comparing that aspect with petrol. Two marks awarded.

(b) Bioethanol is a fuel that can be obtained from the plant, sugar beet.

(i) Bioethanol and petrol can both be used as fuels.

Explain one advantage of using bioethanol produced from sugar beet, rather than petrol produced from crude oil.

(2)

a ~~biofue~~ Bioethanol is ecofriendly which Petrol from crude oil is not.

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Examiner Comments

Vague terms such as 'eco-friendly', 'environmentally friendly' are ignored.

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Examiner Tip

Terms such as 'ecofriendly' need to be explained to gain credit.

Question 5(b) (ii)

Many correct answers were seen but some candidates wrote just O for oxygen in the balanced equation. Many candidates had the correct formulae for the reactants and products and either did not attempt to balance the equation or just balanced the products side and could not work out how to balance for oxygen, O_2, on the reactants side.

(ii) The main component of bioethanol is ethanol.

When burnt completely, ethanol, C_2H_5OH, reacts with oxygen to produce carbon dioxide and water.

Write the balanced equation for this reaction.

(3)

$2C_2H_5OH + 6O_2 \rightarrow 4CO_2 + 6H_2O$

$2C_2H_5OH + O_2 \rightarrow 2CO_2 + 3H_2O$

$2C_2H_5OH + 6O_2 \rightarrow 4CO_2 + 6H_2O$

ResultsPlus

Examiner Comments

Three marks awarded for correct reactants (1), correct products (1) and correct balancing(1). Multiples are always acceptable. Out of the three possible equations, the one on the answer line is the one that is marked.

(ii) The main component of bioethanol is ethanol.

When burnt completely, ethanol, C_2H_5OH, reacts with oxygen to produce carbon dioxide and water.

Write the balanced equation for this reaction.

(3)

$C_2H_5OH \rightarrow Co^2 + H_2O$

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Examiner Comments

The mark for products was not given here owing to the incorrect formula for carbon dioxide - Co^2, and for water, H_2O. Candidates do need to use correct formulae with subscripted numbers and correct upper case / lower case letters.

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Examiner Tip

Practice writing formulae and balanced eqautions for the reactions met in the course.

Question 5 (c)

This was a fairly straightforward 6 mark question for many candidates. Although the question asked for an explanation, it turned out to be a description of properties and uses. A significant number of candidates scored 6 marks through giving very comprehensive answers.

Unfortunately many dropped to 4 as they just mentioned that petrol is used in cars, rather than as a fuel for cars. The uses of bitumen were well known although some candidates did refer to bitumen as a fuel for aeroplanes. Weaker answers often included contradictions for example getting the trend in boiling or melting point down the column the wrong way round. Some candidates thought that the higher up the fractionating column the higher the boiling point. Candidates often compared the boiling points and ease of ignition of petrol and bitumen. Weaker candidates referred just to a temperature without stating its significance e.g. 'bitumen is heated to 360'C and petrol to 40C'.

The concept of viscosity was poorly understood with many candidates referring to 'petrol has a higher viscosity this means it is runny'. Candidates that avoided the term viscous and used 'thick' and 'thin' did not have this misconception. There were also many mentions of bitumen being 'gloopy' to avoid using the term viscosity.

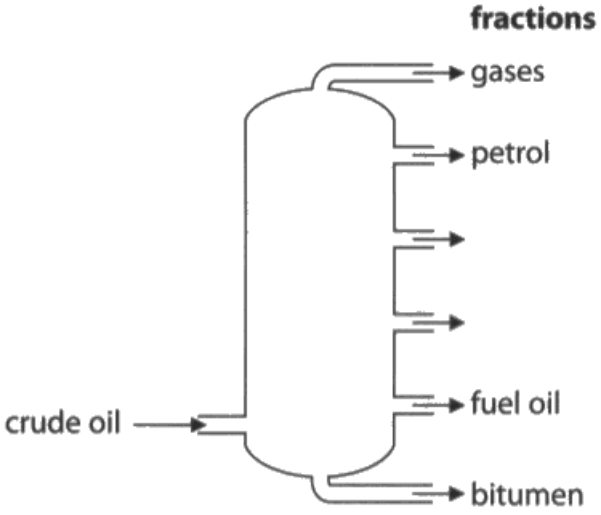
Some candidates who wrote about the hydrocarbon chains got in a bit of a muddle, e.g. petrol contains fewer hydrocarbon chains', 'petrol has shorter chains of molecules'. Some candidates included information and explanation about cracking.

