



General Certificate of Secondary Education

Science A 4405 / Chemistry 4402

CH1HP Unit Chemistry 1

Report on the Examination

2012 examination – June series

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Set and published by the Assessment and Qualifications Alliance.

Science A / Chemistry
Higher Tier CH1HP**General**

This was the second 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 eight 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 five 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.

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 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.

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 is being referred to.

Question 1 (Standard Demand)

- (a) The majority of students achieved the mark for knowing that the centre of an atom contains neutrons and protons.
- (b) Many answers were disappointing, with charges the wrong way round on protons and electrons or charges attributed to neutrons. Some students, who did get the charges correct, omitted to mention that the opposite charges cancelled each other out.
- (c) Nearly all students realised that atom A was unreactive because it had a full outer shell. Others mentioned that A is in group 0 or is a noble gas.

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- (d) Students who identified the correct pair of atoms usually went on to explain why they had similar chemical properties. The most common incorrect pair was B and D, with the reason given that they were in the same period.

Question 2 (Standard Demand)

- (a) Less than half of students gained the mark here but those that did stated that the extraction took several stages or the extraction used more energy. A significant number of students were confused and thought that titanium was expensive because the metal could only be extracted by electrolysis, rather than reduction using carbon. A large number of incorrect answers related cost to availability of the ore and to reactivity of the ore.
- (b) The vast majority of students realised that carbon dioxide was the only waste product on the flow chart.
- (c) Magnesium chloride was often identified as the example of recycling, but descriptions were poor, so students did not always gain full marks. The answer required was that the magnesium chloride was electrolysed into magnesium and chlorine, which were then reused in the process.
- (d) Several students did not attempt this question, which was poorly answered. It was not well known that argon is unreactive, but a few students went on to mention that oxygen or nitrogen in the air would react with one of the metals present.
- (e) The majority of students managed to calculate the correct answer of 240 kg.
- (f) This question was poorly answered. Determination of the mass of waste rock proved very difficult, despite the fact that it was just the difference between the two lines.

Question 3 (Standard Demand)

- (a) (i) Many students do not fully understand the process of the fractional distillation of crude oil. Most students did attempt this question but less than half of students managed to gain both marks.
- (a) (ii) Most students only gained one mark here for stating carbon dioxide, carbon or carbon monoxide. Often the mark given for the product water was not awarded because many students stated hydrogen instead of water.
- (b) This is the QWC question and as such it was marked holistically. Several students gained no credit because they did not add to the information given in the stem of the question. Students found difficulty not only in expressing themselves clearly and organising the information but also in using scientific terms correctly. Many students gave sufficiently clear descriptions of the advantages and disadvantages of using plastic shopping bags made from poly(ethene) to achieve level 2 and three or four marks out of six. However, few students gave sufficiently detailed descriptions to achieve level 3. Weaker students added little to the information given in the question. The most common basic answers were reusing and recycling of the plastic bags but there was no detail of what the bags could be reused for or recycled into. It was not clear from the answers whether many knew the difference between reuse and recycle. Many weaker students focused on employment of people to make plastic bags and profit for the shops. Only rarely did these students give examples of specified problems caused by litter. Vague expressions such as 'cause pollution' and 'environmental damage' should be avoided.
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Question 4 (Standard / High Demand)

- (a) The majority of students gained only one mark for photosynthesis by plants or for carbon dioxide dissolving in the oceans. Common errors were animals photosynthesising and plants breathing in carbon dioxide.
- (b) (i) This question was poorly answered. Very few students realised why the gases methane, ammonia and hydrogen had been chosen. Most students simply repeated information given in the stem.
- (b) (ii) This question was poorly answered. Few students realised the uncertainty of the composition of Earth's early atmosphere and the probability that lightning was not continuous.

Question 5 (High Demand)

- (a) (i) This was not as well answered as expected. Hydrogen was a common incorrect answer.
- (a) (ii) Again this was less well answered than expected. Carbon was a common incorrect answer.
- (b) (i) Several students did not attempt this question. However, most students could balance the chemical equation.
- (b) (ii) Most students knew that sulfur dioxide was formed when fossil fuels were burned and that this caused acid rain. However few students knew the effect of acid rain on limestone, often describing physical processes, such as wears away limestone, rather than the chemical reaction between acid rain and calcium carbonate in the limestone.
- (c) (i) This question was poorly answered. Disappointingly few students knew that the methane was a fuel and that it was burned in the kiln, releasing carbon dioxide. Similarly, a lot of students thought that limestone (or the carbon in limestone) reacted with oxygen to form carbon dioxide. Few students stated that carbon dioxide is produced from the decomposition of calcium carbonate in limestone.
- (c) (ii) A significant minority of students did not attempt this question, which was poorly answered. Very few students realised that, apart from carbon dioxide, the other main gas coming out of the kiln was nitrogen from the air. The most common incorrect answer was methane.

Question 6 (Standard / High Demand)

- (a) (i) There were not many correct answers. The most common correct answer was that there was no emulsifier present, rather than that olive oil and water are immiscible.
- (a) (ii) It was pleasing to see some excellent explanations, with diagrams, of how emulsifiers work, including a good understanding of the terms hydrophilic and hydrophobic.
- (b) Many students did not attempt this question. About half of the students managed to gain both marks for correctly giving the bromine test and the result that the solution turns colourless.

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- (c) Many students did not attempt this question. About half of the students managed to gain at least one mark for describing the reaction and conditions needed to harden a vegetable oil.

Question 7 (High Demand)

- (a) Many students did not attempt this question. The cracking equation produced many poor answers. Often the products contained C_6 and H_{14} as well as CO_2 and H_2O .
- (b) Many students did not attempt this question, which was poorly answered. Most students did not give observations, such as, bubbling or fizzing but named the products.
- (c) This question was, as intended, a good discriminator. The command word was 'evaluate' and the question required an explanation of the importance of each issue described and a justified conclusion. The number of advantageous issues and disadvantageous issues, both environmental and economic/social, were taken into account, as was the detail given in each one. Bullet points are acceptable, however, each point should be written as a complete sentence. Ideally, the justified 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. Many students scored up to three marks, few achieving more. Many did not link the issues to their importance and very few gave a justified conclusion.

Question 8 (High Demand)

- (a) Many students did not attempt this question, which was poorly answered. Many had not read or understood the question properly and answered that the air contained carbon dioxide and oxygen. The concept of density of gases was not well understood.
- (b) (i) This question was poorly answered. A few students correctly realised that carbon dioxide would freeze and/or block the pipes. Others were very confused by the negative numbers used for the melting points and the boiling points.
- (b) (ii) The majority of students correctly identified helium and neon as the two gases that do not condense at $-200\text{ }^\circ\text{C}$.
- (b) (iii) Many students did not attempt this question, which was poorly answered. Only the better students were realised that argon and oxygen would not separate completely because there is only a difference of $3\text{ }^\circ\text{C}$ in their boiling points.

Grade boundaries and cumulative percentage grades are available on the [Results statistics](#) page of the AQA website

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