Examiners' Report
Principal Examiner Feedback

October 2018

Pearson Edexcel International Advanced Level
In Chemistry (WCH06)
Paper 01 Chemistry Laboratory Skills II

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General comment

It was evident from the answers seen that some learners were very well prepared for this examination and consequently scored high marks. Learners still need to be reminded that the question should be read more than once in order to ensure that the answer given does match what is required. In addition learners will aways benefit from 'hands-on' practical experience and to have the reasoning for each practical step explained so that they really grasp what is being done and why.

Q1

Q1(a)(i)-(ii) – a poorly answered start to the paper which was disappointing. The dissolving of the two copper(II) salts in dilte hydrochloric acid to give a blue solution was rarely known in part (i). More learners appreciated that the addition of barium chloride to copper(II) sulfate would give a white precipitate and that this would be not be seen with copper(II) hydroxide but this was still a minority of learners. This is really an AS question about the use of barium chloride to test for the sulfate anion but in an A level context, so more learners were expected to be able to deduce the expected results. Hence learners should be reminded that AS content is required throughout their A level course as chemistry builds on what has been previously learned.

Q1(b)(ii) – This was another example of an AS question in an A level context and answered rather better than the earlier question but the mean was still just under one mark out of two. Common errors included the adding of sodium hydroxide to acidified silver nitrate which shows a failure to understand that sodium hydroxide is an alkali and so will be react with the acid. Also a significant minority of learners misread 'chloride ion' for 'chlorine' and so answered in terms of the bleaching of damp litmus paper. Thus a clear reminder for learners to apply RTQ^2 or to re-read the question carefully to make sure that they are answering the question set.

Q1(c) – The use of standard electrode potentials tended to either be understood and both marks awarded or not understood and so no marks gained. Occasionally one mark was lost for only stating the cell emf as 0.5 V instead of 0.51 V.

Q1(d)(i) – Only a small handful of learners appreciated that beneath the crust a non-anhydrous salt could still be present and could give a correct formula. A wide range of answers were given which included anions, cations and gases oftentimes which even did not contain vanadium despite the question asking for the formula of a vandium salt. This was very concerning and seemed to reflect a complete lack of understanding of very basic chemistry.

Q1(d)(ii) – This question was answered in a much better way as the majority of learners appreciated that more water of crystallisation was being lost.

Q1(d)(iii) – The most common mark was 2 out of 2 as learners generally knew how to attempt this question. However, a sizeable minority of learners

calculated the percentage of solid left rather than the percentage loss of mass. Clearly these learners could carry out the mathematical demands of the question but misunderstood the requirement of the question. Another example of the need to more carefully read the question and then answer accordingly.

Q2

Q2(a) – Only the more able learners expressed themselves clearly enough to score the mark. Reference just to "quicker reaction" was insufficient because it needed to be clear that the learner was referrring to the quenching reaction and not the reaction of the reaction mixture itself.

Q2(b) – The first part (i) serves as a useful reminder to learners to always keep to the precision of the data already stated and so the answer should have been to two decimal places. Most graphs in part (ii) gained some credit. The most common error was the choice of a scale on the y axis which started at zero and then the plotted points failing to cover over half of the graph paper. It could be achieved by starting at zero but the scale was then more challening. It was much easier to start at a number other than zero and this would serve as good practice for future examinations. Occasionally the axes labels included such abbreviations as 'V' and 'T', neither of which were accepted. In part (iii) many learners omitted units despite the instruction in the question and some others gave the unit of 'm' which is not minutes but metres. However, the numerical value was often calculated correctly.

Q2(c) – Many learners incorrectly assumed that because the graph was a straight line that the reaction order must be first. However the graph drawn was a 'concentration versus time' type and not a 'rate versus concentration'. Hence this question proved to be an effective means of differentiation for higher ability learners.

Q2(d) – This was a very poorly-answered question and only a few were able to gain the mark. It would be worthwhile for centres to help their learners to understand that the accuracy of the time taken when the sample was removed is important. If this time is known then the analytical value at this time can be correctly plotted.

Q2(e) – The more able learners with practical experience appreciated the impossibility of removing the final 10.0 cm^3 and recommended a suitable strategy such as titrating the reaction mixture directly in the reaction flask.

Q2(f) – The majority of learners correctly identified that temperature was the factor that was not controlled and then suggested the use of a water bath to control it. A minority proposed that the air-conditioning in a room would be suitable or even that simply use of a thermometer would control temperature but neither of these gained any credit.

Q3

Q3(a)(i) – The key issue which needed to be identified was the lack of concordancy of the titres and this answer was given by just under half of learners. However, some negated their answer by referring to the lack of concordancy of the mean titres while others stated the lack of concordancy of titrations 1 and 2 but this failed to note that titration 3 was also not concordant. Another error suggested was that only one titration started at zero but of course this is not a requirement.