Few answers were written well enough to clearly link the properties with the uses. However, marks of 0, 2, 4 and 6 were seen so there was some discrimination.

To avoid candidates using extra paper, this year we provided an extra page for the answers of each of the two 6-mark questions. Candidates need to be aware that their answer is not expected to fill all the lined space.

*(c) Useful products can be obtained by the fractional distillation of crude oil.

The diagram shows a fractional distillation column and the fractions obtained.



The petrol fraction is obtained from near the top of the column.
The bitumen fraction is obtained from the bottom of the column.

Explain how the petrol and bitumen fractions differ in their properties and uses.

(6)

The major property for fractional distillation is boiling point as those with a low boiling point (bitumen) go to the bottom and those at the ~~top~~ top have a high boiling point (Petrol).
Petrol is used as a fuel for vehicles and is very efficient.

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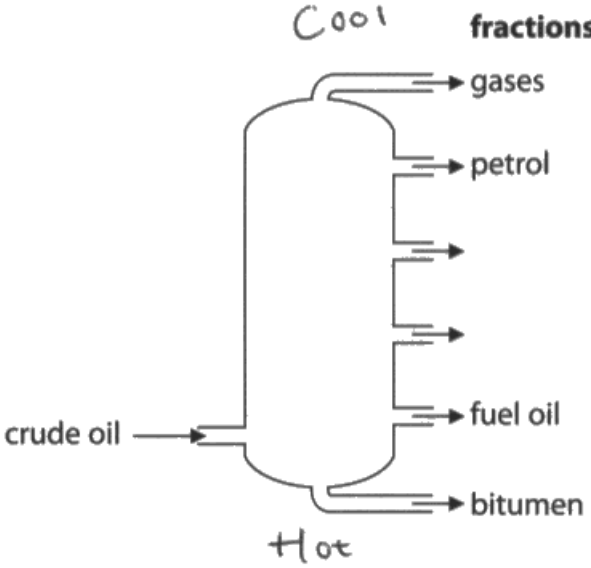
Examiner Comments

The only part of this answer worthy of credit is the last line about petrol being used as fuel for cars. This made the answer to be level 1, scoring 2 marks.

*(c) Useful products can be obtained by the fractional distillation of crude oil.

The diagram shows a fractional distillation column and the fractions obtained.



lower boiling point
smaller hydrocarbon chain
viscous.
Burns easily (more reactive)

higher boiling point
longer hydrocarbon chain
Thicker (more viscous)

The petrol fraction is obtained from near the top of the column.
The bitumen fraction is obtained from the bottom of the column.

Explain how the petrol and bitumen fractions differ in their properties and uses.

(6)

Petrol and bitumen have many different properties. firstly, Bitumen has a higher boiling point than petrol so that means it needs to have a higher temperature to be obtained. Bitumen also has a longer hydrocarbon chain molecule ~~so~~ which are in more demand. Bitumen is very viscous (thick) ~~and~~ which allows it to be suitable to use on roads cars drive on. Bitumen is very good to be used for roads as its very thick, hard when cooled down, and ~~so~~ so it can catch fire as easy.

Petrol, on the other hand, is used for fuel for cars. This is because it sets on fire a lot easier and quicker than bitumen meaning it has a lower boiling point and is a suitable fuel. Petrol is also very runny and not as thick as bitumen. Finally, petrol has smaller hydrocarbon chains so are more useful.

ResultsPlus
Examiner Comments

A very good level 3 answer detailing the differences of several properties of bitumen and petrol as well giving a use of both fractions. Although not a perfect answer, it is still level 3, scoring 6 marks.

ResultsPlus
Examiner Tip

Practice the 6 markers using the questions from the past papers. Performance on these questions has improved since they were introduced.

