Examiners' Report/
Principal Examiner Feedback

Summer 2014

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

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Principal Examiner's Report June 2014 International GCSE Chemistry – 4CHO 1C

Question 1

As be expected there were very few wrong answers, although the pipette was often called a burette, which is odd bearing in mind that a burette appeared in the last question on the paper.

Question 2

There were also very few wrong answers encountered in this question, although some candidates chose to insert the thermometer before adding the crude oil, which clearly could not be poured through the solid bung.

Question 3

In questions such as (a)(iii), there is no need to identify the element, so that an answer of X^{2+} was expected, rather than Mg^{2+}, although the latter was marked correct.

The calculation in (b) caused few problems – although a large number of candidates failed to give their answer to one decimal place, as the question asked. Candidates should also appreciate that if the relative atomic masses of the isotopes given were 24, 25 and 26, then an answer below 24 or above 26 is impossible.

Question 4

Questions that test candidates' understanding of practical procedures covered in this specification frequently appear in question papers, and this question is a good example. Candidates should be familiar with this straightforward preparation, whether by personal experience or by demonstration, and teachers are advised to explain the purpose of each step in such preparations.

Some candidates may have made a salt from a carbonate – and therefore gave an answer to (b) in terms of 'until it stops fizzing'. In this case, the base was an oxide, so this answer could not be credited. Several candidates failed to score the mark in (c) for trying to filter off copper (II) sulfate rather than copper (II) oxide; others because they wrote that the filtrate was sulfuric acid. Part (d) was poorly answered – most candidates thought that crystals formed owing to continuing evaporation of water. All that was required was that students appreciated <u>why</u> crystallisation occurs when a hot, saturated solution cools.

Lastly, those who failed to score the mark in (f) did so because their method involved 'heat', which would lead to the salt becoming anhydrous. A wide range of drying methods was accepted here, although candidates should, in future, avoid the use of 'an oven', which is likely to be too hot for this purpose.

Question 5

The explanation of the term 'compound' in (b) was not well answered, with candidates frequently using the word 'mixture', or failing to mention the idea of bonding. Note that the bonding together of atoms does not always produce a compound (e.g. O_2, H_2) so the expectation was that candidates would answer in terms of a combination of elements. Part (c) was well answered, although in (c)(i) several candidates omitted the necessary reference to the final electron configuration – it was not sufficient simply to refer to 'full outer shells'.

Question 6

This question posed few problems for candidates. The most common mistake in (c) was to quote hydrogen, rather than water, as a product.

Question 7

Different command words are used when asking students to provide the name or formula of substances. In (a), the word 'Identify' was used. This means that candidates may give either the name or the formula. However, if both name and formula are given, then **both** must be correct. Hence, answers such as 'magnesium chloride, MgCl' did not score. It is always a pleasant surprise when candidates give correct answers that the examiners had not expected to see. Credit, therefore, was given to those candidates who gave 'carbon dioxide' as the identity of gas G.

There is usually one question on the paper where examiners penalise the poor use of chemical symbols and chemical formulae. In this paper it was Q7(b). Hence, candidates whose version of magnesium was 'mg' rather than 'Mg', or whose formula of water was 'H2O' rather than 'H_2O', did not score.

Question 8

As the dot and cross diagram for the lithium ion had already been given in the stem of the question, it was surprising to see so many candidates give an answer in (a) that contained a lithium ion with a charge other than +1, or a lithium ion with an electron configuration of 2:1 (or, in some cases, 3 electrons all in one shell). Others chose to show a covalent version of lithium nitride, despite the question asking for ions.

The equation in (b) was very poorly answered. A very large number of candidates could not copy the formula of lithium nitride given to them in the question, deciding that it must be Li_2N or LiN_2 or some other combination. It is disappointing that a number of candidates did not know that the formula of nitrogen is N_2, and not N.

In (c)(i), as always, some candidates gave the state symbol of water as (aq) instead of (l). Answers to (c)(ii) indicated that many candidates still cannot attribute alkalinity to the presence of the hydroxide <u>ion</u> in aqueous solution.

Part (d) could be answered in two ways – as the mark scheme indicates – but many candidates answered in terms of electron movement. This appears to be an area of fundamental confusion – as can be seen by the similar question on Paper 2C this session. Teachers should impress on their students the difference between conduction as a result of electron movement in metals and movement of ions in electrolytes.

Question 9

There were few errors in the early parts of this question, and the general formula for alkanes was more consistently seen as 'C_nH_{2n+2}' rather than '$C_nH_{2n}+2$'.

As always with isomers of butane, there were several versions of $CH_3CH_2CH_2CH_3$ with a bend in the chain, rather than $CH_3CH(CH_3)CH_3$ – but fewer than in previous years.

Part (d) saw a variety of levels of understanding of why carbon monoxide is toxic. Teachers should take care not to give candidates the idea that carbon monoxide completely prevents oxygen binding to haemoglobin. Although the examiners do not expect a full biochemical answer, they do not wish poor science to be propagated. The mark scheme gives a suggested answer, which is not too complicated and does reflect what happens in the blood. Lastly, candidates should appreciate that 'harmful' is not an acceptable answer when a substance is poisonous or toxic.

