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Examiners' Report/
Principal Examiner Feedback

Summer 2015

Pearson Edexcel International GCSE in Chemistry (4CH0) Paper 1CR

Pearson Edexcel International in Science Double Award (4SC0) Paper 1CR

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Question 1

Part (a) was answered well. Many candidates had not read the question properly and so were drawing anywhere from 3 to 10+ circles in the box. However, this range of circles was not penalised. Some had drawn unnecessary arrows to indicate movement, but again this was not penalised.

Most answers to part (b) included 'moving freely' or 'moving randomly', but some candidates confined their discussion to just increased vibration, which was not considered sufficient to score.

In part (c), most scored the first mark for particles gaining energy, but very few scored the second mark, with candidates failing to recognise that the question was asking why the liquid would evaporate **more** quickly. There was the usual confusion between bulk properties of the liquid and those of the particles that make up the liquid. For example, some candidates stated that the **particles** would evaporate more quickly. Evaporation is a property of the liquid not of the particles. The particles **escape** more quickly.

Question 2

Parts (a) and (b) were well answered, although there appeared to be a reluctance by some candidates to use the same letter twice, with two letters F being initially recorded and one of these subsequently crossed out and replaced with another letter.

The majority of answers to part (c) contained, as hoped, a reference to both the number of carbon atoms **and** the boiling point. Any reference to a proportional relationship was ignored on this occasion, since no data to suggest otherwise was supplied.

Question 3

In part (a), almost all candidates correctly chose **C** as the urine sample containing an illegal drug. Many struggled to explain their choice using the correct terminology (e.g. the use of the term 'spots') but the second mark was awarded for any genuine attempt to indicate that there were two spots at the same height or distance from the start line.

Part (b) was generally answered well, but those who got it wrong stated that a solvent was a solution, or confused the meanings of solute, solution and solvent. Some referred back to the experiment saying 'it soaks up the paper'. Presumably these candidates had not realised that a description of the meaning of the term was required, not just an identification of the solvent.

Careful measurement was required in part (c), since the first mark was not awarded if the measurement of the distance of the lasix spot from the start line was not within the acceptable range, nor if the measurement of the solvent front was not exactly 8.4 cm. The second mark was awarded for a correct calculation based on the measurements recorded with the answer given to two decimal places. Since the final answer must be less than one, this is equivalent to two significant figures, and hence consistent with the measurements made.

Part (d) was answered well by most, although some failed to make a comparison between the solubility and the distance travelled.

Question 4

In part (a), most were able to identify potassium, presumably via the lilac flame. However, a small, but significant, number of candidates interchanged caesium and lithium.

There were many fully correct answers to part (b) (i). The most common error was potassium hydroxide, followed closely by potassium oxide. Although a formula was asked for, those candidates who decided to write a full equation for the reaction, and who then identified the H_2 as the gas, usually by giving the state symbol, were awarded the mark.

The most common incorrect answer to (b) (ii) was lithium oxide, but many identified correctly the product as lithium hydroxide.

The use of red litmus to identify alkalinity was commonly seen in part (b) (iii). Other acceptable indicators seen were methyl orange, phenolphthalein and Universal Indicator.

Question 5

There appeared to be very few problems in answering parts (a) (i), (ii) and (iii). Nearly all students could recognise which graph represented the results in the different scenarios (less mass, lower temperature, powdered chips) and were able to link their explanations to the graph lines. Quite a few students went into unnecessary depth by discussing collision theory of rates of reaction.

Part (b) was also answered well with most choosing a gas syringe as a suitable piece of apparatus in which to collect (and measure the volume of) the gas.

Question 6

Many students understood part (a) of this question and answered it well, with a pleasing number recognising that the volume of sodium chloride was the limiting factor in the reaction. ‘The reaction was finished’ and ‘all reactants used up’ were common answers that were considered insufficient to score.

