Examiners' Report
March 2013

GCSE Chemistry 5CH1H 01

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March 2013

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Introduction

This is the fifth examination in the GCSE Science 2011 course, so teachers and candidates have had the benefit of using four previous papers.

The Higher Tier paper assesses grades A* to D and consists of a mixture of question styles, including objective questions, short answer questions, data analysis questions and extended writing questions.

There was evidence that candidates were well prepared for the examination and many of them approached the questions with a good understanding of the topics and answered in detail. It was particularly pleasing to see many good answers to the longer free response questions.

There is, however, one major point of concern. The majority of candidates seem unable to recall the formulae of common compounds, such as copper carbonate and nitric acid, as required in Q4(b)(ii). This is a concern both in the immediate future and in the longer term when considering that formulae and equations are of such importance in any higher level study of the subject.

Successful candidates:

- read the questions carefully and answered the questions as they were set, addressing all aspects
- used correct scientific terminology
- could carry out simple calculations
- could balance equations when presented with unbalanced equations
- could write correct formulae for common compounds.

Less successful candidates:

- did not read the questions carefully and gave answers that were related to the topic being tested, but did not answer the question
- gave vague answers in responses related to the environment
- could not carry out simple calculations as required in Q1(e)(i)
- could not write balanced equations as required in Q1(e)(ii) and Q3(c)(i) or give correct formulae and hence balance the equation in Q4(b)(ii).

This report provides exemplification of candidates' work, together with tips and/or comments for a selection of questions. The exemplification will come mainly from questions that required more complex responses from candidates.

The atmosphere

Question 1(d)

Most candidates gained credit for their answers, with many gaining both marks.

The most common correct responses included the idea that no humans were alive at that time, although some suggested there were no living organisms at the time rather than specifying humans.

Many correctly stated that there are no records or that no evidence is available. Many candidates, however, clearly do not appreciate that there is **no** evidence from that time and gave answers stating that 'not enough evidence' has been found. Others talked about the technology not being in place for the scientists to use at the time! Others referred to evidence from other planets or the ever-changing composition of the atmosphere. Few candidates gave an answer discussing websites.

(d) The information given on two websites is very different.

Explain why it is difficult to be certain about the composition of the Earth's early atmosphere.

(2)

Because there are lots of Sources of information and there was no life around at the time So there is therefore no evidence

ResultsPlus
examiner comment

This refers to 'no life around at the time' rather than specifying humans. It also states there is 'no evidence' so does score 1 mark.

(d) The information given on two websites is very different.

Explain why it is difficult to be certain about the composition of the Earth's early atmosphere.

(2)

There were no people to record any information. Billion year old Rocks do not show the composition from the early atmosphere.

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This answer is worth 2 marks even without the second sentence.

Question 1(e)(i)

This was not as well answered as expected. Although many candidates could calculate the correct percentage of oxygen in the air sample and so gain both marks, a significant number gave 9% or 82% as their final answer. These answers were awarded 1 mark for calculating the volume of oxygen correctly.

It is somewhat surprising at this level that a candidate should suggest these values for the percentage of oxygen in the air, seemingly without going back to check if their calculation might have gone wrong somewhere. Candidates should be encouraged to consider whether their answer is sensible in the context of the question.

On the other hand, some candidates demonstrated a possible danger in knowing what the answer was likely to be by coming up with some inventive ways of using the numbers from the data provided to produce an answer of 21%! Others showed no working but just gave an answer of 21%.

(e) In an experiment to find the percentage of oxygen in the air, some copper was heated in 50.0 cm^3 of dry air.

All of the oxygen in this sample of air reacted to form copper oxide.

After the reaction, the volume of gas remaining was 41 cm^3.

(i) Calculate the percentage of oxygen in this sample of air.

(2)

50.0 − 41 = 9

% oxygen = 9

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examiner comment

This candidate has calculated the volume of oxygen correctly and so scores 1 mark.

(e) In an experiment to find the percentage of oxygen in the air, some copper was heated in 50.0 cm^3 of dry air.

All of the oxygen in this sample of air reacted to form copper oxide.

After the reaction, the volume of gas remaining was 41 cm^3.

(i) Calculate the percentage of oxygen in this sample of air.

