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General Certificate of Secondary Education

Additional Science 4463 / Chemistry 4421

CHY2H Unit Chemistry 2

Report on the Examination

2011 examination – January series

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Additional Science / Chemistry
Higher 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. Some excellent papers were seen.

Question 1 (Standard demand)

a) This part was poorly answered. Many discussed the conduction of the electricity by atoms or electrons without reference to ions. The idea of oppositely charged particles attracting was also common. Only a small number were able to identify the role of moving ions. Some candidates explained why the solid does not conduct electricity; others gave a similar explanation, but without mentioning that they were referring to solid sodium chloride, and so gained no credit.

b) Most answers either stated that chloride ions were negative or that opposite charges attract. Poor answers involved reference to negative electrodes and positive charge.

c) This part was surprisingly poorly answered with only about half of the candidates realising that sodium hydroxide is alkaline.

d) (i) Many candidates correctly drew a straight line through 5 points missing out the anomalous point. Some lines only went through some of the points while others included the anomalous point and these lines were not given credit. Multiple lines and curves were also penalised. There was also evidence of lines drawn in ink or candidates with no eraser as a number of answers contained crossed out lines or annotations pointing to the “wrong” line. In some of these it was very difficult for examiners to distinguish which part of the line candidates intended to be their correct answer.

d) (ii) The anomalous result was usually correctly identified, although 2.2 was a common error.

d) (iii) This part discriminated very well between the candidates. Many answers were vague and candidates often wrote at length without the required detail to gain credit. Common examples of vague answers were; ‘experiment was done wrong’, ‘there was a mistake or error’, ‘equipment was faulty’ and ‘incorrect measurement’.
There were frequent references to human, random and systematic errors, which received no credit unless they were further qualified with a specific idea e.g. error in weighing out sodium chloride or measuring the volume of the hydrogen.

d) (iv) The vast majority of the candidates answered correctly but the most common correct responses were those with the idea of repeating the experiment or comparing results with others. A few vague responses such as ‘do more tests’ or ‘average results’ received no credit.

d) (v) This part was also very well answered. Most candidates realised that there would be an increase in the volume of hydrogen or that it would be produced

faster. A minority of candidates confused time and rate and stated that it would take longer.

Question 2 (Standard demand)

a) (i) A large number of the candidates gained both marks for this question and showed a good understanding of the meaning of the relative formula mass. One mark was allowed for evidence of correct working, i.e. 81-16, if the final answer was incorrect e.g. 75. A common incorrect answer was 97.

a) (ii) Most of the candidates gained this mark. An error carried forward from part (a)(i) was allowed and so technetium and molybdenum scored credit from 97 in part (i). Some of the candidates confused relative atomic mass with atomic number when using the periodic table. Thallium was a common incorrect answer, even when part (i) was correct, which showed a lack of understanding of the difference between atomic mass and formula mass.

b) (i) Most candidates gaining at least one mark. A fair number of the candidates gained one mark for the idea of electrons being lost by an iron atom but fewer candidates realised that 3 electrons were lost. Some confused answers referred to sharing electrons and covalency and iron ions losing electrons**.** Some candidates thought that protons or ions were transferred and that oxygen gave electrons to the iron atom, which showed a lack of understanding.

b) (ii) The mark here was gained by most of the candidates. A few candidates completed the diagram by drawing 4 or 6 electrons in the outer shell instead of 8. A minority of candidates inserted extra electrons into the inner shell and were penalised.

Question 3 (Standard demand)

a) This part differentiated very well between the candidates. A number of the candidates limited themselves to 1 mark by referring to incorrect particles (eg molecules) but many were able to gain two marks. . Some candidates referred to melting and moulding of metals, and some to lattice structures rather than layers or rows. Others simply stated that metals are malleable without explaining why, whilst some thought this has something to do with smart alloys.
Some very sophisticated answers were seen in which the candidates explained that the delocalised electrons allowed the layers of ions to slide over each other whilst maintaining the strong metallic bonds.

b) (i) The majority of the candidates answered correctly but. Incorrect responses included “sulfur hydroxide”, “hydrogen sulfate”, “hydrosulfuric”, “sulfur acid” and “sodium hydroxide”. Taken together with 1(c) it is concerning to see that a small minority of candidates lack basic knowledge of examples of acids and alkalis. Some candidates simply wrote the formula, ‘H_2SO_4’, and gained no credit since they were asked to name the acid.

b) (ii) Candidates were expected to use the equation including state symbols to help them to describe what happens in the reaction. It was pleasing to see from their observations that many of the candidates had probably seen or done this experiment. Most candidates noted that a gas is observed as fizzing or bubbles. Some of the candidates also described the magnesium appearing to disappear or

dissolve. A significant minority described a bright white light, confusing this experiment with the combustion of magnesium ribbon in air or oxygen. A number of candidates simply repeated the equation as a sentence giving no observations.

b) (iii) The method of obtaining a solid salt from its solution was not well known. Many candidates chose to filter the solution, and a significant minority indicated a lack of understanding of the difference between a solution and a liquid, suggesting that it could be solidified. Electrolysis was given by a minority. The candidates' uncertainty was evidenced by a large number of crossings out.

