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Examiners' Report

Principal Examiner Feedback

Summer 2017

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In Chemistry/Science (5CH1H) Paper 01

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Paper Introduction

This is the final Unit 1 paper of the current GCSE Science 2011 specification. The format and style of this paper are now firmly established since the first paper in November 2011.

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

Candidates were assessed on their knowledge and understanding of chemistry of the atmosphere, rocks, acids, electrolysis, metals, fuels, hydrocarbons and polymers. There were opportunities for them to demonstrate their knowledge and understanding of writing both word and balanced equations and of practical work they have carried out in this unit.

The overall impression of the examiners was that most candidates had been well prepared for the examination, with lessons learned from reports, such as in the area of rock formation, when compared to the previous series.

Successful candidates:

- read the questions carefully and answered the questions as they were set,
- understood and used the correct scientific terminology from the specification
- could write balanced equations
- could explain both advantages and disadvantages of using hydrogen as a fuel compared to petrol.

Less successful candidates;

- could not recall the results of the bromine water test used to distinguish between alkanes and alkenes
- could not explain the method of extraction used for a specified metal,
- could not write the word equation for the complete combustion of methane
- had difficulty in answering extended writing tasks, confusing the disadvantages of using hydrogen with those of biofuels.

In future, candidates need to ensure that they revise the factual content of the specification carefully and practise balancing equations, especially those required by the specification. All candidates would benefit from working through past examination questions, to practice the skills needed in answering the range of different types of extended writing.

The report provides exemplification of candidates' work, together with tips and/comments for a selection of the responses to the questions.

5CH1H_01_Q01a

Question Introduction

The majority of candidates scored the 2 marks available, with many giving all three marking points in their answers.

Common errors and misconceptions seen by examiners included:

- in a few cases, candidates only mentioned 'water vapour' so achieving a score of 1 mark only
- commonly seen misconceptions seen in some responses were that 'carbon dioxide condensed or dissolved to make the oceans', or that 'the oceans were formed by hydrogen and oxygen combining'.

5CH1H_01_Q01bi

Question Introduction

This was poorly answered on the whole. Most candidates were able to score just 1 mark only for a correct reference to sedimentary rocks.

Common errors and misconceptions seen by examiners included:

- many candidates simply described the formation of sedimentary rocks, failing to link the formation of sedimentary rocks with the absorption of carbon dioxide by marine organisms and its subsequent use in the formation of shells
- many incorrect responses, referred to 'carbon dioxide combining with calcium to form calcium carbonate' or discussed 'carbon dioxide forming layers within the sediments', as if carbon dioxide was a solid material once dissolved in sea water.

5CH1H_01_Q01c

Question Introduction

This was generally very well answered, with many candidates giving correct explanations linking 'photosynthesis' with the 'lowering of carbon dioxide levels in the atmosphere' to score both marking points.

Common errors and misconceptions seen by examiners included:

- whilst many responses correctly referred to the correct process, namely, photosynthesis, they often failed to mention to link this with the effect on the level of carbon dioxide in the atmosphere. Consequently, the second marking point was not score in many cases
- in few cases the processes of photosynthesis and respiration were confused with each other.

5CH1H_01_Q01d

Question Introduction

This question was very well answered on the whole. Most candidates were able to score the 2 marks available for correctly writing the word equation for the complete combustion of methane. This is a commonly asked question in the specification. Many candidates wrote a balanced equation of the correct formulae, and scored full marks. However, occasionally a few who used the symbol equation, lost marks for incorrect balancing.

Common errors and misconceptions seen by examiners included:

- in some responses, examiners noted that the terms 'hydrocarbon' or simply 'fuel' were given instead of methane, and 'air' was given as an incorrect alternative for oxygen. Consequently, the reactants mark was not scored
- in many incorrect responses, despite having been given one of the products, carbon dioxide, in the question, examiners noted that candidates were unable to recall either one or both products. Commonly given incorrect products included, 'methane oxide', 'hydrogen'. Consequently, the products mark was not scored.

5CH1H_01_Q02b

Question Introduction

Most candidates scored 1 mark only of the 2 marks available, for the first marking point, namely for the correct observation, 'fizzing or bubbling'. Few candidates went further to mention 'disappears or dissolves' to score the second marking point.