(2)

50 − 41 = 9

9 ÷ 41 = 0.21951 × 100

= 21.95121

% oxygen = 21.95121

ResultsPlus
examiner comment

This candidate scored 1 mark for obtaining 9 cm^3 as the volume of oxygen but then, either through not knowing what to do next, or possibly through knowing the true percentage of oxygen in air, proceeded incorrectly to obtain a result close to 21%.

Question 1(e)(ii)

As expected, most candidates could correctly complete the balancing of this simple equation.

Rocks and their uses

Question 2(a)(ii)

This question was well answered, with the majority of candidates correctly identifying the rock as sedimentary and many also noting the presence of a fossil, which was necessary for the second mark.

Some just described dead animals and others thought it was sedimentary rock because the rock was in layers.

(ii) The photograph shows a sample of rock.

Explain which of the three types of rock this is most likely to be.

(2)

It is most likely to be Sedimentary as Fossils are only found in this rock. This is because Fossils would be destroyed in the ~~th~~ formation of ~~metamorphic~~ metamorphic and Igneous rocks.

ResultsPlus
examiner comment

A typically good answer for 2 marks.

Question 2(b)

The formation of igneous rocks was clearly well known but the most common mark here was 2 as many candidates did not mention magma, or lava, or molten rock, simply discussing the rocks or the crystals cooling. Crystal size and cooling rate were generally well known, although there was a small but significant number who had these reversed. Many successfully answered the question in terms of intrusive and extrusive igneous rocks but again some unfortunately reversed these.

Explain how these igneous rocks, containing different sized crystals, have been formed.

(3)

These igneous rocks have been formed when a volcanoe has spued molten lava onto the surface. The faster the lava cools into rock, the bigger the rocks crystals are.

ResultsPlus
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The candidate has indicated that igneous rocks are formed from cooling lava but has unfortunately confused the rate of cooling and its effect on the size of the crystals, so they score 2 marks, not all 3.

Explain how these igneous rocks, containing different sized crystals, have been formed.

(3)

in rock ~~A~~ the magma cooled fast in an extrusive environment so smaller crystels were formed, in rock ~~B~~ the magma cooled slowly in an intrusive environment so larger crystels were formed.

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This is a good answer using the intrusive and extrusive approach.

Explain how these igneous rocks, containing different sized crystals, have been formed.

(3)

Rock A has been cooled the quickest so it has smaller crystals Rock B cooled slow so it has large crystals

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examiner comment

This makes correct reference to rate of cooling and size of crystals but there is no mention of magma, or lava, or molten rock, so was awarded only 2 marks.

Question 2(c)

Most candidates understood that calcium carbonate reacts with or neutralises waste gases but many did not state that this is because the waste gases are acidic. Although many recognised that calcium carbonate is a base, a significant number referred to it as an alkali. Such a reference was ignored. A common error was the notion that carbon dioxide was removed by the calcium carbonate.

In the better answers candidates referred to the production of sulfur dioxide by burning coal and that removal of this gas reduced the amount of acid rain in the atmosphere. However, some made reference to sulfur itself as a waste or acidic gas and occasionally nitrogen oxides were also mentioned.

A very small minority of candidates correctly mentioned salt formation, such as calcium sulfite forming when sulfur dioxide reacts with calcium carbonate.

(c) Limestone is mainly calcium carbonate.

Explain why calcium carbonate is used to treat waste gases produced in coal-fired power stations.

(3)

Calcium carbonate neuralises acidic gases and soils. This can stop acid rain as the calcium carbonate neutralises the sulpur dioxide produced in coal-fired power stations.

ResultsPlus
examiner comment

A good answer for 3 marks.

(c) Limestone is mainly calcium carbonate.

Explain why calcium carbonate is used to treat waste gases produced in coal-fired power stations.

(3)

Calcium carbonate is used to treat waste gases ~~because~~ in coal fired power stations because it ~~[illegible]~~ reacts them. with the gases and ~~a~~ neutralis~~ation~~es ~~reaction takes~~ ~~places~~. Calcium carbonate makes waste gases such as Sulfur dioxide less harmfull to the environment.

ResultsPlus
examiner comment

Using calcium carbonate to 'treat' waste gases would not have been worth a mark but later the candidate states it 'reacts' with the gases and a mark is also gained for mention of sulfur dioxide.

Crude oil and biofuels

Question 3(a)(i)

This was usually answered correctly.

Question 3(a)(ii)

Usually well answered.

Question 3(a)(iii)

Often well answered but some candidates suggested petrol and there was an occasional reference to bitumen.

