ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Additional Science 4463 / Chemistry 4421

CHY2H Unit Chemistry 2

Report on the Examination

2009 Examination – January Series

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Additional Science / Chemistry Higher Tier CHY2H

General

This Report should be read in conjunction with the published Mark Scheme.

Question 1 *(Standard Demand)*

Part (a) gave an easy start to the paper for the majority of the candidates. Some candidates did not understand the chemical formula and gave 56 + 32 + 16 = 104. A small number of candidates multiplied the relative atomic masses.

Part (b) was less well answered with only about half of the candidates gaining the mark. Candidates were allowed to carry forward an error from part (a). Examiners simply looked for the candidate's answer to part (a) in grams.

Many of the candidates in part (c) were unable to work out this simple calculation. A number of them gave 152 multiplied by 28 and gained an answer of 4256.

Question 2 *(Standard Demand)*

Most candidates completed the electronic structure correctly in part (a)(i). A few candidates gave the structure as 2.4 or 2.8.

Part (a)(ii) was answered correctly by almost all of the candidates. A few candidates gave 'neutron' instead of 'nucleus'.

Many candidates gained both marks in part (b). A simple answer such as 'the O-18 nucleus contains two more neutrons' was all that was required for the 2 marks. Some candidates thought that the nucleus contains electrons or gave vague answers such as 'it contains more protons and neutrons'.

Question 3 *(Standard Demand)*

Parts (a), (b) and (c) were testing the ability of the candidates to read and comprehend a scientific passage and to apply their knowledge of 'How Science Works'. It is perfectly acceptable in this type of question for the candidates to pick out relevant information directly from the passage to form their answer. Parts (a), (b) and (c) were all well answered.

In part (a) a statement such as 'he made urea using chemicals from non-living things' was sufficient to gain the mark.

A wide variety of responses were accepted in part (b). This is indicated in the question by the command 'Suggest'. A sensible suggestion based on their knowledge of 'How Science Works' was required. Many very good answers were seen which explained that he had only made one organic compound so that there was not enough evidence. Other candidates suggested that Scientists at the time might have considered the production of urea to have been an anomalous result. Suggestions related to the possible low standing of Wöhler in the Scientific community were also accepted.

In part (c) answers such as 'he made another compound' and 'there was more evidence' were accepted.

Most candidates named the acid correctly in part (d)(i). Errors included; 'nitrate acid', 'nitrogen acid', hydrochloric acid and sulfuric acid.

Part (d)(ii) was poorly answered. Many candidates stated 'electrolysis' and seemed to think that they were extracting lead from the solution. A fair number of candidates simply gave 'filtration'. Answers such as 'evaporation' or 'crystallisation' were accepted.

Part (e) proved to be a discriminating question. Some very good answers were seen in which the candidates displayed a good understanding of the principles underpinning atom economy. A number of candidates correctly calculated the atom economies for the two methods. Simple answers such as, 'In method 1 there are more reactants used and more wasted products', were sufficient to gain two marks. Use of chemical terminology was often poor with the words reactants and products being used interchangeably by a number of the candidates.

Question 4 ***(Standard demand)***

Part (a) (i) illustrates the importance of reading the question carefully. A number of the candidates ignored the question and simply defined the meaning of the term exothermic. This was not given credit since the question asks how the temperature will change. A significant number of candidates also thought 'because heat is given out the temperature will go down'.

The majority of the candidates gained one mark in part (a)(ii) for identifying that covalent bonds are strong but fewer of them gained the second mark. The second mark could be gained either by explaining that a lot of energy would be needed to break the bonds or by explaining the significance of the term 'giant structure'. A number of candidates gave confused answers that referred to ionic bonding and/or intermolecular forces of attraction.

Part (b) was well answered by the majority of the candidates. A number of candidates gave vague answers such as, 'the particles move and collide', which did not gain credit. If they had stated, 'the particles move faster and collide more often', they would have gained two marks. Some candidates showed that they did not understand 'activation energy' by statements such as, 'the particles gain activation energy'. Other errors that were seen included answers which confused time and rate, answers about reversible reactions and answers that were about exothermic and endothermic reactions.

Question 5 ***(Standard Demand)***

Part (a) was usually answered correctly but there are still some candidates with misconceptions about the meaning of 'nanosize'. Some thought that the layer would be smaller than atoms or that the atoms in the layer are smaller.

