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Examiners' Report
June 2016

GCSE Science/Chemistry 5CH1H 01

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June 2016

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Introduction

Paper 5CH1H is taken by all candidates for GCSE Science and for GCSE Chemistry. It follows the usual format of six questions. There is a mixture of multiple choice items, short answer items and two extended response (6 mark) items.

Many good papers were seen, and it is encouraging that some candidates can express scientific ideas very clearly, for example when explaining the strength of alloys or the uses of metals. There was also a decent response to writing equations.

Question 1 (a)

This question was generally well answered, with many candidates scoring both marks. Most made the connection between the Earth cooling and water vapour condensing. For carbon dioxide levels reducing, photosynthesis was the most popular idea followed by the dissolving of carbon dioxide in the oceans. Where the marks were not awarded, it was stated that water vapour formed oceans, but not how; or gave some description of photosynthesis without using the proper term.

1 (a) The Earth's early atmosphere contained larger amounts of water vapour and carbon dioxide than it does today.

Explain how the amounts of water vapour and carbon dioxide in the Earth's atmosphere decreased.

(2)

As the Earth's temperature cooled, the water vapour condensed into the oceans, which trapped some carbon dioxide. Carbon dioxide levels also decreased when plants evolved and photosynthesised, taking in carbon dioxide and releasing oxygen.

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Examiner Comments

An example of a full answer.

1 (a) The Earth's early atmosphere contained larger amounts of water vapour and carbon dioxide than it does today.

Explain how the amounts of water vapour and carbon dioxide in the Earth's atmosphere decreased.

(2)

More plants started to grow so they took in the carbon dioxide and they let out oxygen. this reduced the co2 in the earths atmosphere.

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Examiner Comments

This answer described the process of photosynthesis without using the term.

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Examiner Tip

Always use correct scientific terms in your answers.

Question 1 (b)

Perhaps a difficulty with a question involving an issue linking with everyday life, is that candidates can stray into careless language. All that was wanted was the idea of trapping heat. Examples of incorrect responses included referring to the sun's rays being trapped, or simply that there was an insulating effect or that carbon dioxide was a greenhouse gas. There was also a not uncommon problem of mentioning the ozone layer – carbon dioxide depleting this and allowing in more heat.

(b) Describe how the presence of carbon dioxide in the atmosphere helps to keep the Earth warm.

(1)

carbon dioxide makes up the ozone layer which allows heat to be re-radiated onto earth.

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Examiner Comments

Carbon dioxide has no link to the ozone layer.

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Examiner Tip

Learn carefully the difference between different environmental issues.

Question 1 (c)

A straightforward question. Errors included mentioning activities that involved burning fuels (e.g. driving cars) or naming something not related to human activity (e.g. volcanic emissions). Candidates must also be aware of the difference between respiration (correct) and breathing (incorrect).

Question 1 (d)

A wide range of answers was acceptable, and high scoring candidates described well the limited nature of **this** data (rather than the evidence for global warming as a whole). Good answers mentioned that there were only two data points or that there could be other factors causing the temperature rise.

Common misconceptions were that the percentage change in each factor was not the same, so there could not be a link. Another well-trodden route was that the increase in carbon dioxide was too small to have caused any temperature rise.

(d) This table shows a set of data for the percentage of carbon dioxide in the atmosphere and the mean surface temperature of the Earth in the years 1960 and 2014.

year	percentage of carbon dioxide	mean surface temperature / °C
1960	0.0318	14.0
2014	0.0401	14.4

Suggest why this information does not prove that the increase in percentage of carbon dioxide alone has caused the increase in the mean surface temperature of the Earth.

(1)

This because their has been a very minor increase in carbon dioxide in the atmosphere.

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Examiner Comments

A substantial number of candidates had not grasped that a very small increase in the percentage of carbon dioxide can have a large effect on the climate.

Question 1 (e) (i)

The advantages of hydrogen were well known, although reference to greater energy being released from the combustion of hydrogen rarely scored due the candidates failing to link this to energy per unit mass (it is, of course, **less** energy per mole). The disadvantages were less well known or not clearly expressed. It was important to note that the comparison was with petrol. Petrol is explosive too, so this is not a disadvantage particular to hydrogen. The idea of cost has to be explained carefully – the production cost of hydrogen was allowed but not simply that hydrogen was more expensive.

There was no credit for vague answers e.g. 'better for the environment' or 'cleaner'.

Question 1 (e) (ii)

There were many correct answers, although a surprisingly large number could not name water and used hydroxide or hydrogen hydroxide. Quite a few decided to give a symbol equation which was credited, but incorrectly balanced equations, wrong products or even wrong reactants were given. Candidates should be aware that incorrect cases or wrong use of subscripts/superscripts are penalised (e.g. H2, H^2 or h_2 instead of H_2).

