



General Certificate of Secondary Education

Science B 4462 / Chemistry 4421

CHY1H Unit Chemistry 1

Report on the Examination

2011 examination – January 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, A and A*.

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

The mark scheme was designed to allow candidates to gain marks for showing knowledge, understanding and application of chemistry. The extended response questions caused problems for some candidates who could not organise their answers. However, candidates are becoming much better at fully answering questions.

The majority of candidates appeared to have sufficient time to complete the paper. A few candidates do use up a lot of space by repeating the question, which may waste valuable time. Candidates were much better at fitting their answers into the space available; there were far fewer additional pages.

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 candidates read and analyse the information provided, then read and understand the question before writing their response.

As in previous papers, this paper produced good differentiation of the candidates with a good spread of marks.

Question 1 (Standard demand)

- a) (i) This question was well answered. Most candidates realised that there was very little copper in the ore. Some candidates calculated the percentage of waste produced. The most common incorrect suggestions related to the percentage of metal or copper in the Earth's crust.
- a) (ii) The majority of candidates gained this mark. The most commonly seen incorrect answer related to the abundance of the metal in the Earth's crust and the percentage of metal in the ore.
- b) (i) A good proportion of candidates gained credit here. The best answers came from candidates who appreciated that they had to compare the temperature of the electrolysis cell to the melting point of aluminium. Some candidates thought that the aluminium was liquid to ensure that the electrolysis process could occur, probably confusing this with the need for the mobility of ions in the electrolyte. A small number of candidates suggested it had to be molten for the movement of electrons. A significant number of candidates referred to boiling point instead of melting point.
- b) (ii) Many candidates gained one mark, but only a small proportion gained both available marks, for realising that the carbon in the electrodes would react with the oxygen formed at the electrode.
- b) (iii) This was generally well answered. The most common correct answers referred to 'using less energy' and 'saving resources'. Most candidates gained at least one mark, with a large proportion gaining both marks. The reasons for recycling

seem to be well understood. Unfortunately, a significant number of candidates who still answer in vague terms such as 'eco-friendly' or 'less waste gases'.

Question 2 (Standard demand)

- a) The majority of candidates used the word evaporated appropriately although there was some confusion in weaker answers as to where or when the evaporation process occurred. Many candidates realised that the different fractions boil/condense at different temperatures but very few linked the idea that the fractions had to be cooled in order to condense. Other candidates used the idea of vapours rising to a certain height in the fractionating column and unfortunately failed to mention that this was caused by differences in boiling point.
- b) (i) About half the candidates gained this mark. Some candidates did not make clear whether they were referring to one fraction or to all four fractions. Many candidates lost the mark because of imprecise language, for example, 'you can tell from the boiling point', 'they have a large number of carbon atoms' or 'they have more than one carbon atom'.
- b) (ii) The majority of candidates correctly related the change in the number of carbon atoms to the change in boiling point.
- c) (i) Only a minority of candidates gave a correct response. The most common incorrect answers were 'thermal decomposition', 'cracking' and 'fractional distillation'. A surprisingly large number of candidates did not attempt this part.
- c) (ii) Most candidates scored at least one mark, usually for the mention of 'cracking', with 'catalyst' or 'heat' often gaining the second mark. The most common incorrect answer was one based on a description of fractional distillation.

Question 3 (High demand)

- a) (i) This question was well answered with a majority of candidates gaining both marks. The most common correct response was that the carbon dioxide in the Earth's early atmosphere was removed by 'photosynthesis in plants'; also 'absorption of carbon dioxide by the oceans' and 'carbon dioxide being locked in sedimentary rocks' was quite well known. Incorrect responses included the loss of carbon dioxide through 'holes in the atmosphere' or 'holes in the ozone layer' and the fairly common statement that the decrease in the number of volcanoes led to a decrease in carbon dioxide levels. There are still many candidates who incorrectly write the formula for carbon dioxide as CO^2 , Co^2 or CO_2 and many who confuse 'photosynthesis' with 'respiration' or even with 'breathing'.
- a) (ii) The release of carbon dioxide by thermal decomposition of limestone was quite well known. More able candidates also gained the first mark for stating that limestone is calcium carbonate. A correct chemical equation, which gained both marks, was occasionally present. However, there were many responses that just repeated the information given, such as 'locked up carbon dioxide is released when limestone is heated' or more simply 'when heated limestone gives off carbon dioxide.' Many weaker candidates thought that the limestone reacted with oxygen to produce carbon dioxide.
- b) Candidates gained one mark for stating that there was an increase in carbon dioxide levels and often gained a second mark for the link to global warming.

Many candidates then went into a detailed explanation of the mechanism of global warming and some of its consequences. The final mark for the accelerating rate of increase of carbon dioxide levels was usually earned by most able candidates giving detailed answers. A significant number of candidates lost the global warming mark by reference to the 'ozone layer' or 'global dimming' or 'acid rain'. A similar number gave general consequences such as 'it will harm the environment'. Some candidates thought that the increase in carbon dioxide levels was so severe that if it continued it would lead to the oxygen levels in the atmosphere falling alarmingly so that all humans would suffocate.