Some very good answers were seen to part (b). An answer such as, 'fewer tennis balls would need to be made so that less raw materials would be used up', was sufficient for two marks. A wide range of answers was accepted. Some candidates completely misunderstood the question and thought that the air escaping from the tennis balls would pollute the atmosphere.

Question 6 ***(High Demand)***

Many of the candidates in part (a) answered this correctly and correctly interpreted each of the covalent bonds as a pair of electrons. Some candidates lost the mark due to careless errors such as missing one of the electrons.

In part (b) (i) a large number of candidates missed the command words, 'as fully as you can', and simply stated that, 'the vapour pressure increases when the temperature is increased'. This gained them only one of the two marks. To gain the second mark they needed to give a more detailed answer such as, 'the vapour pressure increases slowly at first and then more rapidly as the temperature is increased'. A number of candidates did not understand the negative numbers on the temperature scale and interpreted it as, 'the vapour pressure increases as the temperature is decreased'. Some candidates answered the question in a slightly different way and having stated that the vapour pressure increases went on to explain why in terms of the kinetic theory. They were awarded two marks.

Many candidates in part (b) (ii) did not include the negative sign in their answer and gave '44' rather than '-44'. Other candidates read the scale incorrectly and gave the answer '56'.

The link between physical properties and the structure of a substance remains a difficult topic for many of the candidates. Only about one third of the candidates gained both of the marks in part (c). Despite being told, 'in terms of molecules', many of the candidates proceeded to answer in terms of ions and ionic bonding. Other candidates made incorrect statements such as, 'the covalent bonds are weak'.

Question 7 ***(High Demand)***

A large number of candidates gained one mark but less than half gained two in part (a). The most common response was that metals contain delocalised electrons. This gained one mark. To gain the second mark this statement needed to be qualified in some way, such as recognising that the delocalised electrons come from the outer shell, or by explaining the meaning of the term delocalised.

In part (b) a simple statement that, 'the ions are charged particles', or that, 'the ions can move in the solution', was enough to gain this mark. Many of the candidates gave the same answer as in part (a) and wrote about delocalised electrons.

Many of the candidates answered part (c) (i) correctly in terms of electron gain. Some either ignored or misinterpreted the equation and wrote about electron loss whilst others gave answers such as, 'mass would be lost'.

Part (c) (ii) was surprisingly badly answered with only about one third of the candidates correctly stating 'sodium hydroxide'. Many incorrect responses were seen including, 'sodium chloride' and 'chlorine'.

Part (d) (iii) was very poorly answered despite being the example given in the specification. Incorrect responses ranged from those who failed to balance correctly (the 2 before the Cl^- was often missed) to those who included positrons ($2Cl^- + 2\,\mathbf{e^+} \rightarrow Cl_2$) or added electrons to the chloride ions.

Question 8 ***(High Demand)***

Candidates have always found this type of calculation difficult and so it is pleasing to report that a good number of the candidates were able to complete part (a) successfully. The most common error was (138/180 x 2).

Part (b) was slightly better answered than part (a). A fair number of candidates used the data given in the brackets even when they answered part (a) correctly. A variety of incorrect responses were seen which usually involved selecting the wrong numbers such as (1.1 / 2 x 100 = 55%).

Part (c) was quite well answered. A wide variety of answers were accepted including simple ideas such as, 'some of the aspirin was lost' or 'weighing errors'.

Many excellent responses were seen in part (d) such as, 'using the catalyst allows the process to take place at a lower temperature which reduces energy costs'.

Question 9 ***(High Demand)***

Candidates have always found the effect of pressure on the equilibrium position very difficult. In part (a) less than 20% of the candidates gained this mark and many did not make an attempt. A large number of candidates simply explained how an increase in pressure would alter the rate of the reaction.

Candidates were more successful in part (b) than in part (a). Some outstanding answers were seen where candidates applied their knowledge of the Haber process to this unfamiliar reaction. An answer such as, 'The best equilibrium yield would be obtained at low temperature because the forward reaction is exothermic. The reaction would be too slow at very low temperature so 200˚C is a compromise temperature which gives a reasonable yield at a reasonable rate', would gain all 3 marks. A number of candidates ignored the question and proceeded to give an answer about the effect of pressure. Some candidates simply restated the question by writing that it is a compromise whilst others gave answers that were too vague, such as, 'temperature affects the rate of reaction and the yield'.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the **Results Statistics** page of the AQA Website.