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Examiners' Report/ Principal Examiner Feedback

Summer 2016

Pearson Edexcel International GCSE in Chemistry (4CH0 2C)

Pearson Edexcel Level 1/Level 2 Certificate in Chemistry (KCH0 2C)

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Examiner's Report International GCSE Chemistry 4CH0 2C

Question 1

In part (a) almost all recognised *Y* as a Bunsen burner and although a large majority identified *X* as a stirring rod, many others thought it was a thermometer. Parts (b)(i) and (ii) were well answered by the majority although there is still some confusion concerning the terms *solute* and *solvent*. Parts (c)(i) and (ii) were answered correctly by the large majority of candidates. In (d) almost all correctly responded with a reference to the water evaporating but some just said the water is being heated, which was not an acceptable answer to the question.

Question 2

Part (a) differentiated well between candidates. Strong ones appreciated that essentially the key points involved were that *iron* reacted with *oxygen* until all the *oxygen* had reacted or until there was no *oxygen* left. There were many excellent answers which clearly gave this information, sometimes also giving references to the fact that $20cm^3$ or 20% of the air in the measuring cylinder was *oxygen*. However, there were many responses where candidates stated that the air or gas was being used up, without reference to *oxygen*. Others did not gain marks because they just referred to iron rusting or iron using oxygen instead of *reacting* with oxygen (or one of the other acceptable alternatives in the Mark Scheme). Many candidates thought the cause of the volume remaining at $80cm^3$ was that the iron had all been used, up not the oxygen.

Part (b) was well answered with most scoring both marks. Of those who did not, the most common incorrect answer was iron sulphide. In (c) the correct colours were often identified but many students lost marks by either just stating the colour only and not indicating a precipitate, or thinking that the products of the reactions were solutions.

Question 3

(a)(i) Most candidates correctly picked out an element that forms a basic oxide with magnesium being the most common answer. Most candidates also selected an element that forms an acidic oxide in part (ii) with sulfur usually given. Surprisingly argon was suggested more than occasionally.

Part (b)(i) was often well answered with many candidates gaining all three marks. However, some only showed the outer-shell electrons and gave no charges, whilst others showed the charges on the ions but no outer-shell electrons in the chloride ions. It should be noted that on this occasion, because of the way the question was set, it was acceptable to show the outer shell of magnesium as containing no electrons or eight electrons. Some obviously did not read the question carefully enough and tried to show movement of electrons by using arrows. A small but significant number of candidates did not attempt the question.

In (b)(ii) Most candidates either did not read the question properly or, possibly more likely, did not understand what it required as an answer. Often their

immediate response was to unnecessarily describe how the ions were formed from their atoms, and usually completely neglect to mention the strong electrostatic attraction between the resulting oppositely charged ions as described in the specification.

In (b)(iii) there were some very good explanations of the high melting point of the ionic compound magnesium chloride and many of these candidates scored all three marks. They sometimes omitted the idea of there being lots of ions/bonds/giant structure/lattice as given in the second marking point in the Mark Scheme. Others missed the third mark as they talked about high temperatures rather than a *lot of energy*.

However, as has been seen in the past, there were a large number of candidates who made valid and correct points only to let themselves down, often towards the end of their answer, by including a statement about atoms or molecules, or most often, intermolecular forces. These incorrect statements caused them to lose any previously gained credit.

A large number of candidates seemed well prepared for the electrolysis calculation in (c) and set the calculation out clearly, showing that they knew exactly what to do and scored both marks. With others, a common error was to fail to divide by 3, giving an answer of 540g which was allowed one mark. Some candidates thought they needed to convert faradays to coulombs and usually got lost in the resulting large numbers.

Question 4

(a) Many candidates did not know the general equation for the reaction of an acid with a base and therefore gave hydrogen as a product rather than water. A significant number failed to use the formulae already given in the question in their answers, and it was a matter of concern that so many did not know the formula of nitric acid.

(b)(i) Only about a half of candidates were able to answer this question correctly in terms of increasing the rate of *reaction*. Of these, some also unnecessarily gave an explanation of why the reaction rate would increase in terms of the collision theory. Unfortunately, a large number of candidates failed to gain the mark as they answered the question with statements about dissolving and solubility without referring to a reaction.

