Examiners' Report

Principal Examiner Feedback

Summer 2018

Pearson Edexcel International GCSE
In Chemistry (4CH0) Paper 2C

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Question 1

This question was very well answered. It was very rare to find any candidate who gave an incorrect answer to (a), (b) or (c)(ii). A large majority of candidates gave carbon dioxide as a product in (c)(i), however there were a significant number who did not realise that water was the other product of complete combustion and often gave hydrogen as their answer.

Question 2

This question was also very well answered. Again it was very rare to find any candidate who did not give three correct temperature increases in (a). A small minority chose the wrong fuel in (b), either choosing X and saying because this showed the smallest temperature increase, or by choosing W and saying this had the greatest temperature increase, although it was usually clear from their answers to (a) that this was not the case. A small number of candidates who chose fuel Y did not score the second marking point as they either just stated that it had the highest final temperature rather than the greatest temperature increase, or that it released the most heat energy, which was just repeating what was in the stem on the question. The answer to (c) was well known, with only a few candidates choosing 'endothermic' as their answer.

Question 3

Only a very small minority of candidates gave an incorrect burette reading in (a) and those who did predictably thought the reading was 4.85 rather than 3.15. Almost all candidates performed a correct subtraction to find the volume of acid added. It was encouraging that more candidates gained full marks here than on similar questions in previous examination papers. In (b)(i) some candidates lost the mark by not ticking the three concordant results, often choosing two of them but missing the third one. A few candidates ticked more than three results, perhaps by misreading the first result as 25.25 rather than 26.25. Most candidates went on to calculate the average correctly in (b)(ii) from their ticked results.

Question 4

The three multiple choice questions were answered correctly by the majority of candidates. In (b) a minority failed to pick iodine as the element which is a solid at room temperature, probably thinking of the iodine solution which is used to test for starch and therefore assuming it was a liquid. Approximately half of the candidates scored all three marks for the calculation in (d). Those who did not score all three marks often scored two, usually by doing the subtraction the wrong way round and hence giving an answer of 103 instead of -103. Other common errors included multiplying the H-H and Br-Br bond energies by two or failing to multiply the H-Br bond energy by two. These candidates then went on to either score one mark if they did the subtraction the wrong way round or two marks if they subtracted the numbers correctly.

Question 5

In (a)(i) the majority of candidates knew that yeast was needed for fermentation to take place, with a few writing zymase, which was also allowed. The most common incorrect answers included oxygen and water, even though sucrose solution was mentioned in the question, indicating that water was already present. Just over half of the candidates managed to complete the equation correctly in (a)(ii). Some candidates lost the mark by failing to balance the equation. Candidates need to be aware that when completing or writing chemical equations, the equation is not correct if it is not balanced. A surprising number of candidates completed the equation with $C_{12}H_{24}O_{12}$ even though the formula of glucose was given in the bullet points in the stem of the question. Candidates must be encouraged to read the questions carefully and make sure that they use any information given in order to help them answer the questions correctly. Approximately half of the candidates gave a fully correct equation in (a)(iii). A few made the same error as in (a)(ii) giving an incorrect formula for glucose and a small minority had an incorrect formula for ethanol, even though this was also given in the question. Candidates were told the products of the reaction so the only formula they needed to remember was carbon dioxide, but a few chose to ignore this and gave other products such as water or oxygen. Again the most common error here was to fail to balance the equation. The majority of candidates answered (a)(iv) correctly, although some thought simple distillation was the most effective method of obtaining ethanol from the mixture.

In (b)(i) just over half of the candidates gave the correct catalyst, although some spelt it incorrectly as phosphuric acid, probably because of confusion with sulfuric acid, but this was allowed on this occasion. Common incorrect answers included silica, alumina, iron and vanadium oxide, which are all used as catalysts but not in this particular reaction. A fair proportion of candidates knew the correct conditions in (b)(ii), however there was again confusion with other industrial processes and a temperature of 450^{o}C was often seen. Candidates

need to learn the catalysts and conditions for the various industrial processes in the specification, as these are often asked for in the examination papers.

In (c)(i) again just over half of the candidates gave the correct answer here, with most giving the mark scheme answer of dehydration, a few writing decomposition and very few writing elimination. The most common incorrect answers included cracking, hydration, displacement and redox. In (c)(ii) the majority of candidates knew that the aluminium oxide was a catalyst. A few thought it was there to remove the water and some mentioned that it was present to increase the surface area, which was insufficient to score the mark. A small minority mentioned that it lowered the activation energy, which was more of a description of how a catalyst works and was ignored.

In (d)(i) the majority knew that unsaturated compounds contained a double bond. A few said that it didn't just contain single bonds. Candidates need to learn that negative statements such as these are not creditworthy and they should always give positive statements when answering questions. Others talked about the fact that more hydrogen could be added to the hydrocarbon, which was also not creditworthy. A small number said it only contained single bonds, confusing saturated and unsaturated. The test for unsaturation in (d)(ii) was also well known with the majority of candidates scoring both marks. A few had the colour change the wrong way round and so limited themselves to one mark. Some candidates confused bromine water with liquid bromine and said the initial colour was red-brown, which lost them the first mark. Only a small minority wrote clear and lost a mark.