Question 6 (a)

Many correct answers were seen, but for some it was difficult to decide if they actually knew what was happening due to poor expression e.g. oxygen removed from a metal – did they mean from a metal oxide? Several candidates did answer this in terms of electrons being added which was chemically correct. Some candidates made an attempt at rewriting the question with such answers as 'Reduction is the extraction of a metal from the oxide'.

Metals

6 The list shows some metals in order of reactivity.

most reactive	sodium
	aluminium
	zinc
	iron
	copper
least reactive	gold

(a) Aluminium and iron are extracted by reduction of their oxides.

State what is meant by reduction.

(1)

Reduction means that the oxygen is lost and a ~~loss~~ gain of electrons.

ResultsPlus
Examiner Comments

Almost a text book answer. Redox in terms of loss and gain of electrons is not in the specification for C1, but is still credited if given as an answer.

6 The list shows some metals in order of reactivity.

most reactive	sodium
	aluminium
	zinc
	iron
	copper
least reactive	gold

(a) Aluminium and iron are extracted by reduction of their oxides.

State what is meant by reduction.

(1)

Reduction is when oxygen is taken out of a metal to form something else.

ResultsPlus
Examiner Comments

Loss of oxygen from a metal is not correct. Fewer candidates this time gave the common meaning of reduction (eg to make something smaller).

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Examiner Tip

Learn the meaning of the chemistry terms used throughout the course.

Question 6 (b)

Many candidates found this question quite challenging with just a few candidates scoring 2 marks. There were many 1 mark answers in terms of different reactivities but many candidates did not know what to write to get the second mark. They knew that aluminium is more reactive than carbon, but few explained that more energy was needed for the extraction which meant that electrolysis was needed.

(b) Electrolysis and heating with carbon are two methods of reduction.

Explain why aluminium needs to be extracted from its ore by electrolysis, rather than by heating with carbon.

(2)

Aluminium is more reactive than carbon, and forms more stable bonds with its compounds, so carbon cannot displace it from its compound. Electrolysis is a more powerful method of reduction, and is required for metals high up in the reactivity series.

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Examiner Comments

A really good answer - but not seen that often in this examination - detailing why aluminium cannot be extracted using carbon and then going on to say why electrolysis is needed.

(b) Electrolysis and heating with carbon are two methods of reduction.

Explain why aluminium needs to be extracted from its ore by electrolysis, rather than by heating with carbon.

(2)

Aluminium needes to be extracted with electrolyses rather than carbon as it is more reactive than carbon.

ResultsPlus
Examiner Comments

Another example of where rewriting the question does not help the answer. The only creditworthy part is 'as it is more reactive than carbon', so scored just the 1 mark.

ResultsPlus
Examiner Tip

Rewriting the question does not improve the answer.

Question 6 (c)

This was the most difficult equation on the paper but many candidates scored all 3 marks.

Many scored 2 marks for all the correct formulae but could not balance the equation correctly. Many had the incorrect formula for iron – Fe_2, which then only allowed them to score one mark for the correct reactants.

(c) Iron is extracted from iron oxide, Fe_2O_3.

In the extraction process the iron oxide is heated with carbon to form iron and carbon dioxide.

Write the balanced equation for this reaction.

(3)

$4Fe_2O_3 + 3C_2 \rightarrow 8Fe + 6CO_2$

ResultsPlus
Examiner Comments

A tricky balanced equation placed here on the last question. Many tried to balance it by using 'C_2' on the reactants side. Only 1 mark here for the correct products.

(c) Iron is extracted from iron oxide, Fe_2O_3.

In the extraction process the iron oxide is heated with carbon to form iron and carbon dioxide.

Write the balanced equation for this reaction.

(3)

$2Fe_2O_3 + 3C \rightarrow Fe_4 + 3CO_2$

ResultsPlus
Examiner Comments

Some candidates tried balancing the equtaion using Fe_2 on the products side - or Fe_4 as in this case. Only 1 mark for the correct reactants here.

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Examiner Tip

Make sure you know the formulae of the compounds used in the course. Also make sure you know which elements exist as molecules.