Q3(a)(ii)(iii) – Only approximately half of the learners could give the correct colour change at the end-point for phenolphthalein which was disappointing since this is one of the main indicators used in chemistry at this level. The issue of the colour of the apple juice interferring with the indicator's colour change was only identified by the top 10% of learners.

Q3(a)(iv) – Another example of the need to apply RTQ^2 when answering the question because many learners failed to give their answer to two significant figures despite the 'two' being emboldened in the question. The other very common error was to miss the 2:1 molar ratio between the hydroxide ions and the malic acid.

Q3(a)(v) – The majority of answers to this question reflected a lack of understanding of the chemistry of OH groups as oppossed to COOH groups. It is only the carboxylic acid groups that react with sodium hydroxide and so the titre for isocitric acid should be 3/2 times the titre of malic acid. Only the very able learners understood this and were able to clearly justify their answer.

Q03(b)(i) – The majority of learners correctly stated the triplet splitting pattern but not all were able to justify sufficiently. Simply stating the (n+1) rule was not enough but reference to the two hydrogen atoms on the adjacent carbon was required.

Q03(b)(ii) – Approximately half of the learners correctly deduced that the number of peaks in the low resolution nmr spectrum would be two.
Q03(b)(iii) – Only about a third of learnes knew that tetramethylsilane or TMS was a suitable substance for a reference standard in nmr. Some learners lost the mark because they gave two answers alongside each other and one was wrong. For example, one learner wrote "TMS tetramethylsaline". If the initials had only been given then the mark would have been awarded but if the name is also given then this has to be correct which is not the case in this example. Centres need to stress to their learners that in situations like this where one mark is awarded for one answer that only one answer is given.

Q03(c)(i)(ii) – These questions proved effective discriminators and a wide spread of marks was awarded. It was important to answer the question set and so if a structural formula was required such as in part (i) then a displayed formula will not gain the mark. Likewise in part (ii) where a molecular formula was required, neither a displayed nor structural formula would be awarded the mark. One mark was deducted from parts (i) and (ii)

if the positive charge was missing. Once again learners should note from the wording of the question that an “ion” formula was required and so were prompted to give a sign.

Q4

Q4(a) – Clearly this question required the learners to think about the two means of cooling and to consider the practical benefits of an ice-water mixture. Too many missed the point of contact/surface area and simply stated that cooling would be faster which was insufficient. Another common error was to state that cooling would be ‘more even’ without any reasoning given.

Q04(b)(i)(ii) – Part (i) was generally well-understood but many learners simply gave the structure of the product with the nitro group in position 3 but drawn on the opposite side (as you look) thus failing to apreciate this is the same as the product given in the question. Part (ii) was much harder and the multi-nitration of the aromatic ring was only understood by the more able learners.

Q4(c) – There were quite a lot of blank spaces for this question which was surprising given that there was a similar-type of question one year previously. Learners are always encouraged to make good use of the past exam papers available. The full range of marks was seen. Many learners identified the mistake but the question required how the mistake would be modified and so without this statement no mark was awarded. A significant number of learners commented on the length of the funnel’s stem or that the filter paper should have holes, neither of which gained any credit. The space below the lined section was effectively utilised by some learners as they drew the modified apparatus. This was not essential but certainly helped those learners to support their modification statements.

Q4(d) – Many excellent answers were seen and thus was evidence that learners took the opportunity to demonstrate their knowledge and understanding. Two key points are particularly worthy of note: firstly that the recrystalised sample should not be washed with cold water if water is not the solvent and secondly that drying requires a description of how this is to be done and not just a statement to ‘dry’.

Q04(e) – Approximately half of learners gained both marks. Common errors were to calculate the 100% yield rather than 73% as required in the question, and the incorrect use of the molar masses given in the table.

Q04(f) – Unfortunately many learners stated that impurities would increase the melting temperature but this is incorrect. Others correctly stated that the melting temperature range would be wider with impurities but then gave values to support their answer which negated this correct statement. For example, a typical response stated that the range due to the presence of impurities would be 60 – 85 ^{o}C but this incorrect on two counts. Firstly it is unrealisic that the presence of impurities would decrease the range beyond 70 ^{o}C and secondly the melting temperature is not going to increase above the maximum of 80 ^{o}C stated in the question.

Summary of advice to learners

- RTQ^2 or Read The Question Twice so that any answer given does address the needs of the question
- Show working for all calculations
- Understand the difference between displayed, structural, skeletal and molecular formulae
- Carry out as many practical activities as possible or at least to observe them being demonstrated and make sure that the reasons for each step of the procedure is understood

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