



General Certificate of Secondary Education

Science B 4462 / Chemistry 4421

CHY1H Unit Chemistry 1

Report on the Examination

2009 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 and A*.

The candidature was very similar to previous years, ranging from very able candidates to those who might have been better doing the Foundation Tier paper.

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 the candidates who could not organise their answers. Candidates' responses to these questions often did not have enough points to gain all the marks, despite the fact that there may be up to ten acceptable points on the mark scheme. Too often candidates concentrated or elaborated on one point, or gave an argument and its converse, anticipating two marks, which were rarely awarded.

The majority of candidates appeared to have sufficient time to complete the 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 candidates read and analyse the information provided, then read the question before writing their response.

Question 1

- (a) (i) The majority of candidates could work out the number of different elements in the formula of calcium carbonate.
- (a) (ii) The majority of candidates could also work out the total number of atoms in the formula of calcium carbonate.
- (b) The new cement works in the quarry, rather than 100 km away, produced very few incorrect answers, most candidates opting for the smaller distance idea, that less transport meant less carbon dioxide emissions.
- (c) (i) Most candidates selected an emission and explained how it caused atmospheric pollution. The most common misconceptions were that water vapour and nitrogen are emissions that might cause atmospheric pollution.
- (c) (ii) Filters, scrubbers and sprays were correctly given as ways of removing the pollutant from the emissions. A minority, using their knowledge of the emissions from cars suggested catalytic converters. These would have little effect in this situation. Others suggested planting trees around the quarry to re-absorb the emissions.

Question 2

- (a) (i) The first part was very well answered with a large majority of candidates correctly identifying the product as calcium oxide or quicklime. Incorrect responses included slaked lime, lime, limestone, plaster, carbon dioxide and water.
- (a) (ii) The hardening of plaster with age, however, caused problems. A significant minority did not focus on Reaction 3, although the question clearly stated that this was where the plaster became even harder with age. Many candidates were able to identify reaction 3 as the key to explaining how plaster hardened with age and went on to correctly explain how the reaction of plaster and carbon dioxide produced the hard material calcium carbonate. The loss of water from the plaster by evaporation was also creditworthy and often stated. A significant number of candidates, however, merely listed the reactions without explaining anything about the plaster hardening with age. They appeared not to understand the information within the three chemical equations, and tried to explain all three equations, often running out of space before they got to equation 3 and the important information. Some candidates produced reactions that did not happen, especially a reaction between slaked lime and water.
- (b) (i) This part was very well answered with the majority of candidates correctly describing the connection between the volume of sand and the strength of the mortar. The most common error made by candidates was to describe a relationship between the strength of the mortar and the height from which the ball had been dropped without referring to the strength of the mortar.
- (b) (ii) Most candidates gained at least one mark in the second part, mostly by recognising that there was an anomalous value in the table. This was usually done by reference to the small gap between the 36cm (500g) and 37cm (400g) or by mentioning the large difference between the 37cm (400g) and 48cm (300g) values. Some candidates could see that the difference between the 200 and 300 values was 6cm, but did not appreciate that this was also the case with the values at the top of the table, missing the idea of a trend. However, many candidates correctly identified the normal increment between heights was approximately 6 to 7cm or indicated that only one set of results had been obtained.

Question 3

- (a) (i) Most candidates did not know that the Earth's early atmosphere came from volcanoes.
- (a) (ii) Better candidates had no problem with the oceans forming when the temperature dropped to 100°C. A common answer was 99°C and this was accepted, as the candidate was presumably thinking that the temperature had dropped below 100°C, the boiling point of water.
- (a) (iii) The effect of the evolution of plants on the atmosphere was well answered, although many still refer to the process as respiration rather than photosynthesis. If the candidates use chemical equations instead of a description of a process then the equation must be correct.

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- (b) (i) The range of evidence that led to the acceptance of Wegener's ideas was very good, although there were vague answers referring to volcanoes and earthquakes that were not sufficient to gain the mark. Some candidates think that we can see the Earth's tectonic plates moving.
- (b) (ii) The explanation of the movement of the Earth's tectonic plates produced good answers with most candidates gaining at least two marks.

Question 4

- (a) (i) This part was well answered with most candidates gaining at least one mark. The reaction of carbon with oxygen to form carbon dioxide is well known. Incorrect answers often suggested that the oxygen would displace either the carbon or the iron.
- (a) (ii) The second part was also well answered. Stronger was by far the most common correct response followed closely by to make alloys.
- (b) The suggestions that recycling was to be encouraged to conserve iron ores and conserve energy were the most popular correct ideas. Candidates seemed very familiar with the subject matter of this question.

Question 5

- (a) This part was a very challenging data interpretation question. The Iodine Values were tabulated in order of increasing values with the corresponding melting points for the oil. These are real data; there is no perfect linear relationship, simply a trend. An additional challenge was the question actually asked about the relationship between melting point and hardness, which is the inverse of the Iodine Value. Many candidates saw the trend and expressed it clearly. Being a higher level paper with numbers, it is expected that numbers would be used in the answer. Good candidates saw the trend and backed it up with two pieces of data quoted from the table. Some gained credit for quoting two pieces of data that were clearly contradictory. It was more difficult to gain the second mark for stating there is no trend as, ideally, three pieces of data are needed. A few attempted to sketch a graph of the data and some managed to show the trend. Some candidates referred to boiling points rather than melting points.
- (b) In this test the brown iodine changes to colourless when first added to the plant oil; the end-point is when it stays brown. A clear statement to this effect would not only have pointed the way to a good answer, it would have gained the candidate full marks. A number of candidates confused iodine with bromine. Many thought that the plant oils would turn colourless. As usual, a number of candidates confused clear with colourless.
- (c) Most candidates indicated that probably nobody would trust the company scientists. Some did write about the results of the independent scientists showing that the company's results were reliable if they were concordant. The majority of candidates thought that the company's scientists would be biased, but being a two mark question, a second statement about the independent scientists was required for both marks.

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- (d) Many good candidates realised that this part was about hydrogenation with a nickel catalyst at 60°C and so gained full marks. It was good to see very few candidates using the wrong metal. A surprising number failed to realise that the question started from sunflower oil and began by detailing the processing of the sunflower seeds so that they ran out of space for the processing of the oil. In this context, hardening is a technical term. Some candidates became confused and talked vaguely about hard/harder and soft/softer oils.

Question 6

- (a) (i) This part was about how ethene forms poly(ethene). Some candidates lost marks for not indicating that many or a large number of ethene molecules were required. Those who understood the mechanism of addition polymerisation gained both marks. Some of the better candidates gave a balanced equation. Generally, the process of polymerisation was not well described.
- (a) (ii) Most candidates knew that a shape memory polymer could, under certain conditions, return to its original shape.
- (a) (iii) The comparison of poly(ethene) and PEX produced a range of responses. Most were able to appreciate that the bonds between chains would cause a change in properties. However, very few were able to extend this idea to explain that these bonds held the chains in place so that the chains could not slide past each other as they do in a thermoplastic polymer.
- (b) Almost all candidates gained some credit in this part, most often for using less energy and reducing global warming and/or acid rain. Some weaker candidates thought that PEX was a metal, just like copper. The more able candidates often gave more than the four points required and some gave excellent answers comparing processes in terms of atom economy. Weaker candidates concentrated on one or two points, often making the converse arguments for copper or PEX. Many candidates make general comments in answers such as more environmentally friendly, produces dangerous gases, makes unwanted gases, depletes resources (unspecified). At all levels these comments gain no credit. Candidates need to state the names of gases or resources that are being depleted.

Mark Ranges and Award of Grades

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