Examiners' Report/ Principal Examiner Feedback

Summer 2014

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

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Question 1

From the chromatogram, few candidates had difficulty in identifying the number of dyes in SR in (a) and the safe food colourings in (b). Many attempts at explaining their choice in (b) did not go beyond restating the question wording, often merely stating that FR and FG were the same as the safe food colourings. Most successful explanations referred to matching, lining up with, having the same pattern as, or travelling the same distance as SR and SG, or similar equivalent wording.

Question 2

Most parts of this question about separating ethanol and water were well answered. In (a), very few candidates failed to mention a method of separation, although the most common unacceptable answers were "simple distillation" and just "distillation". The commonest correct answer to (b) was a reference to a difference in boiling point, with few candidates quoting irrelevant information (such as that they were both liquids, or miscible).

Part (c) was designed to test candidates' understanding of a practical procedure, but few seemed to know how a condenser worked. There were many answers referring to water and ethanol not mixing, hot air rising, temperature gradient, among others. Some candidates did understand the reason and were able to express their points clearly, with answers such as "to make sure that the condenser jacket is full of water" and "at B the water would run out and not surround the tube". Part (d) was well answered, with most candidates scoring by stating that ethanol had a lower boiling point than water.

Question 3

Most candidates scored highly in this question about the Periodic Table. Part (a) was well answered - in (a)(iii), the explanation was usually given in terms of a complete outer shell of electrons, and errors were quite rare - examples being "similar electronic configurations" and references to stability or being noble or inert. Errors were also rare in (b) and (c), although in (d) the numbers were sometimes correct but not in the right order, and with 2 and 18 occasionally appearing.

Question 4

This question was about investigating the rate of the sodium thiosulfate - acid reaction. Most candidates answered (a) correctly by identifying the formation of sulfur or a precipitate (going cloudy or opaque were also acceptable answers). Those who failed to score often did not go far enough and just restated information provided ("because the sodium thiosulfate reacts with the acid"), or incorrectly identified the solid ("a precipitate of sodium chloride forms").

Part (b) aimed to test candidates' understanding of an experimental procedure; very few gave the expected answer - so that the depth of liquid would be the same in each experiment, meaning that the time recorded would be for the same quantity of sulfur obscuring the cross in each experiment. Most answers referred to the need to keep the concentration of sodium thiosulfate solution constant in each experiment, but the purpose of the experiment was to investigate the effect of changing the concentration from one experiment to the next. In (c), many more candidates understood the need to add the water before the acid - because the reaction would start before the correct concentration had been reached, or before the timer was started. The commonest incorrect answers were references to safety issues such as a violent reaction or the risk of breaking glass.

In (d), the safety precautions were well known, and most of the effects of not using them were known - the most common incorrect answers referred to forms of pollution such as acid rain. The full range of marks was seen to the graph part of the question.

In (e)(i) no more than the usual number of errors were seen - misplotting of one or more points, curves that contained straight sections or changed direction, and multiple curves. Part (e)(ii) would have been unfamiliar to most candidates, and a pleasing number scored both marks - the expected curve should have been below the original (higher temperature means faster rate and so shorter times) and going from 10 cm^3 to 50 cm^3 (all other factors remained constant).

Question 5

Part (a) of this question about electrolysis was well attempted, with most candidates scoring 1 or 2 marks. All that was expected were references to decomposition (or equivalents) or chemical change and the use of electricity. The most common wording that did not score the first mark referred to the separation of ions - this was considered insufficient as it does not imply decomposition, chemical change or the formation of new substances. In (b), very few candidates scored no marks, and a pleasing number scored 3 marks. The commonest errors were to include oxygen or carbon dioxide as one of the gases, or to have chlorine and hydrogen at the wrong electrodes (for which 1 mark was awarded). Answers to (c)(i) revealed the widespread misunderstanding that seems to persist in students' minds - that in the electrolysis of a molten compound electrons, not ions, move through the liquid. Although there were many fully correct equations in (c)(ii), there were some that showed the conversion of chlorine to chloride ions, as well as many more that used the symbol Cl instead of the formula Cl_2 for chlorine. Even more disappointing was the appearance of Cl^+ and Cl^{2-} ions, and perhaps even worse, e^+ in the equations.