Common errors and misconceptions seen by examiners included:

- commonly seen responses scoring only 1 mark, often gave 'fizzing and forming a white precipitate'. Consequently, the first marking point only was scored
- on many occasions, both fizzing and dissolving were correctly mentioned. However, an incorrect colour change was also stated, which negated the second marking point
- in some cases, candidates did not read the question which asked for what would be seen and simply named products (the formulae of which were given in the balanced equation in the stem of question).

5CH1H_01_Q02ci

Question Introduction

This was well answered on the whole. The majority of candidates correctly recalled the definition for electrolysis for 2 marks. In some cases, when only 1 mark was scored, this was for the second marking point, by reference to 'dc current or electricity'.

Common errors and misconceptions seen by examiners included:

- a commonly seen error, which lost the first marking point, was a reference to 'separating the compound', rather than decomposing
- in several cases, candidates simply discussed the use of electrolysis in the extraction of metals.

5CH1H_01_Q02cii

Question Introduction

This was very well answered on the whole. The majority of candidates were able recall both the test and result of the test for oxygen, to score the 2 marks available.

Common errors and misconceptions seen by examiners included:

- occasionally both marks were lost by candidates not correctly referring to the use of a 'glowing splint'. Alternatively, 'burned out or blown out splint' was seen which is incorrect
- occasionally candidates confused the test for oxygen with that for hydrogen, namely the use of a lighted splint and squeaky pop, or for the tests for other gases, such as chlorine or carbon dioxide.

5CH1H_01_Q02ciii

Question Introduction

This was very well answered on the whole. The majority of candidates were able recall both the test and result of the test for hydrogen, to score the 2 marks available.

Common errors and misconceptions seen by examiners included:

- occasionally both marks were lost by candidates confusing the test for oxygen with that for hydrogen - incorrectly referring to the use of a 'glowing splint'
- occasionally candidates simply referred to the 'squeaky pop test' which is not a correct test.

5CH1H_01_Q03ai

Question Introduction

This was very well answered on the whole. The majority of candidates were able to state that the compound is not a hydrocarbon and explain this by reference to the definition of a hydrocarbon, to score the 2 marks available.

Common errors and misconceptions seen by examiners included:

- occasionally marks were lost by candidates using inappropriate terms such as 'carbon and hydrogen molecules'. or referring to 'fluoride or chloride'
- a few candidates correctly identified that it is not a hydrocarbon, but cited the wrong reason, such as 'it doesn't have double bonds' and consequently they were unable to score
- very few candidates incorrectly claimed that the compound was a hydrocarbon by reference to the fact that it contained hydrogen and carbon.

5CH1H_01_Q03aii

Question Introduction

This was well answered on the whole. Many responses correctly referred to either 'saturated', 'contains no double bonds' or 'ONLY single bonds', to score the 1 mark available.

Common errors and misconceptions seen by examiners included:

- many incorrect responses simply stated 'alkane' rather than 'saturated'
- some incorrect responses, simply mentioned that the compound contained single bonds, rather than 'ONLY single bonds'
- in very few cases, candidates got the reasoning the wrong way round, namely incorrectly stating that it was unsaturated
- occasionally the incorrect term 'no spare bonds' was seen, given as an alternative for 'no double bonds'.

5CH1H_01_Q03bi

Question Introduction

This was very well answered by candidates. Most candidates answered in terms of the consequences of global warming, such as ice caps melting and sea levels rising.

It was pleasing to note, when compared to previous years, very few responses were incorrectly referring to 'holes in the ozone layer'.

Common errors and misconceptions seen by examiners included:

- commonly incorrect responses referring to 'burning fossil fuels'.

5CH1H_01_Q03c

Question Introduction

This was generally well answered on the whole, with many candidates scoring full marks, for the identification of the correct formulae and subsequent balancing.

Common errors and misconceptions seen by examiners included:

- in several responses, candidates only wrote the correct formulae, without balancing. Consequently, they scored just 1 mark
- examiners noted that many candidates lost marks due to the careless writing of formulae, such as 'HCL' or 'Hcl', rather than HCl
- a common error, in responses which did not score, was 'H₂Cl₂' given rather than '2HCl' as one of the products.

5CH1H_01_Q03di

Question Introduction

The majority of candidates did not score. Very few responses correctly referred to 'polymerisation'.

Common errors and misconceptions seen by examiners included:

- many responses incorrectly referred to 'precipitation', 'electrolysis' or 'oxidation'.

