Examiners' Report
Principal Examiner Feedback

Summer 2017

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

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

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Question 1

The vast majority of candidates answered correctly both parts (a) and (b). The most common mistake in (a) was to state that five elements are shown in the formula, presumably counting oxygen twice. Some lost the mark in (b) for putting zeros in front of both H_2SO_4 and Na_2SO_4. Part (c) was also answered well with most candidates scoring either one or both marks. All three distracters appeared in the list of incorrect answers given.

Question 2

Most of the candidates recognised, in part (a), that there were three periods and eight groups represented in the diagram. The most common mistake was to quote two periods and eight groups, presumably not appreciating that helium, although shown on its own, represented a period. Part (b) was answered correctly by the majority of candidates who recognised that helium and neon were the only two noble gases present in the diagram. The most common incorrect answer in (b) given was four. The trend continued in part (c), with over eighty percent of the candidates appreciating that the formula of magnesium fluoride was MgF_2.

The relative atomic mass calculation was performed well by most, but some lost a mark for not giving the final answer to one decimal place as requested by the question; 28.109 and 28 were both seen as final answers. Worryingly, around twenty percent of the candidates seemed to have little or no idea how to perform this calculation.

In part (e), it was common to see fully correct dot-and-cross diagrams, although some failed to include the non-bonding electrons on the fluorine atoms, so lost one mark. Candidates who insist on drawing either overlapping or touching circles to represent the outer shells need to be aware that the both of the bonding pair of electrons must be within the overlapping or touching area. This problem can easily be avoided by not drawing the circles.

Questions on structure and bonding, as set in parts (f)(i) and (f)(ii), are regularly answered poorly and this proved to be the case once again. In (f)(i), answers comparing the attractions between chlorine and fluorine molecules were common, as were answers discussing the relative relativities of the two elements, leading to a discussion of the relative strengths of the covalent bonds in $SiCl_4$ and SiF_4. Other answers contained a discussion of electrostatic forces without specifying the particles that were being attracted to one another. The best candidates kept their answers very brief and to the point, stating simply that the intermolecular forces of attraction are stronger in $SiCl_4$ than in SiF_4, and so gained both marks.

More candidates managed to score at least one mark in (f)(ii), either for stating that there are strong covalent bonds in SiO_2 or that the intermolecular forces in $SiCl_4$ are weak. Very few managed to state both together. Many of those who used the data supplied in the question that SiO_2 has a giant covalent structure then went on to state, incorrectly, that there are strong intermolecular forces of attraction in the compound. Candidates need to be aware that substances with giant structures do not consist of molecules. A significant number of candidates who stated correctly that the high boiling point of SiO_2 is a result of the strong covalent bonding then went on the state, incorrectly, that the low boiling point of $SiCl_4$ is a result of its weak covalent bonds, despite being told in the question that the compound has a simple molecular structure.

Question 3

Part (a) was mostly answered correctly with the most common incorrect answer being ions.
In part (b), most of the candidates wrote unreactive, which strictly speaking is not correct, since unreactive means ‘little tendency to react’, whereas inert means ‘does not react at all’. However, this answer was allowed, as was non-reactive. Some candidates tried to justify the lack of reactivity by stating that platinum had a full outer shell of electrons. This statement is, of course, both incorrect and also irrelevant.
Many recognised, in part (c), that the lead(II) bromide had to be made molten in order for it to be able to conduct electricity. However around half of the candidates stated correctly that this was to allow the ions to flow, with the other half stating incorrectly that this was to allow the electrons to flow, the latter showing confusion between conduction in ionic compounds and conduction in metals. Candidates also need to be aware that describing the ions as ‘free’ is not equivalent to ‘free to flow’.
In part (d)(i), less than sixty percent were able to state that both chlorine and oxygen can be given off at the positive electrode, whereas over sixty percent did recognise that hydrogen was the gas given off at the negative electrode.
There were very few who produced three fully correct equations in part (d)(ii), although around forty percent of the candidates managed to get either one or both of the equations for the formation of chlorine and hydrogen correct. Common mistakes were to omit the charges on the ions, to have the electrons on the incorrect side of the equation and to fail to balance the equations. It was interesting to note that the preferred equations for the formation of hydrogen and oxygen involving the discharge of water molecules, rather than the discharge of hydrogen ions and hydroxide ions, were rarely seen.
Part 3e proved to be a good discriminator. Around forty percent managed to obtain both marks. The twenty five percent who scored only one mark only did so because they either failed to divide the moles of electrons by two, or they multiplied the moles of electrons by two to obtain the moles of copper. These candidates obtained a mark for producing a correct error carried forward answer of either 2.54 g or 5.08 g respectively.

