



General Certificate of Secondary Education

**Additional Science 4463 /
Chemistry 4421**

CHY2H Unit Chemistry 2

Report on the Examination

2010 examination – January series

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Additional Science / Chemistry
Foundation Tier CHY2H**General**

The candidates appeared to have sufficient time to answer the paper and the majority of the candidates were able to make a good attempt at almost all of the questions. There were many excellent papers, which showed that many of the candidates had a very good knowledge and understanding of the topics they have studied. The vast majority of the candidates were entered for the correct tier of the examination.

Question 1

- (a) A friendly start to the paper for the vast majority of the candidates.
- (b) Well answered. Some excellent detailed answers were seen which mentioned full outer shells of electrons and ideas such as ions are atoms where the number of protons and electrons are unbalanced. Common errors included sharing of electrons or the chlorine atom giving the sodium atom electrons. Others hedged their bets and discussed the sodium losing and gaining electrons.
- (c) (i) Well answered but, some candidates gave sodium chloride as the gas produced. A few candidates described the process of electron transfer taking place at the electrodes rather than why the ion is attracted to the electrode.
- (c) (ii) As on the Foundation Tier paper, hydrogen was less well known.
- (d) (i) All parts were well answered with candidates showing a good grasp of How Science Works. Some candidates gave vague answers such as global warming rather than focussing on the specific issues related to this process given in the passage.
- (d) (ii) A number of the candidates missed the point and gave answers such as chlorine is needed to treat drinking water.
- (d) (iii) A majority of the candidates correctly used their knowledge of How Science Works and gave answers linked to the independent scientists not being biased. Answers to do with accuracy or fair test were ignored since they did not answer this question.

Question 2

- (a) The candidates were expected to use the equation and to identify that hydrogen chloride is a gas. Most of the candidates gave the correct answer and some gave more elegant answers such as, it has weak intermolecular forces or it has a low boiling point, and were also awarded this mark. A few candidates did not understand the meaning of property and gave answers such as the names of common gases or chemicals that were in the equation.

- (b and c) The separation techniques have been asked in several recent papers but remain poorly answered questions. Guesses such as distillation or electrolysis were common and many answers discussed the dissolving process at length. We did not accept sieving in part (b).
- (d) Well answered by the vast majority of the candidates. Virtually all of them gained at least one or two marks with many gaining three or four. A number of candidates lost marks because they did not read the question carefully and only gave half the answer. Some only stated the problem and did not explain how it was turned to profit. Others failed to state what the problem was but did go on to explain how hydrogen chloride or calcium sulfide was used to make a profit. Some candidates ignored the information in the passage and waffled about the general problems of industrial processes. Some of the more able candidates seem reluctant to use information from the passage and search for other answers. It should be stressed to candidates that in these comprehension type questions all or part of the answer might be found in the information given.

Question 3

- (a) Answered correctly by most candidates. The most common error was the 1 at the top and 2 at the bottom.
- (b) (i) The simple M_r calculation was answered correctly by three quarters of the candidates. The most common incorrect answer was 17.
- (b) (ii) Candidates continue to find difficulty in explaining why substances made from simple molecules have low boiling points. Less than half of the candidates gained both marks. An answer such as, there are weak forces of attraction between the molecules, was sufficient to gain both marks. Many misunderstandings were seen such as answers that talked about collisions, distance apart of the molecules and the number of molecules.
- (c) This question proved difficult for many of the candidates. Many misconceptions were seen such as; the H-2 atom would contain more electrons than the H-1 atom or the H-2 atom contains two protons and the H-1 atom one proton etc. An answer such as, the H-2 atom has one proton and one neutron while the H-1 atom only has one proton, was sufficient to gain both marks.

Question 4

- (a) The majority of the candidates gained one or two marks but few went on to gain the third or fourth mark. Some candidates gave very confused answers which mixed different types of bonding in their descriptions. Where candidates gave incorrect chemistry using terms such as molecules, ionic bonding, intermolecular forces etc their mark was limited to a maximum of three out of four. Many of the candidates seem to find metallic bonding more difficult than the other types of chemical bonding. The mark scheme had a list of seven points from which the candidate needed to give any four in order to gain full marks. A simple four mark answer might have been: Metals have positive ions (*1 mark*) in a sea of delocalised electrons (*1 mark*). The positive ions are strongly bonded (*1 mark*) and a lot of energy is needed to break the bonds (*1 mark*).

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- (b) (i) Most of the candidates understood the meaning of the term nano. Some candidates incorrectly thought that the atoms are smaller in the carbon nanotubes.
- (b) (ii) A good number of the candidates gained one mark but fewer went on to gain two. The most commonly gained mark was for stating that there are delocalised electrons. The second mark could be gained either by stating that one delocalised electron comes from each carbon atom or for indicating that the delocalised electrons carry the electric current. Some candidates gave confused answers based on the layered structure of graphite.

Question 5

- (a) (i) The simple calculation in part was correctly completed by the majority of the candidates. A small number of candidates showed the correct working and gained one mark but failed to calculate the answer correctly.
- (a) (ii) Very well answered with candidates showing that How Science Works is well taught and learned.
- (b) Understanding of the collision theory of reaction rates has improved significantly over the last few years and it is pleasing that most candidates gained at least one mark and many scored two. Some excellent answers were seen where, if more marks had been available, the candidate could have conceivably gained three or four marks.

Question 6

- (a) It is pleasing to note that the candidates did not find the flow diagram too complex. Most of the candidates gained at least one mark and many gained two. A few of the candidates simply stated the raw materials, air, natural gas and water, rather than choosing examples of materials being recycled or of heat from the reaction being used to produce steam.
- (b) Most of the candidates correctly identified the use of ammonium nitrate as a fertiliser but a sizeable minority gave answers such as pesticide, herbicide, insecticide or to neutralise the soil.
- (c) Well answered with most candidates inserting the correct number 3.
- (d) (i) This question was less well answered. Some candidates simply restated the question without adding a reason while others tried to explain in terms of the number of molecules on each side of the equation. A simple answer such as, because the reaction is exothermic, was sufficient to gain the mark.
- (d) (ii) Many candidates stated that it was a compromise but failed to explain why in terms of rate of reaction.
- (e) Most of the candidates correctly identified the name of the acid.
- (f) (i) As usual the calculations in this question proved difficult for many of the candidates. A few of the candidates made no attempt.

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- (f) (ii) A number of candidates correctly calculated the number of moles of urea but failed to multiply this by 2 to get the number of moles of ammonia. This gave them an answer of 1700g instead of the correct answer of 3400g. A number of candidates did the opposite and not only multiplied the number of moles of urea by 2 but also used 34 as the M_r of ammonia. This gave an answer of 6800g. In both instances the candidates still gained two marks since they had only made one error. Some answers were simply a jumble of numbers and candidates should be encouraged to set out their calculations logically.

Moles of urea =

Moles of ammonia =

Mass of ammonia =

Some candidates calculated the total M_r of reactants and products for the bottom line of the calculation while others added the M_r for one ammonia to the M_r of carbon dioxide.

Mark Ranges and Award of Grades

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