In part (b) (i), some students did not mark their points clearly and so it was difficult to see if they had plotted the points; small crosses are the recommended method. Some students seemed to find it difficult to plot the final three points in between the two grid lines and consequently lost both plotting marks. Drawing the lines proved a little more problematic for some. A few drew their straight lines without the aid of a ruler and others, who correctly drew two straight lines through the plotted points, then joined the two lines with a curve or a third straight line.

In (b) (ii), a few struggled to identify the anomalous point or forgot to circle it.

Part (b) (iv) seemed to cause confusion for a number for candidates who simply repeated the question using different words. It was important here to state why the reading of **each** axis would be zero and there were a many very good answers explaining that the lack of addition of lead (II) nitrate (zero on the horizontal axis) would produce no precipitate (zero on the vertical axis).

In (b) (v), the most common incorrect answer was 2.1 (a value in cm rather than in cm^3), obtained by reading the vertical axis rather than the horizontal one, so giving the height of precipitate rather than the volume of lead (II) nitrate solution.

Question 7

Most candidates were aware that the answer to (a) (i) required a reference to (carbon to carbon) single bonds, but a significant number failed to state that **all** of the bonds in the molecule have to be single. The easiest, and least unambiguous way, to answer the question was to state that there are no double (or multiple) bonds present. A few answered the question out of context and described a saturated solution.

Part (a) (ii) was better answered with only a few failing to include the word ‘only’, whilst some unfortunately insisted on stating that a hydrocarbon contains hydrogen and carbon molecules. Part (iii) was answered well.

The chemical equation in (b) (i) posed the usual problems for many. Most of the equations seen contained correct formulae, but some were unable to balance their equation correctly. There are still some candidates who insist on writing the formula of oxygen as ‘O’ rather than O_2. Candidates need to be aware that no marks for a chemical equation can be awarded if any of the formulae are incorrect. The vast majority recognised, in (b) (ii), that the poisonous gas is carbon monoxide.

In part (c) (i), some candidates effectively restated the information given in the question by saying that the catalyst increased the rate of reaction, rather than focusing on how the catalyst worked. There were some excellent answers that referred to the provision of an alternative route of lower activation energy. As usual, the name of the catalyst for a given process was either known or not known. Many correctly identified alumina or silica as those mentioned in the specification, but it was not uncommon to see iron, vanadium (V) oxide, phosphoric acid and manganese dioxide listed.

The completion of the equation in (c) (iii) proved to be slightly more difficult than anticipated; there were a significant number of candidates who gave C_4H_8 as their answer. Those who correctly gave C_2H_4 had little trouble in identifying the substance as ethene.

Question 8

The majority of students managed to obtain at least one mark in (a) (i), usually for either its high melting point or being unreactive. Some referred to irrelevant physical properties such as malleability or ductility. Although ductility is a necessary property for making a wire, it is a property of most metals and not relevant to the use of a metal as a flame test wire.

In part (a) (ii), most candidates appreciated the need to remove the impurities to clean it, but many failed to mention the effect it would have on the test if they did not clean it.

The reason for not using a luminous flame in (a) (iii) was generally well known, but proved to be troublesome for some, perhaps because of a misunderstanding of the term luminous. Answers such as 'because the flame will be too hot' suggested confusion with a roaring Bunsen flame.

Fewer than expected scored all four marks in (b) (i). It was all too common to see just the cation listed despite the question asking for the name of a compound. Strontium was allowed as an alternative to lithium, but calcium was not.

Most realised, in (b) (ii), that the cation was iron (II), but some failed to score because they omitted the oxidation number.

In part (c), most candidates knew that an acid should first be added, hydrochloric acid being the most common one mentioned. A few thought sodium hydroxide was the reagent. The majority knew the limewater test and the result, but some stated that the limewater should be added to the solution rather than used to test the gas given off.

Question 9

Most knew, in (a) (i), that chlorine is green, although yellow, which was not accepted, was sometimes seen.

In (a) (ii), many candidates appreciated that the open tube was present to allow the unreacted chlorine to escape, but a significant number thought that it was needed to allow oxygen to enter the apparatus. Some answered in terms of preventing an increase in pressure inside the apparatus, which may lead to an explosion, which was accepted.