Question 4 (High demand)

a) The majority of the candidates were able to correctly define 'exothermic'. A small minority confused exothermic and endothermic. A very few gave answers unrelated to heat or energy, eg gases given out.

b) (i) This part was very well answered. The most common answer was, 'to speed up the reaction', although some correctly referred to the lowering of the activation energy. Some candidates gave the vague answer that catalysts are to prevent the release of harmful substances to the air which did not answer the question.

b) (ii) A fair number of candidates correctly identified the harmful nature of NO or the harmless nature of the products, some specifying reasons such as acid rain. Vague answers such as, 'it forms oxygen and nitrogen which are already in the air' or 'oxygen was formed which is used by animals/plants', did not gain credit.

b) (iii) The equation was usually completed correctly. The most popular incorrect responses were '3 and 3' and '4 and 2'. The scripts of those who gave incorrect responses often showed evidence of much working, indicating that a significant effort had been put into answering the question.

b) (iv) Many of the candidates correctly identified that the catalyst is not used up in the reaction. A few candidates simply wrote, 'the catalyst is not used in the reaction', which is incorrect and did not gain credit. Some candidates referred to the metals being strong or unreactive or not rusting as reasons for not needing to be replaced.

b) (v) Some candidates did not realise the specificity of catalysts and gave ideas such as to compare the effectiveness of the two catalysts, or to make the reaction even faster.

c) This part discriminated very well. Many candidates realised that nanoparticles would be smaller than normal catalyst particles, and would therefore have a greater surface area. However, a number of candidates giving otherwise very good answers failed to mention the smaller size of the nanoparticles. A number of candidates suggested that the converter itself could be smaller. Only the best responses went on to say that less of the catalyst is needed.
Some candidates suggested smaller particles would have a smaller surface area and some stated that because the particles are small, less energy would be needed for the reaction, as the catalyst particles would need less energy to move or to be "converted".

Question 5 (High demand)

There were some excellent and detailed answers to this question. Many of the answers showed a sound knowledge of the structure and bonding in silicon dioxide and the ability to apply this knowledge to the welding situation. A number of candidates sought to explain more than one suitable property and continued on to discuss electrical, thermal conductivity or strength.
Common errors included assuming the structure contained carbon atoms, and incorrect numbers of bonds (often 3 to silicon). A number of candidates lost a mark because they made reference in their answers to an incorrect type of bonding such as intermolecular forces or ionic bonding.

Question 6 (High demand)

a) (i) The majority of the candidates answered correctly. A number of candidates thought that the methanol was in aqueous solution or failed to give a comparative answer, simply saying for example that the bowl dries quickly. Some candidates commented on the solubility of the dyes in methanol compared to water, but had no information on which to base this.

a) (ii) The concept of intermolecular forces of attraction was difficult for many of the candidates. However, there were some excellent responses, clearly differentiating between the strong covalent bonds and weak intermolecular forces. Many of the incorrect responses suggested that the covalent bonds in methanol are weak. A small number of candidates thought that a low boiling point was due to strong bonds or that there were few bonds to be broken. Equilibrium is also a topic that many of the candidates found difficult.

b) (i) Simply stating that the reaction is exothermic was enough to gain credit. Incorrect responses often referred to the boiling points of the gases or reaction rate. The effect of pressure on equilibrium

b) (ii) This part was understood by few of the candidates. Many of the responses which did not gain credit suggested that there would be more collisions because the particles are squashed or packed more closely together. Both parts of (b) revealed confusion between equilibrium and rate of reaction.

b) (iii) Many of the candidates gained two marks and most gained at least one. There were many responses with concise and accurate explanations. Candidates were expected to give two ideas from the three given in the mark scheme
Some responses did not differentiate clearly enough between more frequent collisions and more forceful collisions to be given credit for both the second and third marking points. Some of these explanations also used the term “activation energy” vaguely and even referred to energy being created.

c) The calculations in parts (c)(i) and (ii) were completed correctly by many of the candidates. Unfortunately, working was often not clearly shown and so it was not possible to award a mark for working if the answer was incorrect.

c) (iii) This part was quite well answered. A wide variety of answers was accepted such as the idea of the reaction being reversible or that the temperature could be too high or the pressure too low. Simple ideas such as loss of product were also accepted.

Mark Ranges and Award of Grades
Grade boundaries and cumulative percentage grades are available on the **Results statistics** page of the AQA Website.