Question 3(c)(i)

The two answers here were rarely correct.

Question 3(c)(ii)

This was often poorly answered with many candidates choosing to describe carbon monoxide as colourless, having no smell and being toxic, rather than explaining how it can cause death. The phrase 'the silent killer' was quite common with little else to support it. Some did mention that carbon monoxide attaches to the red blood cells but then did not state that this would cause a lack of oxygen.

(ii) Carbon monoxide is a toxic gas and can cause death.

Explain how carbon monoxide can cause death.

(2)

carbon monoxide reduces the amount of oxygen your blood carries which can cause death.

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examiner comment

This response was worth 1 mark for the reference to reducing the amount of oxygen the blood can carry.

(ii) Carbon monoxide is a toxic gas and can cause death.

Explain how carbon monoxide can cause death.

(2)

Carbon monoxide can cause death by, when breathed in, binding ~~the~~ with the haemoglobin in your red blood cells and not unbinding meaning less oxygen can be transported around the body.

ResultsPlus
examiner comment

A good answer worth 2 marks.

Question 3(d)

This question was well answered, with many candidates gaining maximum marks for demonstrating a good knowledge and understanding that plants for biofuels take up farmland that could be used for growing food crops. Many stated that this could lead to an increase in food prices, due to shortages, and possible starvation.

Some also mentioned deforestation as a potential problem caused by growing plants for biofuels.

A common misunderstanding was that it would lead to less photosynthesis and to higher carbon dioxide levels with all their consequences.

(d) Biofuels are produced from plants.

Explain a problem caused by growing plants to produce biofuels.

(2)

Growing plants for biofuels takes up a lot of land which cannot be used for growing crops or food, so we have less food grown if we use plants for biofuels

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examiner comment

A typical answer that gained both marks.

Acids and electrolysis

Question 4(b)(i)

This was poorly answered, with very few candidates scoring 2 marks. Many did gain 1 mark, usually by stating that bubbles formed or they would see fizzing. Others mentioned the disappearance of the solid. Many vague answers such as ‘a colour change is seen’ did not gain any credit. The colour of copper carbonate (green) and copper nitrate solution (blue) seemed virtually unknown. Many simply repeated information from the word equation and stated a gas, or carbon dioxide, or copper nitrate, or water would be formed rather than what they would see happening. It seems likely that many had not seen or carried this out as a practical exercise.

(i) State **two** things you would **see** when solid copper carbonate reacts with dilute nitric acid.

(2)

you would see bubbles (the carbon dioxide) and you would see the ~~fiz~~ liquid change colour

ResultsPlus
examiner comment

A mark was awarded for ‘bubbles’ but ‘change colour’ is too vague.

(i) State **two** things you would **see** when solid copper carbonate reacts with dilute nitric acid.

(2)

- Water vapour forming and condensing.
- Copper nitrate forming.

ResultsPlus
examiner comment

This candidate has simply copied information from the word equation, which is not worth any credit.

Question 4(b)(ii)

(ii) Write the balanced equation for the reaction of copper carbonate with dilute nitric acid.

(3)

$2CuCO_3 (s) + 2NO_3H (aq) \rightarrow 2CuNO_3 (aq) + 2CO_2 (g) + 2H_2O (l)$

Cu	1	1	2
C	1	1	2
O	6	9	12
N	1	2	2
H	1	2	2

Cu	1	2		
C	1	1	2	
O	6	9	11	12
N	1	2		
H	2	2	4	

ResultsPlus
examiner comment

A mark was awarded for the reactants despite the unusual order of the atoms in nitric acid.

(ii) Write the balanced equation for the reaction of copper carbonate with dilute nitric acid.

(3)

$CuC + N \rightarrow CuN + CO_2 + H_2O$

~~$3CuC + 3NO \rightarrow 3CuN + 3CO_2 + H_2O$~~

ResultsPlus
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Sadly, a typical example with only correct formulae being those of carbon dioxide and water.

Question 4(c)(i)

Most candidates scored at least 1 mark for mentioning electricity or an acceptable alternative. However, many incorrectly referred to atoms or elements being split by electrolysis and others used the idea of separation instead of decomposition.

(c) Two gases can be produced by the electrolysis of water, under suitable conditions.

(i) Explain what is meant by **electrolysis**.

(2)

Breaking down of a compound using electricity.

ResultsPlus
examiner comment

A good answer.

