



General Certificate of Secondary Education

Science A 4405 / Chemistry 4402

CH1HP Unit Chemistry 1

Report on the Examination

2012 examination – January series

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Science A / Chemistry
Higher Tier CH1HP**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 two and three were common to Foundation and Higher Tiers. They were targeted at grades D and C, along with question one. The final four questions were targeted at grades B to A*.

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.

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 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 were 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 (Standard Demand)

- (a) Nearly every student could draw the electronic structure of a carbon atom.
- (b) This question was a good discriminator. Most knew that the missing sub-atomic particle was a neutron. Again, most students could give the number of each particle, but a significant minority did not gain full marks here.

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- (c) (i) The percentages of silver and copper were well read from the bar chart, although a few struggled with the scale. 8.5% was the most common incorrect response. It was good to see many adopting the strategy of marking horizontal lines on the bar chart to read off the values.
- (c) (ii) The last part gave a good spread of marks. Most knew that pure gold was too soft and too expensive, and that gold was alloyed to make it less so. However, common incorrect answers were to do with corrosion, reactivity, brittleness and appearance. Some students simply referred to the presence of the other two metals in the gold.

Question 2 (Standard Demand)

- (a) (i) Nearly every student got the formula for heptane correct.
- (a) (ii) Well over half of the students could complete the general formula for alkanes.
- (b) (i) Surprisingly, only about half of the students could give the correct name for CO. Common incorrect responses were 'carbon dioxide', 'carbon oxide' and 'carbon hydroxide'.
- (b) (ii) Far more students than in (b)(i) realised that the cause of the different carbon compounds was linked to the amount of oxygen used in the reaction.
- (c) (i) The correct answer of 15% was given by most students.
- (c) (ii) The presence of water vapour from the combustion of petrol was not well known.
- (c) (iii) Similarly, most students appeared to think that sulfur dioxide was in the air or the fuel. They had not realised that the sulfur was an impurity in the fuel.
- (c) (iv) Some students did think that there was nitrogen in the fuel. However, the majority of 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.
- (d) In the final part of this question, most 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.

Question 3 (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. Some students just re-stated the stem of the question but many were able to gain marks by conveying the idea of continents moving. The idea of
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a supercontinent was well known. Most students could not explain clearly Wegener's theory of continental drift.

- (b) (ii) This question was a good discriminator. Given the implication that continental drift is caused by mantle dynamics, most students scored one or two marks here. These students understood that mantle dynamics is convection currents in the mantle formed by heat from radioactive decay that causes the Earth's plates to move.

Question 4 (Standard / High Demand)

- (a) (i) Surprisingly only about a third of students realised that the extraction of iron was a reduction process.
- (a) (ii) About half of the students could correctly balance the equation.
- (b) (i) Very few students calculated that there was 55% aluminium oxide in the bauxite.
- (b) (ii) Few students realised that there would also be water or sodium hydroxide in the red mud.
- (b) (iii) A slight majority of students correctly suggested that the advantage of the bauxite quarry and extraction plant being close was related to transport.
- (c) In this last part, students struggled to appreciate the difference between environmental impacts and ethical or social impacts. Many students confuse recycling with re-using.

Question 5 (High Demand)

- (a) The description of how steam distillation was used to separate oil from plants was very well done, with over half of the students scoring three out of four marks. The main failing was to lose the last mark, for the removal of water from the oil, or an observation that the oil and water formed two separate layers.
- (b) (i) This question was a good discriminator. Most students realised that bromine water was decolourised in the presence of unsaturated fats, although "clear" and "transparent" were fairly common answers that did not get the mark.
- (b) (ii) Many answers to this part were incorrectly based on the idea that the fats could be easily separated or to do with health. Those students who realised what they were being asked scored well.
- (b) (iii) This question was a good discriminator. Many of the better answers to the last part scored full marks.

Question 6 (Standard / High Demand)

- (a) This question was a good discriminator. The wording of the first part of this question, 'in this reaction', seemed to confuse many pupils. Less than half of the students gave the correct test for carbon dioxide and its result. A significant proportion of the students added the limewater to the reaction mixture rather than the gas.
- (b) (i) The variables were familiar ground from ISAs and scored well, although a lot of answers surprisingly referred to the time intervals or the volume of carbon dioxide produced.

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- (b) (ii) In the last part, relatively few pupils referred to the graph in their answers, which would have earned up to two relatively low level descriptive marks. However, the mark most frequently obtained was that for 'sulfuric acid produces a solid'. The equivalent mark for nitric acid was often lost by pupils who clearly did not know the meaning of (aq) referring to a liquid or acid instead of to a solution.

Question 7 (High Demand)

- (a) (i) Most students identified the correct hydrocarbon as the odd one out and could explain why. A common error was to explain in terms of general formulae, when the question asked for a difference in structure.
- (a) (ii) There were many good displayed structures in the second part, but also many with bonds missing and others with far too many bonds. A small minority added bonds and atoms to the water molecule.
- (b) This question was a good discriminator. 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 advantages and disadvantages, both environmental and economic/social, were taken into account, as was the detail given in each one. The answer should be written as continuous prose. Bullet points are acceptable, however, each point should be written as a complete sentence. The quality of the conclusion was also considered. Ideally, the conclusion would not simply repeat the factors already given, but would give added value. A good answer would cover both the production of ethanol from crude oil and from sugar cane. 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. Not surprisingly, few students scored full marks, but equally very few failed to score.

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