Question 6

Almost half of the candidates failed to score any marks in (a)(i). Many discussed temperature affecting the rate of reaction rather than the yield. A surprising number talked about higher temperature denaturing the enzymes, even though this was a chemical reaction, not a biological one, and no enzymes were involved. Those who scored one mark usually did so by saying that the reaction was exothermic. Many of these could have also scored the first marking point if they had mentioned the equilibrium shifting to the left, rather than using Le Chatelier arguments with phrases such as 'the endothermic reaction is favoured', which are not required by the specification and are not creditworthy. However around a quarter of the candidates did manage to score both marks. In (a)(ii) around a third of the candidates managed to score both marks. A fair number knew that the yield would increase but failed to make it clear that this was because there were fewer moles on the right hand side. Again the use of vague Le Chatelier arguments caused some candidates to lose the second marking point. As in (a)(i) there was confusion with rates of reaction, with some saying that increased pressure would speed up the reaction and therefore the yield would increase. Those who failed to score either said the yield would decrease or

it would stay the same. Some thought that there were the same number of moles on both sides of the equation and so the yield would not change.

Part (b) was answered correctly by the majority of candidates. The main error here was to omit the '2' in front of the HCl therefore leaving the equation unbalanced. Many candidates drew a correct dot and cross diagram in (c) and gained all three marks. Some failed to realise that there was a double bond between the carbon and oxygen, even though a displayed formula had been given to help them, limiting them to one mark. Others drew all the bonds correctly but either drew extra electrons on the carbon, too many electrons on the oxygen or failed to draw any of the lone pairs, which limited them to two marks. A few drew in an extra oxygen atom, despite the displayed formula being given. It was encouraging that only a small minority thought the bonding was ionic. Candidates should be encouraged to draw clear dot and cross diagrams as some diagrams were very untidy and difficult to decipher, causing some to lose marks unnecessarily. Also if they make a mistake candidates should cross out the diagram and start again, rather than trying to correct an incorrect diagram.

Question 7

Approximately half of the candidates answered (a) correctly. Some failed to score as they stated that carbon dioxide was formed, but gave no indication that it was leaving the crucible. Others talked about evaporation of the carbon dioxide or thought that the magnesium carbonate was undergoing combustion or that heat being given off caused the loss in mass. These answers showed a lack of understanding and so lost them the mark. Just under half of the candidates scored the mark in (b)(i), often for giving the allowable answer of the reaction being complete. Those who failed to score often talked about reliability or making it a fair test, which was not relevant here. Others discussed the reaction stopping, which was not creditworthy. Just over half of the candidates scored both marks in (b)(ii). Very few scored just one mark here, as those candidates that identified experiment 1 usually gave a correct explanation as to why they had chosen it, often saying that the mass was still changing. Those who failed to score here often chose experiment 4 because it had the highest mass after heating for 15 minutes.

Question 8

The calculation was fairly well answered by the candidates with half of them scoring all four marks. A few lost one mark for not dividing by 1000 in (a). Other errors in (a) included dividing by the volume instead of multiplying, introducing 24 into the calculation, presumably confusing this with gas volumes and dividing by the M_r of hydrochloric acid. All of these scored zero. A small minority corrected their answer to one significant figure, losing them the evaluation mark. Candidates need to be aware that ideally their answers need to be given to the same number of significant figures as the data given in the question. Many who failed to give a correct calculation in (a) went on to calculate the moles correctly in (b), therefore scoring two out of the four marks. A small minority left the answer as a fraction in (b) which lost them a mark. Candidates need to be aware that fractions are not acceptable as final answers to calculations in Chemistry examinations. Also a small number misread the question and halved the answer to (a) to obtain the answer to (b), even though the M_r of magnesium hydroxide was given to guide them in the right direction.

Just over half of the candidates failed to score any marks in (c), usually because they did not recognise that the ratio of magnesium hydroxide to hydrochloric acid was one to two, so they thought that not enough magnesium hydroxide had been added to neutralise the acid. A few said that the right amount had been added but failed to explain why this was the case. However there were some very good two mark answers where candidates clearly explained their reasoning using numbers from their calculations.

Question 9

In (a)(i) the majority of candidates scored both marks. Common errors included referring to equilibrium instead of reversible and just writing energy change without referring to heat. A few wrote temperature change, which was automatically rejected and a small minority wrote enthalpy without reference to change. Slight misspellings of enthalpy were allowed, but not if the wrong word was used, for example 'empathy change' was seen occasionally. Just over half of the candidates gave the correct catalyst in (a)(ii). A small minority gave the wrong oxidation state for vanadium which lost them the mark and some just wrote vanadium rather than vanadium oxide. Other incorrect answers included aluminium oxide, iron and oxygen. Approximately half of the candidates scored both marks for the conditions in (a)(iii). Some thought a pressure of 200 atmospheres was used, probably because of confusion with the Haber Process.

On the whole (b)(i) was poorly answered with only a minority of candidates scoring the mark, more often for the idea of the reaction producing too much heat rather than for the idea of a mist of sulfuric acid being formed. Many candidates just repeated the stem of the question, saying it was very exothermic and therefore dangerous, which was insufficient for the mark. A significant proportion ignored the information in the stem of the question and said that the

sulfur trioxide was insoluble in water or that the acid would be too dilute. The majority of candidates scored both marks in (b)(ii). Those who didn't usually scored one mark for the first equation but failed to balance the second equation therefore losing the second mark.

Part (c) was surprisingly poorly answered with half of the candidates scoring zero and only a small minority scoring both marks. Those who knew some correct uses often omitted the words 'manufacture of' or 'to make', which limited them to one mark. Just stating 'detergents' as a use for sulfuric acid is insufficient as it implies the actual sulfuric acid is a detergent and I am sure candidates would not want to wash their clothes or their hair with sulfuric acid! Many thought that sulfuric acid is present in bleach, probably confusing it with a use of sodium hydroxide. Some gave non-industrial uses such as school experiments, titrations and neutralisation reactions. Some gave vague answers such as cleaning products and sterilising equipment, which were not creditworthy. Quite a few said it was used in the Contact Process to make more sulfuric acid, which is true but not creditworthy here as this was already shown in the flow diagram in the stem of the question.

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