Question 2 (a)

A very well answered question with good descriptions. Some candidates missed out because they did not refer to the formation from magma/ lava/ liquid rock.

2 (a) Granite is an igneous rock.

The size of crystals in granite vary.

Describe how a sample of granite which contains large crystals was formed.

(2)

Molten rock underground will have slowly cooled. This means that the crystals have more time to form meaning they are larger.

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Examiner Comments

This is a well expressed, full answer, giving details of how the rock formed (molten rock cooling) and why the crystals are large (slowly cooled underground).

Question 2 (b)

Most responses were correct in mentioning heat and pressure – the most common mistake was only mentioning one (normally heat) or attributing the formation of marble to a weathering or a chemical process.

Question 2 (c)

Most candidates were able to score two marks on this question. The most common marks were for acidic waste gases and neutralisation. Candidates should be aware, however, that calcium carbonate is not an alkali (base is a far safer description!).

Question 2 (d) (ii)

Of the symbol equations in this paper, this was best answered by the candidates, perhaps due to its use on past papers.

Some candidates could not work out the formula for calcium oxide, often given as CaO_2, or for calcium hydroxide, even though it was given in the question. Please also see the note about formulae in the comment on Q1(e)(ii).

Question 3 (b) (i)

A straightforward question – well answered.

Question 3 (c) (i)

The use of litmus paper was well known and it was pleasing to see that the idea that blue litmus paper would first go red before being bleached was commonly included. Some candidates did not give a test and described the electrolysis instead.

Question 3 (c) (ii)

Surprisingly, this question was answered fairly poorly, with most correct answers referring to ventilation/ opening the windows. Very few referred to the use of a fume cupboard. Many general answers were given:'wear goggles', 'wear gloves', 'do not inhale the fumes' etc.

(ii) Chlorine is a toxic gas.

State a safety precaution that should be taken when chlorine gas is formed in a reaction.

(1)

Dont breathe in the gas (wear a face mask) because it releases toxic fumes that can harm the body.

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Examiner Comments

This question shows laboratory apparatus in the diagram and a sensible laboratory method was expected – a fume cupboard or using a well-ventilated room. Face masks do not stop gases, and gas masks are not often found in school labs.

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Examiner Tip

In safety questions, think of when you have carried out experiments in the school laboratory and what precautions you took.

Question 3 (c) (iii)

Many good answers, almost always with correct formulae. The most common error was giving 2Cl, and some equations that were back to front.

(iii) Write the balanced equation for the decomposition of hydrochloric acid to form hydrogen and chlorine.

(3)

$2HCl \rightarrow H_2 + Cl_2$

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Examiner Comments

This answer is correct.

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Examiner Tip

The three uses of "2" are clearly different (though the ones in hydrogen and chlorine formulae could be even lower).

(iii) Write the balanced equation for the decomposition of hydrochloric acid to form hydrogen and chlorine.

(3)

$2HCl \rightarrow H2 + Cl2$

ResultsPlus
Examiner Comments

Subscripts must be clear.

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Examiner Tip

The subscripts on the right hand side formulae should be lower. H_2 and H2 are not the same.

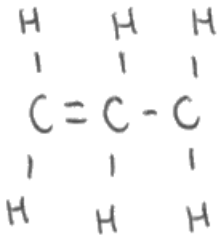
Question 4 (b) (i)

This question provided some interesting answers. Many answers were completely correct; others gained just one mark for having the 3 carbon chain with unsaturation but dropped the other mark because they couldn't place the other hydrogens.

Sometimes the symbols for the elements were there, but no bonds between them. The most common mistakes were a pentavalent carbon for the alkenic carbon, and then a terminal CH_2 rather than CH_3, or two double bonds, or no double bonds:

(b) Propene is an alkene and has the molecular formula C_3H_6.

(i) Draw the structure of a propene molecule, showing all of the bonds. (2)



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Examiner Comments

The correct number of C and H is given, and a double bond (1 mark awarded), but the structure has a tri-valent and a penta-valent carbon.

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Examiner Tip

Count the bonds! The central carbon has 5 bonds and the right carbon has 3. Carbon always forms 4 bonds.

Question 4 (b) (ii)

This question was well answered with the vast majority identifying bromine as the reagent and only a few candidates got the results the wrong way round. Quite a few gave correct explanations for the decolourisation of bromine, even though this was not required.

Marks were lost by not identifying that propane does not change bromine water, or using 'clear' instead of 'colourless' or 'discolour' instead of 'decolourise'. Candidates do have to be careful to write '...ane' and '...ene' in a distinguishable way.