Most answered (a) (iii) correctly by stating that chlorine is toxic/poisonous, but some answers were too vague, e.g. chlorine is harmful or chlorine will affect the eyes or chlorine will affect your breathing.

The empirical formula calculation in (b) (i) produced a large number of correct answers with full working shown. There were, pleasingly, very few calculations in which atomic numbers, rather than relative atomic masses, were used and the number of inverted calculations was less than in previous sessions. A few had perfect working, but then gave the final answer as Fe_3Cl.

Having managed to obtain the correct formula in part (i), a significant number of candidates then failed to give the oxidation number in their answer to part (ii).

The equation in (c) was usually either fully correct or no marks were achieved as one or more of the formulae were incorrect. Those who wrote the correct formulae nearly always went on to balance the equation correctly. The most common error was to write 2Cl instead of Cl_2. Some missed out one of the products, usually NaCl.

Question 10

The common errors with the state symbols, in the equation in part (a), were (l) for HCl and (s) for zinc chloride. A few failed to balance the equation. A significant number of candidates wrote ZnCl for zinc chloride and/or H for hydrogen. These mistakes were penalised for the equation mark, but were ignored for the state symbol mark.

The observations required to answer part (b) were well known, although some failed to score both marks by giving the same observation in different words, e.g. bubbles of gas and effervescence. It was surprising to see so many references to the observations made when Group 1 metals react with water. Statements such as the zinc melts or the zinc skates across the surface were not uncommon.

In (c) (i), many scored the first two marks for correct burette readings, but there are still some who insist in giving these readings to only one decimal place, despite the instruction to give all readings to the nearest 0.05. Strangely, it was not uncommon to see five values quoted to two decimal places, but 20.80 then given as 20.8.

Part (c) (ii) should have been a very straightforward question to answer. The volume of acid required in experiment 2 is double that required in experiment 1, so the acid must be half as concentrated. Unfortunately, the question should have stated that the concentration of acid in experiment 2 was 0.74 mol/dm^3, and then should have asked how to calculate the concentration in experiment 1. Hence, some candidates who calculated the number of moles of zinc used in experiment 1, and then doubled it to find the numbers of moles of acid used, correctly arrived at an answer of 0.74 mol/dm^3 for the concentration of acid in experiment 2. Candidates who took this route were given full credit.

Question 11

The majority of candidates managed to produce a correct displayed formula in (a) (i). Those that did not either drew a single bond between the carbon atoms or added extension bonds to their monomer.

Most scored at least one mark for the description of a polymer in (a) (ii). Lack of precision was often the reason for not scoring both marks here, e.g. not stating that the monomers were **joined or linked or bonded** together to make the chain, or not stating that it was a **long** chain that was formed.

Considering the requirement to answer part (a) (iii) was to put the word 'poly' in front of the given name of the monomer ('tetrafluoroethene'), it was surprising that so many candidates failed to score this mark. The three most common incorrect answers were polyfluoroethene, tetrafluoroethene and fluoroethene.

A pleasingly large number of the candidates managed to obtain the correct answers to the monomer in (b), but a significant number simply counted up the number of carbon atoms in the part structure shown and produced an answer of either decene or decane.

The question in part (c) has now been asked a number of times, but many candidates are still failing to answer this in terms of the information provided in the specification, i.e. the polymers are non-biodegradable because of their inertness. Instead they focus on the high strength of the covalent bonds present within the polymer. Biodegradable polymers also contain strong covalent bonds, so this is not a suitable argument to explain non-biodegradability.

Question 12

Copper was often given as the correct answer to part (a), but the incorrect answers of copper (II) or copper ions were also seen.

Part (b) was generally poorly answered. A very common error was to state that zinc cannot react with zinc, rather than zinc cannot react with zinc **ions**. It was considered too vague to state merely that no displacement would occur.