Question 6 (d)

This question was more discriminating than Q5c as it involved more of the higher level content. There were many excellent descriptions of how alloying increases strength. Many included labelled diagrams which helped their answers. A few used incorrect terminology such as 'adding alloys' or referred to 'molecules' instead of atoms. Some omitted the part on how alloying improves the usefulness of metals or they just referred to increased strength which was in the question. Good candidates gave excellent descriptions of the structures of pure metals and alloys and referred to all the alloys stated in the question, giving improved properties and uses.

The weaker answers often had diagrams that were not identified or labelled. In addition these answers often contained just general statements rather than specific uses for the alloys in the question, such as 'alloys are used for jewellery and bridges'.

The better answers seen for this question used an excellent standard of written communication and used scientific terminology with precision and accuracy.

*(d) Pure metal can be converted into alloys.

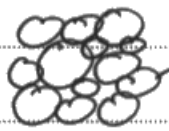
In many cases alloys are more useful than pure metals, for example they are stronger. Gold alloys, stainless steel and nitinol are examples of useful alloys.

Describe how alloying improves the usefulness of metals and how strength is increased in terms of structure.

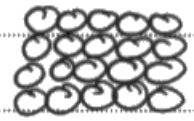
You may use diagrams to help your answer.

(6)

An alloy is much stronger than a pure metal because it is a mixture of 2 or more ~~[illegible]~~ metals with different sized atoms. This means that the alloy does not have a uniform shape.

e.g.  ~~the~~ the atoms are different size so the section cannot slide alongside each other making the alloy stronger.

In pure metals the structure is a uniform shape, the atoms are all the same size so the can slide along each other easily making them malleable.

e.g.  all the atoms are the same size and can slide alongside eachother.

The different sized atoms and the heat alloys are not malleable making them useful because they can be used for a wider range of uses. For example stainless steel is an alloy and is used for cutlery because it is strong. If a pure metal was used the cutlery may bend when being used. Alloys make stronger compounds and have a lot of uses.

ResultsPlus
Examiner Comments

A very good answer making use of diagrams to help the explanation. The inclusion of how alloying to make stainless steel a more useful metal puts this answer into level 3, scoring 6 marks.

*(d) Pure metal can be converted into alloys.

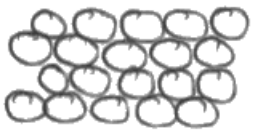
In many cases alloys are more useful than pure metals, for example they are stronger. Gold alloys, stainless steel and nitinol are examples of useful alloys.

Describe how alloying improves the usefulness of metals and how strength is increased in terms of structure.

You may use diagrams to help your answer.

(6)

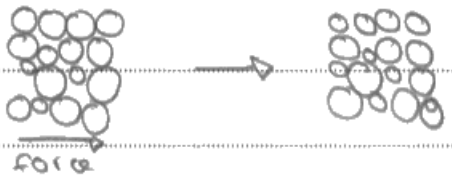
pure metal



added alloy

~~the~~ Pure metal atoms are all the same size this means the layers of atoms can easily slip over eachother

By adding a different sized alloy it shifts the layers ~~compression~~ which stops ~~these~~ layers from sliding over one another



This is useful because it strengthens the metal and allows them to be (usefully) used for more things. For example, the alloy metals can be used to make cars and other vehicles because they are still malleable, but they are much stronger due

to the addition of the alloy.

The strength of the metal is increased because the alloy distorts the layers of atoms due to the difference in size. This ~~not~~ makes it harder for the atoms to slip over eachother as easily.

ResultsPlus
Examiner Comments

The question starts well with an explanation about why pure metals are weaker than alloys. However, after that, there is confusion, particularly in the use of the term 'alloy'. There was no use given for a named alloy or how this had improved the usefulness and so this answer was only level 2, scoring 4 marks.

ResultsPlus
Examiner Tip

Use diagrams to help explain your answers; they can often be more useful than a written explanation.

Paper Summary

Based on their performance in this paper, in order to improve their performance, candidates should:

- learn the meanings of the specific terms used in the course, e.g. reduction and oxidation,
- revise the experiments carried out during the course,
- learn to write balanced chemical equations using correct symbols for the elements and compounds found within the specification,
- not use chemical symbols as shorthand for the names of substances,
- learn the tests for all of the gases in the specification e.g. hydrogen.

Grade Boundaries

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