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General Certificate of Secondary Education

Science B 4462 / Chemistry 4421

CHY1H Unit Chemistry 1

Report on the Examination

2012 examination – January series

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Science B / Chemistry
Higher Tier CHY1H

General

There were five questions on this paper. The first two were common to Foundation and Higher Tiers. They were targeted at grades D and C. The final three questions were targeted at grades B to A*.

The paper produced the usual range of answers, from students whose responses showed an excellent understanding to students who would have found the Foundation paper a more positive experience.

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 becoming better at fully answering questions and therefore gained more than one mark on the 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 and just wastes their time. There seemed to be 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 were far better at fitting their answers into the space available; there were far fewer additional pages, 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 everyday 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.

As in previous papers, this paper produced a good degree of differentiation amongst students with a fair spread of marks.

Question 1 *(Standard Demand)*

(a) (i) This question was a good discriminator. The stem informed students that carbon neutral means that there is no increase in the amount of carbon dioxide in the atmosphere. Students were then expected to link the concept of carbon neutral to the idea that the crops absorbed carbon dioxide, which was then released when the biodiesel was used as a fuel. It is surprising how many students think that biodiesel emits no carbon dioxide on burning. Many students tried to link the concept that biodiesel is carbon neutral to trees, which was the focus of the second part.

(a) (ii) Most students scored one or two marks. Here the idea was either that clearing forests by burning trees added to the carbon dioxide in the atmosphere or that the removal of these trees meant that there was less photosynthesis to remove carbon dioxide from the air.

(b) Surprisingly, less than half of the students could give a correct answer as to why there is an increasing demand for biodiesel. The increasing demand for biodiesel was most commonly linked to the fact that fossil fuels are running out or to the fact that biodiesel is renewable.

(c) **(i)** The ethical issue caused by the use of crops for biodiesel instead of for food was fairly well known.

(c) **(ii)** This part was poorly answered. The economic impact of increasing food costs was less well known. A lot of students did not understand the distinction between ethical and economic factors.

Question 2 ***(Standard Demand)***

(a) **(i)** Nearly all of the students recognised that earthquakes happen on a plate boundary.

(a) **(ii)** Surprisingly, more than half of the students could not give a correct suggestion as to why scientists cannot predict when earthquakes will happen. The main correct suggestions were that scientists do not know what happens below the Earth's crust or that there is no pattern as to when earthquakes occur. The most common incorrect answers to the inability of scientists to predict when an earthquake will happen simply repeated the stem.

(b) **(i)** Wegener's lack of evidence or that he could not explain how continents could move was well known.

(b) **(ii)** Nearly all of the students scored one or two marks. The majority of these students only got one mark mainly because they repeated the same idea twice. This was the idea that the coastlines had shapes that fit or that there were matching sedimentary rocks on both continents. The similarity of the sedimentary rocks or the similarity of the fossils in them was often not mentioned.

(c) This question was a good discriminator. The explanation of what is causing the continents of South America and Africa to move further apart was generally well understood. These students understood that convection currents in the mantle formed by heat from radioactive decay caused the continents or their plates to move.

Question 3 ***(Standard Demand)***

(a) This question was a good discriminator. The majority of students were able to correctly describe that the formation of coal commenced with the absorption of carbon dioxide by trees during photosynthesis. Many students omitted the release of oxygen in this process. Most students did not relate photosynthesis by trees to the change in the amount of carbon dioxide and oxygen in the earth's early atmosphere. Many students recalled that coal contained 'locked up carbon' but often students concentrated on the release of carbon dioxide when coal is burnt in present times.

(b) Surprisingly few students were able to correctly identify all three elements present in coal. Often oxygen was included as one of the three elements present in coal, but this response did not gain credit. Some students adopted the strategy of writing out the formulae for the named compounds and then circling and extracting the three correct elements.

(c) **(i)** Most students could balance the chemical equation.

(c) **(ii)** This question was a good discriminator. Most students gained the first two marks.

These students correctly explained that the increase in atmospheric pollution was due to the reaction producing carbon dioxide and consequently increasing global warming. Many students recognised that the decrease in atmospheric pollution was due to the reaction removing sulfur dioxide and so reducing acid rain. Very few students explained that the sulfur dioxide was removed by the reaction with calcium carbonate or calcium oxide.

Question 4 ***(Standard / High Demand)***

(a) A majority of the students scored one or two marks. Most students were aware that the low density would make aluminium useful for overhead cables as it would reduce the weight on pylons. The more able students gave excellent answers comparing the relative conductivity and availability of copper and aluminium while most were able at least to realise that 60% was a good conductivity and at least better than iron. A significant number of students thought that they would gain full marks simply by restating all the data given for aluminium in the table.

(b) This question was a good discriminator. The most common response gaining no credit was 'carbon dioxide and sulfur dioxide are produced', without explaining the impact that these gases would have on the environment. The most common correct responses were that recycling requires less energy and conserves copper resources. Simply repeating the information given in the stem of the question will not earn marks.

(c) **(i)** This question was a good discriminator. Considering how often a question about cracking is asked, it was surprising that many students gained no marks. Of those that did gain marks most gained one for mentioning that the process was 'cracking'. Only a minority of students were able to identify and explain the reaction conditions needed, with a few going on to give correct balanced equations.

(c) **(ii)** Similarly, it is surprising that this very basic structural equation, shown in most text books and taught by most teachers, was not more widely recognised. Many students proposed some very strange bonding structures for poly(ethene).

(c) **(iii)** While most students recognised that PEX had links of some kind between the polymer chains whereas poly(ethene) did not, many students were confused about what these links actually were. Very few students correctly referred to PEX having bonds linking the polymer chains or to poly(ethene) having only weak intermolecular forces holding the polymer chains together. Many students knew that the polymer chains in poly(ethene) could slide over each other when heated. A few students correctly stated that the bonds in PEX prevented this movement of the polymer chains or kept the polymer chains in a fixed position.

Question 5 ***(High Demand)***

(a) Most students could calculate the mean total mass added to break the model sleeper that had 20% cement by volume, although a few students omitted the anomalous result.

(b) Most students made a valid conclusion from the results.

(c) **(i)** There was a wide range of correct suggestions of further factors that should be taken into consideration. The main correct suggestions were that the company should take into consideration 'the availability of materials', 'the cost of the materials' and 'if the full-size concrete railway sleeper could take the weight of a train'.

(c) **(ii)** Students could answer yes, no or maybe to the question 'Do you agree with the

scientist's claim?' because no mark was allocated to the answer. This part required students to justify their answer by making comparisons between using concrete or using wood for railway sleepers. Loss of habitats or biodiversity by quarrying was often stated, however, there was a lot of confusion between the managed use of woodland and deforestation. Deforestation would destroy habitats and reduce biodiversity, however, managed woodland would not only be carbon neutral, but it would also possibly provide habitats and increase biodiversity. Most students scored one or two marks, but very few students gave enough information to justify their answer for full marks.

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