Question 10

Few incorrect answers were seen in either (a) or (b). In (c)(i), the term 'exothermic' should be explained with reference to 'heat energy' (as in the specification); 'heat', but not just 'energy' is an acceptable alternative.

In (c)(ii), the second mark was not awarded to candidates who said that aluminium displaces ‘oxygen’ or ‘iron oxide’. A simple definition of oxidation – in terms of gain of oxygen – was expected in (iii), although an answer in terms of electron transfer were also accepted, as long as this did not contradict any answer in terms of oxygen.

Part (d) discriminated well between candidates, with few using language correctly enough. All exothermic reactions release heat energy – but would not cause the change of state we see here, as the heat energy dissipates to the surroundings. Here, the key is that the heat energy is contained and the result is that a high temperature is reached, above the melting point of iron. It was this reference to temperature that eluded many.

Question 11

The test in (b) was not well answered – maybe because the question referred to ‘unsaturation’ rather than to ‘alkenes’ or ‘C=C bonds’. Hence there were a number of squeaky pops, relit spills, and cloudy limewaters. Those who did identify bromine did not always gain the second mark. It was quite common to see the bromine remain orange/red, and there are still a number of candidates who, despite it never having been marked correct, write ‘clear’ instead of ‘colourless’.

The catalyst and temperature in (c) were not well recalled, with many quoting those for the Haber process.

Question 12

Unfortunately, it was not uncommon to see answers to (a)(i) where the division was the wrong way up, or involved atomic numbers instead of relative atomic masses. Although candidates may have forced these calculations to come out to 1:1:2, they gain no marks because of the fundamental misunderstanding of the process involved. Note, also, it was expected that candidates showed that 0.02:0.02:0.04 equated to 1:1:2.

Although it is frequently asked, there are still large numbers of candidates who cannot convert an empirical formula to a molecular formula, with a range of wrong answers being seen, with the most common incorrect one being $2CFCl_2$.

Lastly, the dot and cross diagram in (b) was usually well done. However, the examiners would like to encourage candidates to assist the ease of marking by drawing these diagrams neatly and of a suitable size; and by arranging the non-bonding electrons in pairs, as this also helps candidates to see that their answer is correct!

Question 13

There were many good answers (b)(i). However some candidates ruined otherwise fully correct answers by subsequently referring to 'intermolecular forces' being overcome. Equally, there are many candidates in situations such as (b)(ii) who lose marks by referring to bonds between atoms (i.e. covalent bonds) breaking. These questions are commonly asked and candidates need to appreciate the difference between the two circumstances. It is also worth noting, for (b)(i), that candidates should refer to covalent bonds being 'broken' when diamond is melted. The use of the phrase '…energy is needed to <u>overcome</u> the bonds' is not as precise, especially as it could be interpreted as referring to intermolecular forces, not covalent bonds.

Part (c) tested the ability of candidates to use simple information in order to reach a conclusion. Many candidates ignored the information and went for Theory A, as it was the theory they had been taught. Those who correctly selected Theory B usually gave a suitable justification.

Question 14

The table in (a) produced the usual problems with this sort of question – a structure for poly(ethene) that did not show the idea of continuation bonds, for example. Structures for propene were also often incorrect. Most surprising was the inability of candidates to name poly(propene). Some candidates must have seen a 'Cl' that was not there, as they chose PVC. Others named a polymer not on the specification, such as polystyrene, and some were unfamiliar with this part of the specification, as indicated by answers such as poly(methylethene). In (b), candidates should note that the answer 'the double bond breaks' was not allowed, on the grounds that only one of the two bonds in the double bond breaks. Some candidates were, however, able to salvage this mark as their 2nd answer referred to 'single bonds are made'.

Parts (c)(i) and (c)(ii) were recently tested so it was surprising to see that these questions were not well answered. Teachers are recommended to look at which answers were allowed and which were not. One theme that arose in (c)(ii) was gases being referred to as 'harmful', as happens in other questions e.g. on safety precautions. Teachers should note that 'harmful' is not precise enough and is not accepted in place of a word such as 'toxic' or 'poisonous'. Although the burning of polymers does produce toxic gases, carbon monoxide is not one of them since precautions are taken in incinerators to make sure that complete combustion takes place.

Question 15

Part (a) was well answered, although quite a few candidates either could not work out the *M*r of sodium hydroxide or treated this calculation like a titration. As always, a number of candidates read the burette the wrong way up, or failed to give the readings to the precision requested. It cannot be emphasised too strongly to candidates that all burette readings must be given to 2 decimal places, the second place being a ‘0’ or a ‘5’. The colours of the methyl orange were usually correct – although some candidates had them round the wrong way. Those who said ‘red to yellow’ scored zero, as neither colour was correct. Those who have been taught correctly, that the end point with this indicator is the first colour change, and wrote ‘red to orange’ were at least able to score one mark. As a similar question to (b)(iii) has been asked recently, this question was answered better than on its previous outing, although there were still too many vague references to ‘precision’ or ‘accuracy’.

Finally, part (c) was usually well answered, the main error being a failure to spot the 1:2 ratio in part (ii), giving a final answer of 17.6g for one mark only.

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