Question 4 (c) (i)

Candidates found this part challenging. The typical answer included brackets and often had the subscript *n* as well. Other candidates just gave the – CF_2-CF_2-unit, and some gave a structure that had the double bond still present.

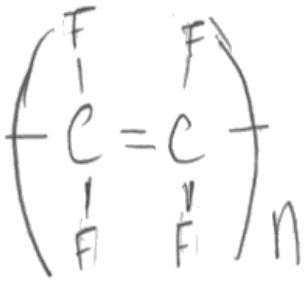
Candidates sometimes were aware of what the unit should be but did not pick up on the need to place two of them together. There was an issue when it came to including the continuation bonds which were often omitted.

(c) The diagram shows the structure of a tetrafluoroethene molecule.

Tetrafluoroethene can form the polymer PTFE.

(i) Draw a diagram to show part of a PTFE molecule formed from two tetrafluoroethene molecules.

(2)



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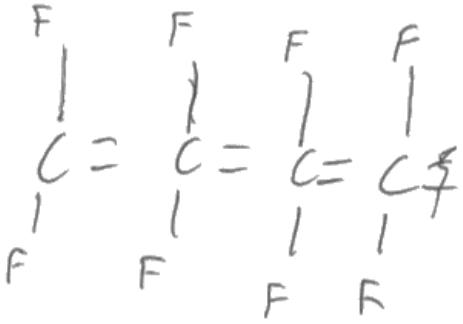
Examiner Comments

Some candidates did not give 2 molecules joined, left in the double bond or added n.

(i) Draw a diagram to show part of a PTFE molecule formed from two tetrafluoroethene molecules.

(2)



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Examiner Comments

This answer has 2 molecules, but has left in double bonds, and continuation bonds are not correctly shown.

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Examiner Tip

When monomers link, double bonds are removed. Always show continuation bonds to show links to the rest of the polymer.

Question 4 (c) (ii)

Most correct answers came from cooking utensils of one sort or another, with relatively few proposing lubricant, clothing or skis. Many candidates just described general plastic items, e.g. plastic bags or confused PTFE with PVC and talked about window frames.

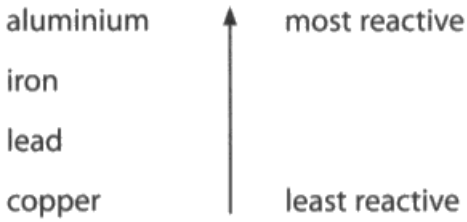
Question 4 (d)

This part was well answered, recognising that recycling or incineration (typically burning) were the other methods used to dispose of plastics. Errors occurred where candidates did not read the question – e.g. suggesting making a biodegradable polymer/ adding starch grains to the polymer when producing rather than stating how waste already produced could be disposed of.

Question 5 (a) (ii)

Lots of marks were awarded for identifying lead as being less reactive than carbon (although some did not make the **comparison** with another element). However, the descriptions of what happens were much vaguer – with the majority who scored the second mark stating that reduction with carbon avoids expensive electrolysis. Some candidates had the misconception that electrolysis won't work on some metal oxides, or that lead cannot conduct electricity.

(ii) Part of the reactivity series is shown



Lead is extracted from its oxide by heating the oxide with carbon rather than by using electrolysis.

Explain why.

(2)

Lead is lower than carbon in the reactivity series so it will be extracted by heating carbon. Electrolysis is an expensive form of extraction so is only used for metals higher than carbon ~~on~~ in the reactivity series.

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Examiner Comments

A well stated answer showing why heating with carbon can be used, and why electrolysis should be avoided.

Question 5 (b)

There were many very good answers. Some failed to describe the pure aluminium as a comparison so lost a mark. The best answers used 'ions' and 'layers' to give concise answers: "layers of ions slide..." rather than looser answers: "they can move across each other".

Question 5 (c)

The key to this question was to read it: describe some uses.... *in relation to their properties.* The best answers were to the point and mentioned a use(s) of each metal with the most relevant property, and then gave a comment about recycling.

Where candidates did not achieve marks they gave, for each metal, a list of properties and a list of uses, without directly relating a use to a specific property or properties. Some common errors were to think that high density of steel is advantageous in its use as a material for the construction of buildings, that the corrosion resistance of copper is advantageous in its use as an electric cable, and that aluminium is light (rather than having low density).

*(c) Iron in the form of steel, aluminium and copper are used to manufacture many useful articles.
These uses depend on their density, strength, electrical conductivity and resistance to corrosion.

Describe some uses of each of these metals in relation to their properties and the advantages of recycling these metals rather than extracting more of the metals from their ores.

