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General Certificate of Secondary Education

Science A 4405 / Chemistry 4402

CH1FP Unit Chemistry 1

Report on the Examination

2012 examination – January series

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Science A / Chemistry
Foundation Tier CH1FP

General

This was the first paper for the new specification. The paper was out of sixty marks and the students had one hour in which to complete it. There were seven questions on this paper. Questions six and seven were common to Foundation and Higher Tiers. They were targeted at grades D and C. The first five questions were targeted at grades G to E.

This paper was more difficult for students than previous papers on core chemistry. This reflects the requirements of the new GCSE subject criteria and the new specification. Half of the marks on the paper are for application of skills, knowledge and understanding in practical and other contexts and for analysing and evaluating evidence, making reasoned judgements and drawing conclusions. Students should be prepared to expect that they will be given unfamiliar contexts and information that assess these objectives. Familiar contexts are those mentioned in the specification and assess recall, selection and communication of students' knowledge and understanding.

Most students followed the instruction to draw a ring around the correct answer to complete the sentence, although a few students did select more than one word.

The mark scheme was designed to allow students to gain marks for showing knowledge, understanding and application of chemistry. The extended response questions caused problems for some students who could not organise their answers. However, students are better at fully answering questions and therefore gained more than one mark on questions that were worth more than one mark.

The majority of students appeared to have sufficient time to complete the paper. A few students used up a lot of space by repeating the question, which really is not needed in an examination as it does not gain them any credit. There was a large number of students whose scripts were difficult to read, either due to poor handwriting or the use of pens with other than black ink, or both.

Students are better at fitting their answers into the space available, but a few students used additional pages to write a few words, which would have fitted on to the original paper.

Basic knowledge and understanding of how science works in familiar and in unfamiliar situations, including in the laboratory, are tested throughout this paper. This means that it is essential that students read and analyse the information provided, then read and understand the question before writing their response. Students should then read through their answers, especially those that are descriptions or explanations. Many students use 'it' or 'they' without any clear indication of what the student is referring to.

This paper produced a good degree of differentiation amongst students with a fair spread of marks.

Question 1 *(Low Demand)*

(a) Most students knew the name electron. The charge on the proton was less well known.

(b) **(i)** The majority of students knew that gold and carbon are elements.

(b) **(ii)** It was surprising that most students did not understand that carbon is a non-metal.

(c) Only one third of students gained both marks for knowing that gold is alloyed because pure gold is too soft to make a ring.

(d) The majority of students scored one or two marks on this question. Less than half of the students gained all three marks.

Question 2 *(Low Demand)*

(a) It was surprising that most students did not know that iron is produced from iron oxide by reduction.

(b) Most students realised from the information given that carbon is less reactive than aluminium.

(c) There were some clear answers showing a good understanding of ions and of electrolysis. However, most students did not use the diagram to simply state that aluminium ions are positively charged. Very few students understood that aluminium ions are attracted to or move towards the negative electrode. Students need to have an understanding of the different particle types, that is, 'ions', 'atoms' and 'molecules'.

(d) The vast majority of students managed to score at least one mark for correctly understanding that aluminium is used to make cans because aluminium has a low density and is resistant to corrosion

(e) Almost half of the students were able to analyse the information and correctly select one advantage and one disadvantage of recycling aluminium to make aluminium cans. Several students did not gain credit because they ticked two advantages and two disadvantages.

Question 3 *(Low Demand)*

(a) **(i)** Most students knew that compounds made up of carbon and hydrogen are called hydrocarbons.

(a) **(ii)** The majority of students were able to correctly answer this question using the information given in the table.

(a) **(iii)** This part was poorly answered. Most students do not understand that in fractional distillation the crude oil is heated to evaporate most of the compounds. Then, as the vaporised compounds rise up the fractional distillation column, they cool and condense at different temperatures.

(b) **(i)** Quite a few students managed to gain both marks for understanding that in the apparatus steam would be produced in W and the steam and oil would be condensed in Y.

(b) **(ii)** Most students used the diagram correctly to complete the sentence that when oil separates from the water, the oil floats.

(b) **(iii)** A few students thought incorrectly that the addition of an emulsifier to form an emulsion would remove the water from the oil. Also, restating the information given that part Z can be used to remove water from the oil did not gain any credit. Only a small number of students gave clear answers showing they understood the function of the tap. Despite this, many gained both marks for describing how the water could first be let out of Z while retaining the oil. Some students thought separation was achieved by filtering and stated that 'oil would be too thick to filter through'. Other students thought that the contents of Z could be heated to evaporate the water leaving the oil behind, which failed to answer the question asked.

Question 4 ***(Low Demand)***

(a) **(i)** Most students could not identify that the reaction to make ethanol from sugar is fermentation.

(a) **(ii)** Most students answered the first part correctly but fewer were able to identify the gas that turned the limewater cloudy. A significant proportion thought that the limewater turned cloudy because it was reacting with the yeast or with the sugar. A number of students instead of using words wrote the carbon dioxide formula, this would have been acceptable but many used a superscript.