(c) Two gases can be produced by the electrolysis of water, under suitable conditions.

(i) Explain what is meant by **electrolysis**.

(2)

Electrolysis is the decomposing of a compound to form at least two substances.

ResultsPlus
examiner comment

This candidate made no mention of electricity so gained 1 mark only.

(c) Two gases can be produced by the electrolysis of water, under suitable conditions.

(i) Explain what is meant by **electrolysis**.

(2)

Electrolysis is the decompostion of compounds using electricity.

ResultsPlus
examiner comment

A very good answer.

Question 4(c)(ii)

As expected, this was well known but some did not gain marks due to mention of a blown out splint (which, unless stated explicitly, may not be glowing) or relighting a burning splint. Others confused the test for oxygen with the test for hydrogen and a few even tested with litmus or limewater.

(ii) One of the gases is oxygen.

Describe a test to show the gas is oxygen.

(2)

I ignite a splint blow it out and hold over the gas realeased if there is oxygen present it will reignite.

ResultsPlus
examiner comment

A blown out splint is not sufficient – the response must state that it was glowing.

(ii) One of the gases is oxygen.

Describe a test to show the gas is oxygen.

(2)

damp litmus paper bleached and then put into a ~~Ga~~ test tube with solution. The litmus paper should be clear.

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Some confused this with tests for other gases, including chlorine.

(ii) One of the gases is oxygen.

Describe a test to show the gas is oxygen.

(2)

by putting that Gas in a tight area or place; then tell a person to go and sit or breath in it for 30 seconds and see if they can breave in it. If they can you know the oxygen is a Gas.

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A bit of a drastic suggestion! The answer doesn't score any marks.

Metals and alloys

Question 5(a)

This was a well-answered question with candidates showing a good knowledge of the properties of gold; all five marking points were commonly seen. Those who did not score 2 marks had often given two very similar points. Others often mistakenly used the word ‘rust’, which was ignored. Candidates would be well advised to use the word ‘corrode’ instead and to use the idea of rusting only in relation to iron. Candidates would also do better to describe gold as simply ‘unreactive’, rather than trying to make qualified statements about how reactive gold is.

5 Gold is used to make some jewellery.

(a) Explain why gold is used to make jewellery.

(2)

Gold is a soft metal and can be molded into different shapes. Gold is also attractive and shiney.

ResultsPlus
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‘Attractive’ and ‘shiney’ [sic] are the same marking point but the candidate also conveyed the idea of gold being able to be shaped, so this response was awarded 2 marks.

5 Gold is used to make some jewellery.

(a) Explain why gold is used to make jewellery.

(2)

Gold is used to make jewellery because it is an unreactive metal, this means it won't ~~react~~ react with water or another substance which can harm you.

ResultsPlus
examiner comment

‘Unreactive’ and ‘won't react with water’ are the same marking point so this answer was worth only 1 mark.

Question 5(c)

Many candidates knew that pure gold atoms were all the same size and that the atoms in the alloy were of different sizes. Many, however, then discussed the atoms moving easily in gold rather than the layers of atoms and as a result scored only 2 marks.

Labelled diagrams were sometimes used and were able to score marks. The word ‘molecules’ was seen quite often and was not accepted on its first use.

There were also some candidates who did not discuss the structures at all but instead described the mixing of metals and the consequent change to properties of the alloy.

(c) Gold can be alloyed with other metals to produce alloys that have a higher strength than pure gold.

Explain why gold alloys are stronger than gold.

(3)

All alloys are stronger than the original/pure metal because the atoms in the original metal can easy slide over each other when force is applied as the atoms are the same size. However when metals are mixed, the atoms are different sized so it takes a greater force to break them as they don't slide over each other as easily. This is why combining gold with other metals (alloys) are stronger than pure gold.

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There is no mention of layers/sheets of atoms so this answer was awarded just 2 marks.

Question 5(d)

This question was well attempted by many candidates who made suitable comments about the three aspects: relative reactivity, method of extraction, and cost; Level 2 and 3 answers were often seen. The majority of candidates realised that the extraction method was linked to the relative reactivity of aluminium and iron.

Candidates did not always link the relative cost of the process to the extraction method and so did not reach Level 3.

There was occasional confusion about the reactivity of aluminium but the large majority correctly noted that Al was the more reactive. Many usefully compared the reactivity of both iron and aluminium to carbon.