(6)

Copper is used for ~~it~~ electrical wires and plumbing. This is because copper has the properties of being an excellent conductor of electricity and also is also very resistant the corrosion. As well as that, it doesn't release toxins into the water. Aluminium is used to build aircrafts and drinks cans. ~~Used~~ Aluminium has properties of ~~having~~ having a low density and a ~~be~~ relatively high strength for its weight. The low density and high strength makes it useful in order to build ~~an~~ aircraft, as they need to be lightweight in order to fly, but also strong so it doesn't easily break apart. Steel is used for building bridges and giant structures. Steel isn't very corrosive, ~~so~~ but ~~has~~ ~~is~~ a high density and therefore high strength.

Bridges and buildings need to have a lot of strength to withstand the weight of things on/in them, but also need a high density so it doesn't collapse. Furthermore, a lack of corroding on bridges is important, as typically bridges go across bodies of water, which can cause corrosion. If the bridge started to corrode, it may eventually collapse. Recycling these metals has a lot of advantages compared to extracting more. Aluminium is very expensive to extract as it requires electrolysis and needs to be heated up before hand to get it into a state to be electrolysed through. Copper and Iron are extracted by reacting their ore, which contains an oxide of the metal, with carbon. Although this isn't as expensive, ores are starting to run out as they are non-renewable. Recycling them will help to preserve the ores for a longer length of time.

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Examiner Comments

An example of a very full answer, which whilst not being perfect, has much good material.

Firstly iron in the form of steel is alloyed with three things, for one, low carbon, this allows steel (iron) to be used for things such as cars bodies, secondly, high carbon, this allows steel (iron) to be used for things such as weaponary, or bridges, and finally when iron is alloyed with titanium, it forms stainless steel which can not rust or corrode and is strong, therefore is used in sinks and such.

Aluminium is used for building planes due to its low density it allows the plane to not fall because of its weight.

Finally Copper, Copper is used in things such as pipes because it does not corrode or rust when water passes through, and its also used in wires because its a good conductor of electricity

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Examiner Comments

Not all of the uses are linked to properties here, and recycling is not mentioned at all.

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Examiner Tip

In questions such as this, structure your answers to cover all points.
In this case, one structure could be;
1. steel use/property
2. aluminium use/property
3. copper use/property
4. recycling advantages

Question 6 (b)

This was not an easy equation to balance, however many candidates gained the three marks. Quite a few had forgotten to add oxygen as a reactant (or even used O as the formula), thus scoring only 1 mark. As already noted in this report, there was careless writing of all the formulae, especially CO_2 and H_2O.

Question 6 (c)

Most candidates here managed to get two of the three possible marking points and a good number gave all three. The most common combination was sulfur dioxide being formed which then produced acid rain. Where the sulfur dioxide could not be awarded, often because the candidate had talked about sulfur as the waste product, the third marking point was available. In the latter case, the effect on appropriate organisms or buildings was the commonest way of scoring, with almost none talking about breathing/lung difficulties. Vague answers e.g. damages environment were given, although the best used the terms corrode, weather and eroded in the correct context.

(c) Sulfur is present as an impurity in some fuels.

Explain how the product of combustion of this impurity in a fuel can damage the environment.

(2)

It can damage the environment because when sulfur undergoes combustion, a lot of harmful gases are let out, which damages the air in the environment.

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Examiner Comments

This is an example of a vague answer which says nothing.

Sulfur ~~can~~ reacts with oxygen in the air to form Sulfur dioxide. Sulfur dioxide ~~can~~ reacts with rain water to form acid rain. When acid rain falls it can kill fish in lakes and rivers. Also it can damage buildings and statues.

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Examiner Comments

In contrast, a fuller answer.

Question 6 (d)

There were some good responses here with some kind of idea of supply and demand, but answers could be confused and the interpretation of the data given in the question was sometimes jumbled. One advantage of cracking – to produce alkenes for polymers production – was not often given.

The school laboratory method was sometimes ignored or only picked up with a brief idea of heating paraffin and/or using a catalyst. Unfortunately, some described fractional distillation, electrolysis or heating liquid paraffin with kerosene (with paraffin the catalyst).

It was useful to give a diagram for the laboratory apparatus for thermal cracking (which could score some of the marking points) although these were generally poor (but those that did attempt them were often the more able candidates).

Paper Summary

On the basis of performance in this paper, candidates are offered the following advice:

- Read very carefully the question and direct your answer accordingly, answering each part of the question
- Be sure to explain, using scientific reasons, when the questions says "Explain..."
- Be able to distinguish between the greenhouse effect and ozone layer depletion
- Consider laboratory safety precautions for experiments that have been undertaken
- Practise drawing parts of polymer molecules
- Check the use of correct subscripts when writing formulae.

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