Question 6

In part (a), many examples of the correct response (brown precipitate) were seen, although often accompanied by other acceptable colours such as orange, red and rusty. Some of those who recognised that a precipitate would be formed used an unacceptable colour (usually green), while others gave acceptable colours but did not mention a precipitate. There were also many references to effervescence, which were ignored.

There were several all-correct answers to (b)(i), and thankfully very few that referred to incorrect ions such as H^+ and SO_4^{2-}. However, there were many more that revealed the ongoing confusion between ammonium (ions) and ammonia (gas), and many answers for the cation were incorrect formulae such as NH_3^+ and incorrect names such as ammonia.
In (b)(ii), many correct identifications of the sulfate ion were seen (by name or formula), although there were many errors that prevented candidates from scoring, such as SO_4^- and sulfide.

Part (c) was well answered by very few candidates, with most answers revealing a widespread confusion about reduction and reducing agents. A common, but not unexpected, incorrect choice was Fe^{3+}, but there were many others including oxygen and the ions formed in the reaction. Many of those who correctly chose Zn then went on to give an explanation in terms of zinc gaining electrons. Some candidates failed to score the explanation mark because they wrote about iron gaining electrons (it is the Fe^{3+} ion that gains an electron).

Question 7

This question about alcohols was generally well answered by most candidates. In (a)(i), candidates were familiar with the characteristics of a homologous series, although the usual errors were seen: similar, rather than a gradation in, physical properties; giving a specific chemical property such as combustion; and referring to properties without specifying whether they were chemical or physical. There were very few incorrect answers to (a)(ii), the most common being the omission of the O–H bond. The comparison of the batch and continuous processes to make ethanol in (b) was well answered, with many high scores seen. One problem was the failure to make a comparison (for example, it is not sufficient to state that the batch process makes impure ethanol without also stating that the continuous process makes pure ethanol, although to state that the continuous process makes purer ethanol is sufficient). Another problem was the use of imprecise language in the resource comparison – possible descriptions of the batch process are to state that it uses renewable, sustainable or non-finite resources, but to state that sugar grows easily, or that the resources are easily found, is not close enough to the idea of sustainability to score.

The calculation in (c) was well attempted and many high scores were seen. The most common error was the failure to use the kg→g conversion in (i), which led to an answer of 20 mole – however this error involved only a 1-mark penalty and the subsequent parts were dealt with by consequential marking and allowed access to all the marks in (ii) and (iii). Another common error was the failure in (ii) to consider the 1:2 mole ratio or to use a 2:1 mole ratio.

Question 8

This question about an unfamiliar industrial process was quite well answered. There was some confusion shown in answers to (a)(i), as evidenced by the crossing out of the low/high prediction, sometimes more than once. The expected reason was that the forward reaction is endothermic (or other equivalent wording); although only a small number of candidates referred to Le Chatelier's principle it should be noted that this principle does not appear in the specification and that merely quoting it is not an explanation. There are similar comments to be made on (a)(ii) - this time the expected answer was in terms of the greater number of moles or molecules on the right-hand, or products, side. Candidates should be advised that poorly expressed ideas (such as "there are more moles in the forward direction") may not be sufficient to score the mark - such answers require the examiner to interpret what the candidate is thinking, but this is the job of the candidate, not the examiner. Some candidates were confused about pressure and temperature, and there were some answers in (a)(i) that referred to pressure, and in (a)(ii) to temperature.

Many candidates were able to explain the action of a catalyst in (b) in terms of an alternative pathway of lower activation energy. A few described the action of a heterogeneous catalyst in terms of adsorption of gas molecules on a surface which was not what the question asked, but such answers were credited. The most common answers that were not accepted referred to a catalyst speeding up a reaction (information provided in the question) and not being used up in the reaction (not an explanation of how it works).

Many candidates made good attempts at writing the equation for the unfamiliar reaction in (c)(i). The names of both reactants and one of the products were supplied, so candidates were expected to deduce the other product and use the correct reversible arrow symbol in the equation, which did not need balancing. Although many candidates scored both marks, quite a number omitted the reversible arrow, while some wrote an equation with only the substances given in the question and ignored the hydrogen formed. In (c)(ii) most candidates recognised that gain of oxygen was the expected answer, although there were some references to electron transfer and rather more to the need to convert carbon monoxide to a less toxic gas. Again, in (c)(iii), most candidates succeeded in scoring one or both marks for writing this unfamiliar equation. In spite of the clear wording in the question, it was a bit disappointing to see reactants such as carbon monoxide and oxygen appearing.

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