



General Certificate of Secondary Education

Science B 4462 / Chemistry 4421

CHY1H Unit Chemistry 1

Report on the Examination

2012 examination – June series

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Science B / Chemistry
Higher Tier CHY1H**General**

There were six questions on this paper. The first two were common to Foundation and Higher Tiers. They were targeted at grades D and C. The final four 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.

The majority of students appeared to have sufficient time to complete the paper. A few students used up a lot of space and wasted time by repeating the question. 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 other than black, or both. Students should be aware that any part of an answer written outside of the clip area is not scanned, so that piece of writing cannot be seen by the examiner.

In this series students were far better at fitting their answers into the space available; there were far fewer additional pages. Still, a few students used additional pages to write very few words, which could have fitted on 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 is being referred to.

Question 1 (Standard Demand)

- (a) (i) Most students made a good attempt at a curve of best fit; however, several drew a straight line or joined the points dot-to-dot. Using a black pen to answer all questions created problems for those students who tried to improve their line.
- (a) (ii) The concept of viscosity challenged most of the students. Many students recognised that the viscosity of petroleum diesel was unaffected by temperature. Some students incorrectly concluded that the viscosity of biodiesel increased as temperature increased. Weaker students gained one mark by relating their answer to time or rate of flow of one of the diesels. A significant number of students' answers only referred to 'diesel', so it was difficult to decide whether these students were referring to biodiesel or to petroleum diesel.
- (a) (iii) Few students were able to translate the viscosity of the biodiesel into the way it would flow in a practical situation. At lower temperatures the biodiesel would flow slowly into the fuel tank or into the engine and may even solidify or block pipes. Some students correctly suggested that the fuel would be difficult to ignite.

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- (b) (i) Many students correctly identified global dimming. There was the usual range of incorrect answers including, global warming, acid rain and damage to the ozone layer.
- (b) (ii) A high percentage of students got this right. The main incorrect answers were 58% or 44%.
- (b) (iii) Only a few students recognised that using biodiesel would increase the amount of nitrogen oxide formed and gained the second mark by linking this to (an increase in) acid rain. Most students recognised that using biodiesel would increase the amount of nitrogen oxide formed but did not link this to (an increase in) acid rain. Again there were a large number of incorrect answers including global warming, global dimming and damage to the ozone layer.
- (b) (iv) The stem informed students that a carbon neutral fuel does not add extra carbon dioxide to the atmosphere. So it was surprising how many students think that a 'carbon neutral fuel' would release no carbon dioxide into the atmosphere. Many students did not appreciate that the carbon dioxide released by biodiesel had been absorbed by the plants that were grown to produce biodiesel. Some responses suggested that carbon dioxide was released when the plants were burnt rather than when the biodiesel was burnt. Other students believe that carbon neutral means zero carbon emissions and do not make the link to photosynthesis by plants.

Question 2 (Standard Demand)

- (a) This was well answered in terms of improving the appearance of the sweets, although there were several incorrect answers that the colouring was added to improve the taste of the sweets or to provide an energy boost or even to preserve the sweets.
- (b) The vast majority identified X.
- (c) There were a few excellent answers that gained all three marks. Many students had difficulty interpreting the chromatogram. Some students incorrectly thought that W, X, Y and Z were also sweets. A comparison of the number of colourings and the types of colourings in each sweet was required. The most common marks awarded were for 'the sweets may cause hyperactivity', 'both sweets contain W and Y' and 'sweet S contains more colourings than sweet P'. Fewer students mentioned the actual number of colourings in each sweet or mentioned that both sweets did not contain X and Z.

Question 3 (Standard Demand)

- (a) (i) Less than half of the students knew that an ore contains enough metal to make it economical to extract the metal.
- (a) (ii) The formulae for the two products were usually correct and many went on to correctly balance the equation.
- (a) (iii) Less than half of the students knew that the type of reaction that produces a metal from its metal oxide is reduction.
- (b) (i) Most students realised that the carbon in the molten iron would react with the oxygen to produce carbon dioxide, which would escape as a gas.

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- (b) (ii) The idea of different steels having different properties or having different uses was well known.
- (c) Very few students gained both marks. The most common mark awarded was for 'copper is expensive'. Most students did not explain why copper is expensive, that is, the supply of copper-rich ores is limited.

Question 4 (Standard / High Demand)

- (a) (i) The majority of students understood that calcium carbonate is made from three elements. A misunderstanding of number of elements against number of atoms produced the majority of errors.
- (a) (ii) Most students understood that nitrogen did not react and some went on to explain why. Very few answers reflected an understanding that methane was reacting with oxygen from the air or burning to produce carbon dioxide. Few answers mentioned that carbon dioxide is a product from the decomposition of calcium carbonate. One misconception was that oxygen reacted with calcium carbonate to produce carbon dioxide.
- (b) This was well answered. Most of students correctly described the reaction of calcium oxide with water to produce calcium hydroxide or that heat is released from this reaction.

Question 5 (High Demand)

- (a) (i) There were a lot of vague answers. About half of the students realised that this happened a long time ago, so we cannot be certain about what happened. Another correct suggestion was that scientists do not know what happens below the Earth's crust.
- (a) (ii) Many students understood that the Earth had cooled over millions of years. However, most did not appreciate that this caused the Earth to contract or shrink. Some students ignored the instruction to use the diagram and suggested that volcanoes formed the Earth's mountain ranges.
- (b) (i) This question was a good discriminator. The explanation of how the tectonic plates are able to move was generally well understood. The better students understood that convection currents in the mantle formed by heat from radioactive decay caused the tectonic plates to move.
- (b) (ii) Students who used the diagram were able to describe that the oceanic plate and the continental plate are moving together or are colliding which caused the continental plate to be pushed up forming a mountain range. Although the formation of mountain ranges had not been asked before, many students used the diagram to gain both marks.

Question 6 (High Demand)

- (a) This question was a good discriminator. The explanation of how fractions, such as naphtha, are separated from crude oil was generally well understood. The better students gained three marks for describing that crude oil is heated; this causes evaporation, and as the vapours rise up the fractionating column they condense at a number of different temperatures.

- (b)** Good students gave clear advantages and clear disadvantages, and made appropriate comparisons of the environmental impact of using milk bags instead of milk bottles. Weaker students were unable to do more than simply repeat information already given in the article. These students also often used basic statements about possible environmental issues, such as, 'recyclable', 'cause pollution' and 'produce carbon dioxide' without a link to the type of milk container. The biggest problem was that many students just listed the advantages and disadvantages without mentioning the comparisons that the question required.

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