5CH1H_01_Q03dii

Question Introduction

A significant number of candidates did not score the mark for naming the solid produced, namely poly(tetrafluoroethene). This was a little surprising, given the fact that the name of the monomer, the more difficult part of the name, was provided in the stem of the question. Of the correct responses seen, many candidates were able to score with either Teflon or PTFE. Pleasingly, of those candidates who gave the chemical name of the polymer, most managed to spell it correctly.

Common errors and misconceptions seen by examiners included:

- the most common incorrect answers included: 'wax', 'precipitate', 'white solid' and 'plastic'.

5CH1H_01_Q04ai

Question Introduction

This was very well answered. The majority of candidates were able to balance the equation with the numbers '4' and '3' respectively. The most common error was '2' and '3', which scored 1 mark only.

5CH1H_01_Q04b

Question Introduction

The majority of candidates were able to score full marks by reference to the fact that the gold alloy is both 'stronger' and 'cheaper' than pure gold, or by the reverse argument. Many candidates did go into unnecessary detail, regarding the structure of alloys, which was not asked for in the question. Very few candidates identified the alloy as 18-carat or the pure gold as 24-carat.

Common errors and misconceptions seen by examiners included:

- in many incorrect responses, marks were lost for not making a correct comparison between the two types of gold, often just quoting the data from the table
- occasionally properties of gold, not mentioned in the table, such as attractiveness or resistance to corrosion, were discussed. It clearly mentions in the question that information from the table needs to be used.

5CH1H_01_Q04ci

Question Introduction

The majority of responses correctly identified the method of extraction of sodium from its ore as electrolysis. The most commonly seen incorrect answers referred to 'heating with carbon'.

5CH1H_01_Q04cii

Question Introduction

Most candidates scored just 1 mark of the 2 marks available, by reference to the fact that 'sodium is more reactive than carbon'. A few candidates were able to score the 2 marks, by reference to sodium being more reactive than carbon or aluminium, coupled with the fact that electrolysis is a more powerful or stronger method of extraction. Very few referred to 'reduction' or made use of the information about aluminium in their responses.

Common errors and misconceptions seen by examiners included:

- most candidates were able to make a comparison of relative reactivity, but were unable to give the reason why electrolysis is used
- this question is analogous to questions from previous exam series; but most candidates were unable to explain why electrolysis is used, namely that it is a more powerful method of reduction.

5CH1H_01_Q04d

Question Introduction

This was well answered, with the majority of candidates able to score full marks. In a small proportion of the excellent responses seen, answers were directly linked to the example given in the question. The most commonly correct explanations involved both a reference to shape memory alloys returning to their original shape through heating, with fewer candidates referring to use of an electric current.

Common errors and misconceptions seen by examiners included:

- although the word 'remembers' shape was used in many responses which is not creditworthy, more often than not it was qualified by a correct reference to 'returns to original shape...' to score the first marking point
- many responses stated only that shape memory alloys return to their original shapes and scored 1 mark only, since there were no references to heating or electric current
- some responses were completely wrong, in that they stated that the shape could not be changed when formed or alloys simply took the shape of their environment.

5CH1H_01_Q05bi

Question Introduction

This was well answered on the whole. Most candidates were able to score the 2 marks available for correctly describing cracking.

Common errors and misconceptions seen by examiners included:

- in many cases, when 1 mark was scored only, this was for a correct reference to the first marking point, namely decomposition of long molecules. However, invariably the second marking point was not gained, since there was no specific reference made to 'hydrocarbon / alkanes'
- in many cases, cracking was confused with the process of fractional distillation, with many incorrect references seen relating to 'separating hydrocarbons / fractions'.

5CH1H_01_Q05bii

Question Introduction

This was generally well answered, with many responses, giving a range of fully correct possible products of the cracking of butane, mainly methane, ethane or ethene, to score the 2 marks available.

Common errors and misconceptions seen by examiners included:

- in many cases, when 1 mark was scored only, this was for a correct reference to the first marking point, namely a structure showing the correct number of carbon and hydrogen atoms, but with incorrectly shown bonding
- in a few cases, when 1 mark was scored only, repeating units of polymers were drawn, which scored 1 mark since they had the correct number of carbon and hydrogen atoms
- in many cases, it was apparent from the responses that candidates had misread the question and incorrectly drew a structure of butane, rather than a product of its cracking
- a surprising number of candidates showed the symbol B (for boron) instead of C (for carbon), assuming B represented butane
- many incorrect structures were shown with the hydrogen and carbon atoms the wrong way round.