Candidates had to combine information from two tables in order to deduce an answer to part (c). This proved problematical for some, although many fully correct answers were seen. Common errors were to list the nitrates instead of the metal, and to list the correct metals in reverse order.

Part (d) (i) was generally answered well, usually in terms of both reduction and oxidation taking place, although some chose correctly to state that both gain and loss of electrons was occurring. Lack of precision in the answer was the downfall for some, who stated, for example, that a redox reaction involves eitherreduction **or** oxidation, rather than both.

There were some fully correct answers to part (d) (ii), but many failed to gain the first mark by stating that silver, rather than the silver ion, was acting as the oxidising agent. These candidates usually went on the state that the silver was gaining electrons so were awarded the second mark on the basis of a ‘near miss’ answer for the oxidising agent. Some thought that an oxidising agent was a species that was oxidised and hence gave magnesium, because it is losing electrons, as their answer.

Question 13

Most candidates sensibly chose a measuring cylinder for their answer to part (a). Although the increased precision offered by the use of a burette or a pipette is unnecessary in this preparation, either answer was accepted.

Part (b) was usually answered well with most students either stating that the zinc carbonate would stop disappearing or the bubbling would stop. Some were unsure of the chemistry, stating that a precipitate would form. Some answers simply stated that the reaction would stop, which was considered to be too vague.

Most candidates recognised that filtration was the method used for the separation mentioned in part (c), although it was not uncommon to see distillation given as the answer.

Part (d) tended to be answered either very well or rather poorly. Some wasted valuable time, and answer space, by repeating the steps given in the stem of the question. Other did not make it clear that they were heating to **partially** evaporate the water or were heating to the point where crystals **started** to form. Some omitted the ‘leave to crystallise’ step and went straight to filtering. The majority of those who successfully reached the stage of obtaining crystals knew that the crystals needed to be dried, and gave an appropriate method for drying them. Unfortunately, some candidates started their preparation by evaporating the solution to dryness. Since this produces an anhydrous sample of the salt, no marks could be awarded.

Question 14

Most knew, in (a) (i), that the covalent bonds in silicon dioxide are strong, but some failed to mention that these bonds have to be broken in order to melt the compound. Others produced a very good argument but then added a discussion on the influence of intermolecular forces. Silicon dioxide is a network structure and should therefore not be considered to be molecular, so this argument negated any marks scored from a correct answer.

In (a) (ii), those candidates who approached the question logically were able to deduce that the bonding in silicon dioxide is likely to be stronger than that in sodium chloride. Some simply repeated the information given in the question by stating that silicon dioxide is covalent, whilst sodium chloride is ionic. Others failed to make a comparison between the two, simply stating that the bonds in silicon dioxide are strong, rather than stronger. Again, some candidates were under the misapprehension that both sodium chloride and silicon dioxide consist of giant molecules and hence made a comparison of the relative strengths of the intermolecular forces of attraction.

In part (b), there were a disturbingly large number of candidates who seemed to believe that molten sodium chloride contains delocalised electrons. Some stated that molten sodium chloride is a good conductor because it contains a metal. Of those that correctly identified the ions as the potential charge carriers, some failed to mention that the ions move in an electric field. Stating that the ions are ‘free’ is not sufficient, but ‘free to move’ is.

Many answered part (c) well, with a suitable mention of weak intermolecular forces of attraction. Some stated that there were weak forces but did not identify the type of force, whilst others stated either that the covalent bonds were weak, or that there were weak forces of attraction between the atoms.

Question 15

Most candidates ticked the two correct boxes in (a), and then subsequently in (b) calculated a correct value for the average volume of $KMnO_4$ added. However some of those who ticked the two correct boxes, rather strangely, used all four titration results to calculate their average. Some failed to score the second mark in (b) by not giving their final answer to two decimal places, despite the instruction to do so in the question.

Very few failed to recognise, in (c), that a pipette was the correct piece of apparatus to use.

The calculations in parts (d) and (e) were done well by the more able candidates, with many scoring all nine marks.

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