(b) **(i)** Generally well answered. Most students gave a correct, simple description of the trend for the amount of ethanol used and usually made accurate reference to the years indicated. There were a number of students who referred to a decade (80s or 90s) rather than using a specific year for when the increase in ethanol used changed and began to decrease. Several students incorrectly referred to the label on the vertical axis, describing this as 'the number of people using ethanol' rather than the 'amount of ethanol used as a fuel'.

(b) **(ii)** Nearly half of the students gave a variety of correct suggestions. Confusion was evident in some suggestions over the source of the ethanol. Some students thought the ethanol came from petrol or from oilfields

Question 5 ***(Low Demand)***

(a) There were only a small number of correct answers. This indicates that the number of reacting molecules or the number of atoms involved in symbol equations is not well understood. Many students could correctly name three of the chemicals. The main difficulty experienced was that very few students knew that CH_4 is methane. It was surprising that H_2O, the formula for water, was not always known.

(b) This was the first of the new six mark questions including quality of written communication. This was marked holistically, the answer linked to three levels on a best fit basis. The number of positive impacts and negative impacts was taken into account, as was the detail given in each one. A good answer would cover both the positive impacts and negative impacts of quarrying limestone and making cement. The answer should be written as continuous prose. Bullet points are acceptable, however, each point should be written as a complete sentence. No credit is given for simply repeating things that are given in the stem to the question. The spelling, punctuation and grammar, together with the use of specialist terms, are also considered before a final mark is awarded. Most students were able to give at least one positive impact and one negative

impact of quarrying in this area. However, although descriptions were often clear, many lacked the necessary detail to achieve marks at the highest level. Vague comments, such as 'this is bad for the environment' or 'this causes a lot of pollution' are not creditworthy. Where reference is made to visual, noise or atmospheric pollution, students must clearly describe the source of this pollution to gain any credit. Not surprisingly, few students scored full marks, but equally very few failed to score.

Question 6 *(Standard Demand)*

(a) **(i)** Most students correctly worked out the formula for heptane from the information given.

(a) **(ii)** Very few students were able to write the general formula for the alkanes, even though there was much prompting. A surprisingly large number of students did not attempt to answer this question.

(b) **(i)** There was only a small number of correct answers. This indicates that the names of simple molecules are not well known. A few students realised that CO is the formula for carbon monoxide but many others instead gave 'carbon oxide', 'carbon dioxide' or 'carbon hydroxide'.

(b) **(ii)** Students often achieved a mark by noticing that there is less oxygen involved in Reaction 2 than in Reaction 1. Only a small number of students made reference to complete, partial or incomplete combustion. Few students realised that the cause of the different carbon compounds was linked to the amount of oxygen used in the reaction. The most common vague reason given was 'there are different amounts' without reference to oxygen.

(c) **(i)** A majority of students were able to correctly answer this question using the information given in the table.

(c) **(ii)** The presence of water vapour from the combustion of petrol was not well known. Students offered many different, incorrect gases in their responses.

(c) **(iii)** Most students appeared to think that sulfur dioxide was in the air or the fuel. Many students failed to say that sulfur dioxide is produced because there is sulfur in the petrol but just mentioned that sulfur reacts with oxygen to produce sulfur dioxide. Some students thought that the petrol engine would not operate without sulfur.

(c) **(iv)** Some students did think that there was nitrogen in the fuel. Not many students realised that it was nitrogen and oxygen in the air that were reacting. Very few students realised that it was the high temperatures in the engine that allowed the reaction between nitrogen and oxygen. Students did not gain credit for saying that nitrogen and oxygen mix, rather than react together. The reaction of nitrogen with carbon dioxide to produce nitrogen oxides was a common error.

(d) In the final part of this question, many students referred to global warming, but very few mentioned that the carbon dioxide levels were increasing or that the carbon dioxide produced had been locked up in fossil fuels. A number of students also incorrectly included some reference to global dimming and/or the ozone layer in their answer.

Question 7 *(Standard Demand)*

(a) (i) Most students could interpret the Richter scale value of the earthquake from the information given in the question.

(a) (ii) The majority of students only got one or two marks, mainly because they repeated the same idea twice. The most common correct answers were to do with predicting exactly when or where an earthquake might happen, that scientists had often been wrong before, that the government did not want to cause panic or unnecessary expense and that the earthquake might be very minor or cause no damage to buildings.

(b) (i) Many students carried over their thinking on earthquakes to this part of the question and attempted to link their answer on continental drift to occurrence of earthquakes. A number of students just re-stated the stem of the question but most were able to gain marks by conveying the idea of continents moving. The idea of a supercontinent was less well known. Most students could not explain clearly Wegener's theory of continental drift.

(b) (ii) Although students were given the implication that continental drift is caused by mantle dynamics, few students scored one or two marks here. A small number of students were aware of convection currents in the mantle and their affect on tectonic plates. Fewer realised that they should go further and explain how the convection currents are formed. There were some very clear answers given by students but many answers indicated confusion between key terms such as 'plates'/'continents' and 'mantle'/ 'core'/ 'crust'.

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