Examiners' Report
Principal Examiner Feedback

Summer 2017

Pearson Edexcel GCSE In Science (5CH3H) Paper 01

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This paper followed the usual format of six questions, the last two of which contained the extended writing questions. This is the last sitting of this paper.

Question 1

1(a)(i) Although generally well answered, there were a few poor guesses at this, indicating a lack of understanding of general formulae for homologous series.

1(a)(ii) The structure of a molecule of ethanol was usually well drawn, using capital letters for the atoms and showing the covalent bonds. Some marks were lost due to showing C=C, C=O-H, -HO (where -OH group had been drawn on the left hand carbon), penta- or tri-valent carbon, or for missing the bond between CH_3 and CH_2OH.

1(b)(i) There were many correct equations with most candidates writing H_2O (water as a product being given in question), fewer getting ethene. Errors for ethene included C_2H_3, C_2H_5 or $2CH_2$, and others were confused by the catalyst and tried to include Al_2O_3 (or Al). Other candidates did not deduce the formula from the reactant formula given minus water, and guessed for example, with CO_2. There were examples of incorrect use of capital or small letters, or not using subscripts.

Question 2

2(b) Most candidates were able to draw the correct structure. The two most popular mistakes were a poorly drawn carboxyl group with students either drawing it in a line: C - O – O – H or with the double bond on the OH, or C-O rather than C=O, or having a C=C. Less common errors were pentavalent and even hexavalent carbons or too many carbons in the chain. Some candidates did not show the structure at all (the question stated "showing all the bonds") and gave -COOH.

There were some who clearly did not have any idea of the structure at all but this was unusual.

2(c)(i) Most candidates had a go at magnesium ethanoate ('ethonate' or 'ethanate' not unusually seen), but a pleasing number were correct. Scrappy handwriting did not help examiners in some answers. Most though did not score for the second product, with incorrect products, commonly water, or even carbon dioxide, or just a blank.

2(c)(ii) Those that scored did so with fizzing, but many added extra incorrect observations that cost this mark: white precipitate, colour change, bright light or steam. It was frustrating to see candidates putting more than one answer, and as the question was worth 1 mark this should be avoided.

2(d) This question was worth 2 marks so needed a use with suitable description. Some answers incorrectly referred to polyesters (or fabric/ clothing) rather than esters. The most common correct answer referred to sweets or perfumes, with pleasant taste / smell.

2(e) There was much confusion in this relatively straightforward part– some heated with a carboxylic acid or an ester. Those that did mention an alkali often neglected to heat it, or even heated without any alkali.

Many did not state how to make the soap but simply described the hydrophilic and hydrophobic ends, and it was apparent that they had not read or understood the question.

Question 3

3(a) Most candidates knew that calcium or magnesium ions were responsible. It was disappointing to see many candidates then lose the mark by writing the name and then following it up with the incorrect ion symbol (usually the wrong charge), or the symbol for a magnesium or calcium atom, or even gave the name of a compound.

3(b) A majority of candidates gained 2 marks here, correctly identifying samples A and B with correct reasoning for each.

Candidates were good at using the data for these samples, but much less good at interpreting the data for C. Incorrect statements include C has temporary hardness, or C is "not as temporary as A". Some correctly identified C as containing both types of hardness, but did not use the data given to justify this.

Some candidates referred to temporary hardness as softness ("A is soft"). Others talked about the ions present causing temporary and permanent hardness, but did not use the information in the table about the volumes of soap.

3(c)(i) There were some good responses to this equation, particularly the left hand side which was straightforward. On the right hand side it was not uncommon to miss out carbon dioxide. Where all of the substances were given, most went on to correctly balance the equation. Some, however, lost this third mark due to incorrect capital or small letters in formulae or incorrect use of subscripts/ missing subscripts (e.g cL, cl or CL, CO2 rather than CO_2).

3(c)(ii) This calculation generally had a fair response with many candidates able to calculate the concentration correctly. Nearly all candidates had 1 mark for the relative formula mass.

A common error here was to get 100.5 (65 + 35.5) so not taking into account the 2 Cl in the formula. For the second marking point, lots of responses divided by 0.25 instead of multiplying. In some responses, dividing by 1000 was seen.

3(d) There were good, clear answers here, but where both marks were not scored it was difficult to award one mark, because working was not clear, and, to quote an examiner, there was 'an explosion of random numbers'. A common error was to multiply 18.5 by 25. Many candidates made an attempt with lots of titration calculation tables laid out, but the numbers were put in the wrong place and the number of moles usually calculated incorrectly. A lot of incorrect rounding of the number of moles led to an incorrect final answer. Some candidates are very untidy in their calculations - not stating what they are trying to calculate but leaving the examiner to search the page for relevant method. There were also issues with standard form; with the answer derived from a calculator but converted incorrectly into decimal form.

There was some responses where they forgot the 1000 scaling so forgot to x1000 or /1000.