Incorrect ideas seen included the thermal decomposition of the iron ore and discussion of metals other than aluminium and iron.

*(d) Iron and aluminium occur in the Earth's crust as their oxides.

Different methods are used to extract iron and aluminium from their oxides.

Explain, in terms of the position of the metal in the reactivity series and the cost of the extraction processes, why iron and aluminium are extracted by different methods.

(6)

Iron is less reactive than aluminium so it is easier to seperate from its impurities and oxygen Iron is usually extracted using a blast furnace with carbon. When iron oxide is heated with carbon the iron becomes reduced and the carbon oxidised forming iron and carbon dioxide or monoxide This is because carbon is more reactive So it can take the oxygen Aluminium is more reactive than carbon So it cannot have the oxygen removed. Aluminium is then extracted using electrolysis this uses large amounts of heat and electricity This leaves pure molten aluminium at the bottom and at the cathode. Aluminium oxide as the electrolyte and oxygen at the anode. This can be tested with a lit splint.

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Unfortunately, there is no reference to the cost of extraction so this otherwise very good answer is limited to a Level 2.

ResultsPlus
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This highlights the need for candidates to read the question carefully to ensure all required aspects are covered.

*(d) Iron and aluminium occur in the Earth's crust as their oxides.

Different methods are used to extract iron and aluminium from their oxides.

Explain, in terms of the position of the metal in the reactivity series and the cost of the extraction processes, why iron and aluminium are extracted by different methods.

(6)

Iron is extracted by heating the ore with carbon because Carbon is more reactive than iron. This results in the oxygen atoms oxidise the carbon and the oxygen is removed from the iron oxide, leaving the pure iron. Aluminium is extracted a different way because it is more reactive than carbon meaning that the carbon can't take the oxygen from the bauxite. Aluminium is extracted by electrolysis. Spliting the oxygen from the the aluminium using electricity. Electrolysis isn't used to seperate iron and oxygen because it is very expensive and requires alot of fuel to produce the required electricity.

ResultsPlus
examiner comment

A very good answer covering all aspects and worthy of a Level 3.

*(d) Iron and aluminium occur in the Earth's crust as their oxides.

Different methods are used to extract iron and aluminium from their oxides.

Explain, in terms of the position of the metal in the reactivity series and the cost of the extraction processes, why iron and aluminium are extracted by different methods.

(6)

oxidisation, is when oxygen is added to a substance and hydrogen is taken away.
Respiration, is when hydrogen is added and oxygen is taken away.
When these occur in the earth's crust, Iron and alluminium, metals in the reactivity series, are extracted with either hydrogen gas or oxygen. However they are not extracted together because they are both on different reaction scales on the reactivity series.

(Total for Question 5 = 12 marks)

ResultsPlus
examiner comment

Unfortunately, this response was not worthy of any credit.

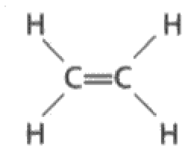
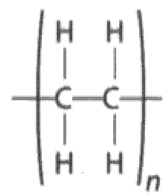
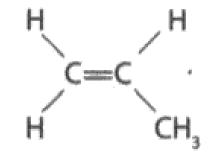
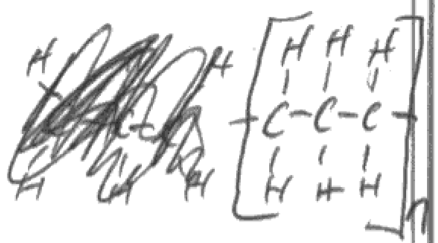
Polymers and alternative fuels

Question 6(b)

Considering that examples were given, this proved more difficult than expected. Many candidates were able to give the correct name, poly(ethene), but only the better candidates were able to draw out the structural formula of poly(propene) correctly. Common faults were to have three carbons in the chain, to leave in the carbon to carbon double bond or to omit the *n* outside the brackets.

(b) The table shows two monomers and the polymers they form.

Complete the table.

monomer structure	name of polymer formed	polymer structure
	Poly(ethene)	
	poly(propene)	

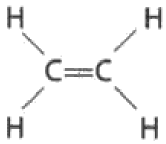
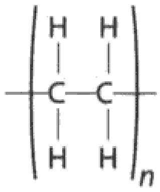
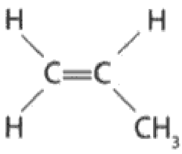
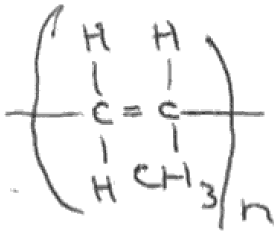
(2)

ResultsPlus
examiner comment

A typical incorrect answer for the polymer structure – because it has the three carbon atoms in a line.