Question 4

Part (a)(i) was another high scoring question with most candidates able to select correctly compounds A, B and C as being hydrocarbons, and then to state that they contained only the elements hydrogen and carbon. A mark was lost by some for stating that the compounds contained hydrogen and carbon molecules, whilst a few described the hydrocarbons as elements despite the question stating that the substances were compounds. In part (a)(ii), well over ninety percent of the candidates spotted that B is shown as a displayed formula, and half of those were able go on to state that this is because all of the bonds are shown.
Part (b) proved to be another excellent discriminator, with an almost equal spread between the four available marks. Faster reaction and pure ethanol were seen very often as the answers to the process involving hydration of ethene. Many referred to renewable in answer to the advantage of fermentation, but some did not link this to the resource. An answer of ‘it is renewable’ did not score since the question referred to the process involved. Many hinted at different temperatures and pressures in the fermentation process as compared to the hydration process, but did not always mention that these were much lower. Other answers that failed to score were unqualified references to fermentation being a cheaper process, or it using cheaper equipment or it being a less complicated process.
The vast majority of candidates failed to obtain any marks in part (c)(i) simply because they did not read the question. They attempted to name the compound given in the

question, rather than the name of compound C that reacts with bromine to form this compound. The molecular formula of compound C was given in the table at the beginning of the question, but it would appear that these candidates also did not refer to this information when answering this question.

In part (c)(ii), approximately equal numbers of candidates gave either the correct answer of colourless, or the incorrect answer of brown/orange.

The majority of candidates were able to produce a good description of isomers in part (d)(i), although some used the rather vague and unacceptable term 'same chemical formula' for 'same molecular formula'. Others quoted same empirical formula or same general formula, both of which failed to score. A few gave descriptions of isotopes. Just over half of the candidates scored both marks in (d)(ii), with the most common incorrect answer being oxidation instead of addition. Some candidates had one mark deducted, even though they identified correctly both addition and hydration, because they placed a tick in a third box.

Most of the candidates were able to identify correctly, in (e)(i), the polymer made from chloroethene, giving either poly(chloroethene) or polyvinyl chloride as their answer. There was evidence in (e)(ii) that candidates did not refer to the table at the beginning of the question in order to obtain the correct formula for compound D, chloroethene, since there were a large number who used ethene as the monomer, or made up a formula of their own containing sometimes two, three or even four chlorine atoms. Of those that did produce the correct formula for the monomer and the polymer, a significant number then failed to balance correctly the equation by correct use of the letter '*n*', most commonly omitting the letter altogether on the reactant side.

Question 5

The most common error in (a)(i) was to omit oxygen from the reactants or to have carbon dioxide, instead of carbon monoxide, as a product. Most of those who got all four formulae correct then went on to obtain the second mark for balancing.

Surprisingly only half of the candidates were able to suggest a sensible reason as to why the temperature rise of the water was less than expected. Some lost the mark by not being precise enough in their answer, quoting just energy transferred to the surroundings, rather than heat or thermal energy, or stating just that heat energy was lost. Others quoted potential mistakes that the experimenter may have made such as not reading the thermometer correctly. Candidates need to be aware that in this type of question a procedural error, not a mistake that an experimenter may have made, needs to be identified.

Most were able to obtain the first two marks for the calculation of the heat energy change, Q in (b)(i). The subsequent use of this value in (b)(ii) posed more problematic. Many could obtain the number of moles of methanol burned, but then failed to use this correctly to calculate ΔH, or if they did they failed to recognise that this was an exothermic reaction and hence omitted the negative sign.

The calculation in part (c) was done better, with the majority of candidates able to score either three or four marks. Scores of less than two were rare. Many of those who did not obtain the correct values for the bonds broken and bonds made used their values correctly to find the difference and were able to give an appropriate sign to their final answer.

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