In (ii) Many candidates were able to give an acceptable answer but large numbers just referred to *the reaction stopping* or *it stopping fizzing*.

Responses to part (iii) often seemed to indicate if candidates had themselves actually made crystals in a practical situation as they usually described an actual procedure involving the use of a glass rod. Other good candidates appreciated that crystallisation point is reached when crystals start to form. Many incorrect responses described waiting until all of the water had evaporated. In (iv) the majority correctly identified Stage 3. The most common incorrect response was Stage 6.

Question 5

The meaning of the term *isomers* is quite frequently asked so it was disappointing that not more candidates gained both marks in (a)(i) as they used the term chemical/general/empirical formula instead of *molecular* formula. Occasionally confusion between the terms isomers and isotopes was evident. Drawing another isomer of but-1-ene in part (ii) proved challenging with many just re-drawing the formula of but-1-ene but showing it differently, often with the C=C bond on the right instead of on the left as shown in the question. Other common errors were drawing carbon atoms with too few or too many bonds.

In (a)(iii) many candidates could describe the test using bromine water to distinguish between but-1-ene and cyclobutane but a common error was to omit to give the result with cyclobutane. Incorrect responses often used bromine in the presence of UV light but some students did give a very full answer including explaining that the alkane and bromine mixture would not change unless UV light was used.

Part (b) required the candidates to predict the structure of the product of (i) the reaction between but-1-ene and steam and (ii) the polymerisation of but-1-ene. In (i) it was common to see incorrect bond linkages such as C-H-O whilst some just added an –O and others added H_2O on to a carbon atom on the end of the molecule. Some just added hydrogen atoms and others gave structures with the double bond still present.

In (ii) a common mistake was again leaving the double bond in the structure which lost both marks, since the structure shown could not be regarded as a near miss. Some either left out the *n* after the brackets or placed it in front of the brackets. Others did not show continuation bonds going through the brackets.

Question 6

(a) The majority of candidates gave a correct answer of titration with neutralisation being the most common incorrect answer. In (b) most rightly selected a pipette as the correct piece of apparatus but large numbers chose a measuring cylinder. In part (c) less than half of candidates achieved both marks with the starting colour of the indicator proving a real difficulty. Red and pink were common acceptable alternatives for the final colour. Many candidates scored one mark for having the correct colours but reversed. It was interesting to note that significant numbers of students used the trick of writing orange (possibly because it was methyl orange) or red for both answers presumably hoping it would be right once!

In (d) most scored at least two marks. A common error was to miss the *0* off the end of 23.6 although the question asked for readings to be given to the nearest 0.05cm^3 and many others reversed the first two values in the table. Disappointingly some candidates incorrectly read the values for both readings

but in both situations candidates were able to gain a mark consequentially for a correct subtraction.

There were many completely correct answers in (e) but a significant number could not identify the concordant results despite being told that they are within 0.2 cm^3 of each other. Almost all candidates knew how to calculate an average correctly, although some were unable to give a correct number of significant figures.

Question 7

A large majority identified the correct fractions in (a) and (b). Most equations in (c)(i) were correct with the majority of candidates giving the $C_{10}H_{20}$ + C_8H_{18} combination. It was surprising to see some candidates giving an equation for combustion instead of cracking.

In (c)(ii) the most common answer was to state that there were more uses for short-chained fractions which gained one mark and many included references to fuels/petrol as well as alkenes and polymers. Surprisingly few candidates referred to an over-supply of long chain hydrocarbons. A number of candidates wrote about viscosity and volatility, quoting physical properties rather than answering the question asked.

In (d) most candidates realised that carbon monoxide is produced and gave its correct formula. Balancing proved more challenging and this provided differentiation in the question but a wide variety of balanced equations were seen.

Question 8

This two-part calculation proved to be very effective at differentiating amongst candidates of varying abilities. In (a) the correct calculation of moles proved difficult for many, and of those who could calculate the number of moles, many were unable to recognise the need to divide by 2 and therefore ended up with a mass double that expected. This nevertheless gained one of the two marks available.

In (b) a number of candidates simply multiplied their mass from (a) by 24000, without converting the mass to moles. Some divided rather than multiplying by 24000 whilst many others made no attempt at this part.

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