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Examiners' Report/ Principal Examiner Feedback

June 2011

International GCSE
Chemistry (4CH0) Paper 2C

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Question 1

This was a straightforward question and the majority of candidates scored full marks. It is possible that some candidates had not seen the reaction of potassium with water since they thought the potassium would sink. All possible combinations of answers were seen but, not surprisingly based on past experience, the two most common incorrect answers were that 'potassium oxide solution is formed' and 'bubbles of oxygen gas are produced'.

Question 2 This was a high scoring question showing candidates had good knowledge of the chemistry involved. Only the weakest candidates failed to score between 3 and 5 marks. The most common incorrect answers were iron as a metal ore and chlorine as a substance used to make soap.

Question 3 This was also a high scoring question showing that the majority of candidates used the data in the table wisely. In part (b) some candidates did not read the question carefully enough and assumed lead would be unsuitable because of its high density; the clue in the text was that 'very <u>small</u> amounts' are used. In part (c) the majority scored all 3 marks but some thought copper would be the most suitable metal. These candidates, however, usually scored 2 marks for giving sensible reasons. A number of candidates gave all three correct reasons for why titanium was the most suitable metal. This, obviously, was not penalised, but teachers may wish to warn candidates that producing more reasons than asked for is likely to result in a penalty being imposed if one, or more, of the reasons given is/are incorrect.

Question 4

Part (a) was well known and most candidates gained all 3 marks, however 'discoloured' instead of 'decolourised' was a common mistake for the effect on bromine water. Part b(ii) was, surprisingly, not so well done and answers such as hydration and condensation were common mistakes. In part (c) many candidates knew how to complete the equation correctly but some forgot the 'n' after the brackets, or placed the 'n' before the brackets. Some gave too many —CH_2— units and, thankfully, an even smaller number left the double bond in situ.

Question 5

This was another high scoring question. Very few candidates had problems in identifying the anomalous result, with the most common incorrect answer being 0.05. Part (a) caused few problems. Some candidates failed to appreciate the significance of the results and chose sodium and potassium chlorides as their answers, but, quite inexplicably, a minority chose pure water and soap.

The most important reason for carrying out an experiment more than once is to check on the reliability of the method/results. However, the opportunity of calculating a mean from several results is likely to improve the accuracy of the final result, hence this was given credit. Repeating an experiment will not increase its validity and nor will it increase the accuracy of the method, as was thought by some candidates.

Surprisingly a common mistake in part (d) was to think that a pipette should be used to add the soap solution. A burette has a tap and hence much greater control can be exercised when adding the soap solution.

The calculation proved to be very straightforward with very few candidates not scoring both marks. However, some thought that the answer of 1.65 to two decimal places was 1.70 and, even worse, 1.7.

Question 6

Good candidates gave clear concise answers to 6(a) and gained all 4 marks. However, a lot of unnecessary information was often included and teachers may wish to reinforce this message to their candidates. Marks were sometimes lost by confusing the breaking of covalent bonds with the breaking of intermolecular forces. Diamond is a giant structure and hence there are no intermolecular forces in action.

In 6(b), most candidates scored one mark by saying that the layers slide over each other but only the better candidates mentioned that this was due to the weak forces of <u>attraction</u> between the layers, or supplied some evidence that the layers were attracted to one another.

Again, in 6(c) most scored one mark as they knew that electrons that are able to move are responsible for electrical conduction, but only the more able candidates were able to suggest that, in common with metals, graphite contained delocalised electrons. The Examiners are aware that several books refer to the concept of 'free' electrons. All electrons are free to move within their own orbits and this term is therefore not meaningful and teachers are encouraged to use 'delocalised' instead.

6(d) proved to be an excellent discriminator and was poorly answered by many candidates who thought that covalent bonds were broken in C_{60} and that the reason for the low melting point was that each C had only 3 bonds to it and not 4. This showed a lack of understanding of the difference between giant structures and simple molecular structures and what type of bond/attraction needs to be broken to melt these structures. This topic needs to be taught more thoroughly in order to ensure candidates can answer this type of question in the future. Candidates should be aware that there are differences between intermolecular <u>forces</u> and covalent <u>bonds</u>, hence candidates who use the phrase 'intermolecular <u>bonds</u>' are in danger of confusing themselves when they develop their answer. Also, it is useful to note that forces between molecules can be both attraction and repulsion. It is the fact that the molecules have weak <u>attraction</u> for one another that is important here.

Question 7

Most candidates could calculate the moles correctly in (a)(i), but (a)(ii) proved to be more difficult. Common mistakes were to not use the equation and to assume the moles of NaN_3 was the same as for N_2, to use 130 instead of 65 as the M_r or to double up the sodium giving a M_r of 88. Despite these errors the majority of candidates scored 1 or 2 consequential marks and the better candidates did the calculation correctly and gained all 3 marks.

Part (b)(i) produced a variety of answers many of which made reference to nitrogen being produced and/or inflating the air bag, but did not qualify the statements with <u>more</u> (nitrogen) or inflate the air bag <u>more quickly</u>. There were also many references to how the reaction makes the sodium less harmful or vague references to it no longer being a liquid, but not giving the idea of it being removed. In (b)(ii), only the better candidates gave the correct state symbols. The most common mistake was to think that SiO_2 was a gas, presumably through comparison with CO_2. It was hoped that candidates would be able to transfer their knowledge of the removal of SiO_2 in the Blast Furnace to recognise that it would be a solid under these conditions. It would also be useful for teachers to point out that candidates should be extremely careful when writing state symbols. It was often difficult to distinguish an 's' from a 'g'. Examiners were instructed <u>not</u> to give the benefit of the doubt in such cases.

In (c)(i), candidates were expected to use the state symbols to recognise that a solid was being formed from a reaction taking place in aqueous solution, and hence identify the reaction as a precipitation. This, surprisingly, seemed beyond the capability of all except the most able. Common mistakes were to say it was a displacement reaction or a redox reaction. Part (c)(ii) was answered correctly by most candidates.

Question 8

Parts (a), (b) and (c) were answered well by most candidates and full marks were often scored here. Since all solutions are clear, regardless of colour, this answer was not accepted in part (a). A few candidates thought that because sulfuric acid contained H and O it would hydrate the copper(II) sulfate and some confused the conditions for the Contact process with those for the Haber process.

The calculation in (d) was well attempted with many candidates gaining the marks for parts (i) and (ii). After this there were a multitude of variations on how to manipulate the numbers. Credit was given for any correct processing of an incorrect answer from (ii), of which there were quite a few. It was surprising how many candidates correctly calculated 0.12 in (iii) and then failed to realise that all that was needed in (iv) was multiply this by 100, often only multiplying by 10, or performing some totally unnecessary complex calculation.

General points

- If **one** or **two** reasons / points are asked for it is not a good idea to give more than the requested number, since any error may well lead to a penalty being applied.
- When asked to identify a substance either a name or a formula is acceptable, but if both are given then both need to be correct.
- If a temperature or pressure is required then do not give a range, since both extremes of the range will be within the acceptable range in the mark scheme.
- Candidates should use words in their calculations where appropriate so that examiners can follow their working more easily.
- Care should be taken not to confuse intermolecular forces with covalent bonds.
- Candidates should print state symbols very carefully so that they can be easily read.

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