(b) The table shows two monomers and the polymers they form.

Complete the table.

monomer structure	name of polymer formed	polymer structure
	poly (ethene)	
	poly(propene)	

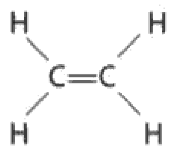
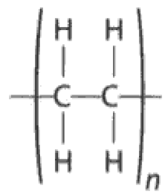
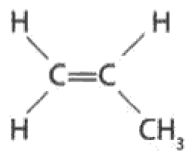
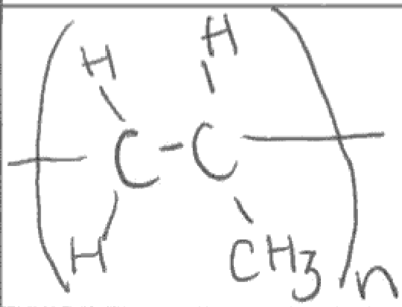
(2)

ResultsPlus
examiner comment

Another common error, with a double bond being shown in the polymer structure.

(b) The table shows two monomers and the polymers they form.

Complete the table.

monomer structure	name of polymer formed	polymer structure
	Poly (Hexene)	
	poly(propene)	

(2)

ResultsPlus
examiner comment

Some candidates obtained the more difficult mark but could not name the first polymer correctly.

Question 6(c)

Many candidates correctly referred to the non-biodegradability of many polymers and the consequence of this for landfill sites. Others mentioned that polymers release toxic gases when burnt; however, many did not mention 'burning', stating merely that polymers release toxic gases. There were some other vague responses about the environment and pollution that did not gain credit.

(c) A number of methods are used to dispose of waste polymers.

Explain a problem caused by the disposal of polymers.

(2)

Polymers contain harmful chemicals that damage the atmosphere and the envuroment.

ResultsPlus
examiner comment

A vague response not worthy of any marks.

(c) A number of methods are used to dispose of waste polymers.

Explain a problem caused by the disposal of polymers.

(2)

The disposal of polymers releases harmful gases into our atmosphere, which can contribute to the enhanced greenhouse effect

ResultsPlus
examiner comment

This response makes no mention of burning the polymers to produce the harmful gases and has not named the gas, eg carbon dioxide, causing the greenhouse effect.

Question 6(d)

Most candidates had some idea of what properties a good fuel should have and all the points in the mark scheme were seen. However, many candidates found great difficulty in setting out their answer coherently. This often resulted in them repeating themselves or getting confused and failing to include information that would have increased their marks. There was a small minority who felt the fuel should not be flammable, but this was usually a poorly expressed point about a fuel not being too dangerous to handle safely.

A fairly common, but unsatisfactory, approach was candidates giving a series of questions, or factors, to consider, without ever saying what would make a good fuel, eg 'consider ease of ignition' or 'is it easy to ignite?', etc. Candidates had to give definitive answers to reach Levels 2 and 3.

There were also the usual vague answers such as 'a fuel should not cause pollution' or 'it should be eco-friendly'.

*(d) Most of the energy we require comes from burning fossil fuels. The supply of fossil fuels is limited and therefore other fuels are needed.

Various fuels are being tested.

Explain the properties required of a good fuel.

(6)

Firstly it must be cheap to produce as not too make it cheap for the consumer secondly it must produce alot of energy when ~~b~~ heated to be able to fuel various things, it must also be ~~easy~~ Easy to lite to make it easy to use for people also it must produce little to no ~~g~~ smoke as this would make it easy to use finally it must be highly available or even re-newable so you will not run out of it very soon.

ResultsPlus
examiner comment

A good answer covering many aspects and worthy of a Level 3 – scores 6 marks.

Summary

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

- read all of the information in the question carefully and use it to help them to answer the question
- learn and use correct scientific terminology
- learn the correct formulae for the substances in the specification
- practise writing balanced equations for the reactions in the specification
- practise simple calculations
- practise writing organised and therefore concise answers to the extended writing questions, addressing the whole question and not including information that is not relevant.

Grade boundaries

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