- c) (i) This was very well answered, with 'no evidence' or 'no proof' the most common responses. However, ideas of land bridges and the lack of respect for Wegener amongst geologists at the time were also quite well known.
- c) (ii) This question was a good discriminator. Most candidates gained two marks for the mention of 'plates moving' and 'in the mantle'. A small majority of candidates gained all three marks because they understood that heat released by radioactivity produced convection currents within the mantle and these caused the Earth's plates/continents to move.

Question 4 (High demand)

- a) (i) Good candidates could answer this question, with a significant number answering in terms of 'gain of electrons'. Other candidates struggled to define 'reduction'. The most common incorrect answer was 'reduction means make it smaller'.
- a) (ii) There were many correct answers, but a surprising number of scripts were left blank. Possibly, candidates did not realise that they had to do something to the chemical equation.
- a) (iii) More able candidates knew the answer, but weaker candidates struggled to express themselves. Many candidates omitted the word 'atoms' and some claimed that 'both sides of the chemical equation had to be equal' or that 'the reaction would not work if it was not balanced'.
- b) (i) The majority of candidates realised that sodium was more reactive than titanium.
- b) (ii) Many candidates appreciated the role of argon in the reactor. There were several candidates who thought that because air is a mixture it could not be used in the reactor.
- c) (i) Many candidates knew the basic definition of an element, although weaker candidates omitted the word 'atoms' and just described the diagram of titanium.
- c) (ii) More able candidates were able to describe how the diagram showed that sodium chloride is a compound. Most candidates got the first mark for 'two different atoms', but omitted to say that they were bonded together. A disappointingly large number of candidates stated that they were mixed together. Some answers suggested that candidates just looked at the diagrams and assumed that the question was about metals and alloys.

Question 5 (High demand)

Many candidates wrote a lot but gained few marks. This was often because they used vague terms for the advantage or disadvantage, such as, 'saves time and money', 'quick and easy' or 'environmentally friendly'. As always, when specific pollutants are mentioned in the Specification they need to be stated for the mark. Significant numbers of candidates did not seem to realise that both an advantage and disadvantage were required for each of the methods. Many candidates did not gain credit because they either just defined each method or simply stated 'this method is better than the other method(s)'.

REUSE: Some candidates just repeated the information in the table by giving as an advantage 'can be used again' or 'bag is used again'. Many gave as a disadvantage 'forget to bring old bags to the supermarket'.

RECYCLE: Many candidates confused recycling with reusing so 'passing on germs' and 'unhygienic' were frequently given as a disadvantage and 'by recycling bags they can be used again' as an advantage. Many candidates confused 'melting' with 'burning'.

BURN: Most candidates repeated the information in the table that 'heat energy would be released' but many did not say how the energy could be used. A significant number of candidates did not realise that carbon dioxide would be given off.

DUMP: Most candidates just said 'convenient' or 'easy to do' as an advantage. Many candidates gave an advantage as 'it clears your house'. Several candidates stated it was good to dump the plastic bag because 'it was out of sight'.

Question 6 (High demand)

a) This question discriminated well. The more able candidates were able to explain the formation of carbon monoxide by incomplete combustion when oxygen supplies are limited and were even able to give one of the two possible reactions involved, in words or symbols. A surprising number of candidates think that the carbon monoxide is already in the diesel and that it is released or evaporated when the diesel is heated up in the engine. The next most common error was to believe that carbon monoxide is CO_3 , formed when CO_2 reacts with further O_2 from the air. Other incorrect explanations seen included 'carbon from the diesel reacting with heat', 'carbon and sulfur from the diesel reacting together', 'carbon reacting with sulfur dioxide' or 'carbon dioxide reacting with sulfur', all to form carbon monoxide.

b) This part also discriminated well, with only the most able scoring all five marks. However a large number of candidates did score three marks, usually for:

- stating that biodiesel is renewable or is carbon neutral,
- stating that biodiesel produces less acid rain (due to less sulfur dioxide) and/or biodiesel creates less global dimming (due to less carbon particles) and then
- forming a justified conclusion

Very few candidates mentioned 'the use of waste vegetable oils', 'the ability of poorer countries to make their own bio-fuel for cars' or that 'biodiesel will break down more easily if spilt'.

Many candidates were confused as to whether it was carbon atoms, carbon particles, carbon monoxide or carbon dioxide that caused global dimming or global warming. Many candidates did not read or did not understand the information given. Thus there were many incorrect statements such as, 'carbon monoxide is given off only by fossil diesel';

'only fossil diesel gives off carbon dioxide'; 'biodiesel produces no carbon particles and no sulfur dioxide'. A few candidates confused biodiesel with bioethanol (which was on last summer's paper).

Despite being reminded to write a conclusion, many candidates failed to do so, simply stating a list of pros and cons for biodiesel and/or fossil diesel.

Mark Ranges and Award of Grades

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