Question 4

4(a)(i) For what should have been a simple question to answer the candidates did not do well. They generally identified carbon dioxide as the gas as a result of the limewater test but then failed to make the link with carbonates. Many identified the (an)ion as carbon or carbon dioxide rather than carbonate. Some suggested that carbonate turned limewater milky.

Some described other ion tests, particularly the one for copper.

4(a)(ii) A good number proved able to identify the 'pale blue precipitate' as copper hydroxide; fewer give a correct formula as an alternative.

4(a)(iii) Many candidates had no concept of an ionic equation. Thus, there were many full (correct or otherwise) word equations written out or attempts at symbol equations. It was worrying that many wrote Br as the symbol for barium rather than Ba.

Those that had a go had strange ions: Br^- and S^{2-} being commonly seen. A good number of responses sought to involve copper and/or chloride and their alleged ions. There was a distinct lack of state symbols, even though these were asked for.

Most who scored did so for the correct formula of barium sulfate (with no other) on the right, although lots of incorrect attempts at the sulfate ion were seen.
4(b) Some exemplary answers were seen with well described tests giving excellent detail, mentioning (although it was not required by markscheme) acidification with nitric acid first and even explaining how this removed carbonate ions and stopped white silver carbonate forming. Some even identified the names of the precipitates formed. Only a few missed out by not stating silver nitrate (often suggesting silver chloride, silver sulfate or sodium hydroxide as the appropriate reagent), and very few students omitted to mention that precipitates were formed.

Question 5
5(a)(i) Many candidates understood the relevance of the endothermic nature of the reverse reaction, although clarity of expression was an issue in this, and the next, question. It was not clear in quite a few answers which way the equilibrium position had moved. Some candidates still get muddled with this concept, and for example talked about the rate of reaction rather than the position of equilibrium shifting. The weakest candidates just stated 'optimum conditions' (or even talked about enzyme effectiveness).
Candidates should be aware that in (i) and (ii) just repeating the stem is not credited.
5(a)(ii) This question was less easily grasped than part (i) interestingly. There was a greater propensity to have confusion with rates with talk of higher pressure leading to more collisions. Better candidates used well the 3:2 ratio of moles.
5(c) Some answers here contained superb descriptions, but many were far too sketchy – for example not including the critical step of weighing out the magnesium. There was the impression that the candidates had not really thought about the point of the experiment – and thus identify the key issues, including measuring the total volume of gas evolved. Some, but sadly a minority, went on to very effectively use the data to derive the molar volume. (Some candidates assumed the answer of $24dm^3$ and some showed that this was consistent with the data, but this was not the point of this experiment). It was quite extraordinary on this paper at higher tier how many candidates named incorrectly the syringe, or even the flask.
It should be noted that some candidates very helpfully labelled the diagram and this could score credit.
Examiners noted that logical, step-by-step presentation of (a) the method and (b) the calculation would have greatly helped the candidates organise their work and score marks.

Question 6

6(a)(i) This was answered well, with those not scoring talking about oxygen.

6(b). Many good responses scored 3 marks, with those usually missing the final, most difficult mark about why the colour of electrolyte did not change. (The majority of responses did not even make reference to this aspect at all).

Most understood the Cu^{2+} ions were moving from anode to cathode, although they often struggled to explain this clearly with technical terms. Too many attempted to discuss 'impure copper ions moving from the anode' or 'impure copper falling from the anode'.

Most knew about the impurities and the sludge and even gave correct composition of it. Sometimes, this was the only mark scored. One misconception was that sulfate ions reacted at the anode to produce the sludge, or that the sludge was 'impure copper'.

Those that did attempt an explanation of the colour were not specific enough in terms of the ions entering and leaving at same rate or by same quantity so that concentration remained constant. They mainly said that Cu^{2+} ions were still present or copper sulfate still there, hence stays blue.

There was widespread incorrect use of atoms and ions; incorrect use of anion and cation; there was muddling up of oxidation and reduction too, often with them being the wrong way round. There seems to be a common misconception that the anode was losing electrons and the cathode was gaining electrons (and therefore, sometimes, this was the cause of the electrodes losing or gaining mass), and several talked about electrons moving through the solution.

6(c). There were, here, some very well written responses demonstrating good understanding and knowledge, as well as the ability to write cogently about electrolysis, and examiners were impressed overall. However, some candidates confused molten and aqueous here, or talked about 'molten solutions' or did not specify which they were discussing.

Many tackled the more straightforward molten electrolyte very well with good descriptions of what was happening.

Some good attempts were seen for the aqueous solution, although some had oxide ions present instead of hydroxide ions. Nevertheless, many identified the correct products for the aqueous solution and some could even explain preferential discharge.

Half-equations were not essential for full marks, and It is clear that writing half equations needs a lot of work. Equations for sodium and hydrogen formation were sometimes well done; for chlorine, much less well done with incorrect subscripts and charges and electrons added in all sorts of unlikely places (even the occasional positive electron!).

There was much confusion of anions and cations and oxidation and reduction and of the electrodes being the wrong way round. Some discussed electrolysis in general which indicated a failure to understand the question or more likely that the candidate had not really read the question.

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