5CH1H_01_Q05c

Question Introduction

On the whole, candidates found the demand of this extended writing question challenging, but were able to access the available marks by identifying and explaining the disadvantages and disadvantages of using hydrogen in cars rather than petrol.

Many candidates did access Level 1 (1-2 marks) by reference to two advantages/disadvantages or one advantage/disadvantage explained. At Level 2 (3-4 marks), responses referred either to a combination of three advantages/disadvantages (not explained) or one explained advantage/disadvantage and one advantage/disadvantage (not explained). At Level 3 (5-6 marks), of which there were fewer, but some excellent responses seen, detailed responses referring to both an explained advantage and an explained disadvantage, were expected.

Typical responses, common errors and misconceptions seen by examiners included:

- many candidates identified advantages and/or disadvantages, but did not explain them. However, they could access to Level 2, by referring to a mixture of three advantages or disadvantages'
- some candidates gave accounts of the advantages/disadvantages of petrol, not hydrogen as required in the question
- most candidates identified 'water as a product of combustion' or 'renewable fuel' as advantages, without explaining these
- most candidates identified 'storing under pressure' or 'production by electrolysis of water' as disadvantages, again without further explanation
- in some cases, candidates confused hydrogen with biofuels
- another typical misconception was that hydrogen is renewable because it is abundant in the air.

5CH1H_01_Q06bi

Question Introduction

This question was very poorly answered. Very few candidates were able to score the 3 marks available. It was evident from examiners that few candidates understood the process of heating to a constant mass.

Typical responses, common errors and misconceptions seen by examiners included:

- it would appear that many candidates misread the question and assumed that they were being asked if the reaction had proceeded at all; so many suggested adding water to the product to see if there was a reaction to produce calcium hydroxide
- it would appear that many candidates misunderstood the question and thought that the experiment was about investigating conservation of mass
- most candidates omitted the need to reheat the calcium oxide, but described the test for carbon dioxide and gave the wrong inference about the presence of carbon dioxide, indicating the reaction is complete instead of the absence of carbon dioxide.

5CH1H_01_Q06bii

Question Introduction

This was generally well answered. Most candidates were able to score at least 1 of the 2 marks available for correctly writing the formulae of the reactants.

Typical responses, common errors and misconceptions seen by examiners included:

- many candidates incorrectly omitted 'H₂O' as one of the products and scored just 1 mark for stating the correct reactants
- many attempted to incorrectly balance the correct formulae,
- several candidates gave word equations, despite the question clearly asking for a balanced equation
- many candidates were careless with writing formulae, especially when the more difficult formulae were given in the question. Many typically wrote Co₂ or H₂O for the formulae of carbon dioxide and water respectively.

5CH1H_01_Q06c

Question Introduction

On the whole, candidates found this extended writing question very straightforward. They were able to access the available marks by explaining how the four rocks given in the question were formed. The majority of candidates were able to access Level 2 to Level 3. Typically, examiners noted that many of the better candidates clearly structured their answers logically. It was clear that candidates had been thoroughly prepared for this aspect of the specification.

Many candidates did access Level 1 (1-2 marks) by reference to an explanation of the formation of one of the rocks. At Level 2 (3-4 marks), candidates were able to explain the formation of at least three rocks with at least two of these in detail. At Level 3 (5-6 marks), candidates were able to explain the formation of all four rocks with at least three of these in detail.

- the most common detailed explanations were often for granite and basalt, with statements about metamorphic and/or sedimentary rocks, which scored Level 2
- fewer candidates explained the formation of metamorphic rock in detail, if they did, it was for references to limestone and sometimes, the sources of heat and pressure
- the most common route for Level 3 responses was: detailed explanations for granite, basalt and sedimentary rock formations with metamorphic rock explained in less detail
- in some cases, there was some confusion of the formation of sedimentary rock with metamorphic rock, with some responses incorrectly referring to formation of sedimentary rock requiring both heat and pressure.

Paper Summary

In order to improve on performance, candidates should:

- read all the information in the question carefully and use this to help them answer the question
- learn the key definitions for key processes, such as electrolysis and cracking
- ensure that formulae, especially in balanced equations, are written carefully, with particular emphasis on correctly writing upper and lower case symbols in formulae, coupled with correctly subscripted numbers,
- practice writing the names of common polymers highlighted in the specification
- understand what is meant by heating to constant mass, to prove that a reaction is complete, such as in the thermal decomposition reactions of metal carbonates
- with extended writing questions, check their responses, to ensure that when a point has been made it has been linked to an explanation if necessary.

