Examiners' Report
Principal Examiner Feedback

October 2020

Pearson Edexcel International Advanced Level in Chemistry (WCH16)
Paper 1: Practical Skills in Chemistry II

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Introduction
This was the first Unit 6 paper for the 2018 Specification but was similar in structure and expectation to earlier Unit 6 papers. The paper seemed accessible to well-prepared candidates across the ability range particularly when they were familiar with the experimental work referenced in the Specification. The calculation question showed the strength of the candidates with many accurate and well-presented solutions. In contrast, the graph question produced very mixed responses with many marks lost through quite basic errors, including incorrect choice of axes, incomplete labels and the omission of units. Candidates often seemed to lose marks as a result of failing to read the question fully or carefully.

Question 1
Candidates who recognised that this question was centred around the chemistry of copper, scored well, tending to lose marks only on detail such as the appropriate numbers of ligands and, more frequently, the correct charges on the various ions. Most candidates used formulae rather than names to give their response, either being acceptable. There were many excellent answers to 1(a), common errors being giving the formula of complex ion D with six ammine ligands and the omission of the charge. Some candidates seemed to focus on the green colour of compound A and suggested various nickel or chromium compounds. The identity of the black solid was less well known and, even when candidates realised that an oxide of copper was formed, they sometimes omitted the oxidation state or opted for copper(I) oxide. Candidates who had recognised the copper ions were likely to correctly identify $CuCl_4^{2-}$, otherwise almost any yellow ion or compound might be suggested. The three ions in 1(b)(i) were well known with the most common error being to give the chromate(VI) ion a single negative charge. When candidates appreciated that the compound required in 1(b)(ii) was organic, the mark was usually scored but there were many inorganic compounds or ions suggested. Items 1(c) and 1(d) produced some very good answers but these were very dependent on their understanding of the earlier parts of the question and also appreciating that this was not a question about why transition metal ions are coloured.

Question 2
Part 2(a) was very well answered. The most common errors were the omission of the positive charge on the CH_3CO^+ ion and the failure to make the link between the smell of compound P and its chemical identity. Candidates who went astray on this item most usually did so through identifying the m/z = 43 as $C_3H_7^+$ leading eventually to suggesting that P was propyl methanoate. Most candidates were able to suggest the correct structures of Q and R although some omitted the justification. There were many excellent answers to 2(b)(ii), with a clear structure and well-marshalled explanations. These candidates were following the template indicated in the question and referred to the number of peaks, the relative peak areas and the splitting patterns in the spectrum. Some of the best answers made good use of the spectrum and linked the proton environments to the peaks. Candidates did seem prone to using imprecise language referring to hydrogens rather than protons and to ‘surrounding’ or ‘nearby’ rather than adjacent (protons).

Question 3

Part 3(a) brought a very mixed response. Some candidates presumed that toxicity was the most important hazard while others ignored the question and simply suggested a precaution for each hazard. A significant number of candidates identified flammability as the most important hazard of phenol, sometimes referring to phenol being a gas or a volatile liquid. Even when the corrosive hazard was recognised candidates often wanted to reduce the risk by using a fume cupboard.
For 3(b) there were some excellent explanations of the purpose of phenol in the experiment but most candidates were unable to progress beyond an appreciation that phenol would react with bromine, despite the clear hint given in Step 5 of the procedure. Otherwise candidates relied on standard answers which often showed little relation to the information given in the question, for example it was suggested that phenol was a solvent, a common incorrect response that ignored the states given in the equation. Most candidates scored the mark for 3(c) although the use of the white tile, card or board as a background was often far from clear. 3(d)(i) produced a range of responses and, while a good number appreciated the significance of keeping the total volume constant, there were many generalised answers that did not score the mark.

Many of the graphs drawn for 3(d)(ii) were marred by some basic errors including placing the rate term (1/t) on the x axis and omitting units; plotting errors were more unusual. Most candidates realised that the reaction was first order but often this was justified by a generalisation such as ‘rate is proportional to concentration’ rather than by referring to the experimental data. The technique of using reciprocal time as a measure of rate is very common at this level but very few candidates had any idea of the theoretical basis for this; that said there were some excellent explanations. In 3(d)(v) candidates were most likely to score a mark for stating that the sample should be discarded as the total volume would have changed. Those candidates who appreciated that the exact volume of potassium bromate(V) solution was unimportant provided it was known, often failed to note that the volume of water would have to be adjusted accordingly. The effect of using a burette to deliver the solution seemed to be well understood although the way this was explained was often unclear. Some candidates focused on the superiority of the burette as a measuring instrument compared with a boiling tube. Most candidates were able to score at least one of the available marks in 3(e)(ii) and there were some excellent explanations of the effect of measurement size on the percentage uncertainty. The appearance of the word ‘uncertainty’ in the question seemed to encourage discussion about apparatus uncertainty while a number of candidates suggested that the first run would have the most accurate results as the presence of impurities would be minimised. While many candidates scored a mark in 3(f) the basic idea of varying the concentration of each reactant in turn while holding the other concentrations constant was poorly expressed; few candidates appreciated that the effect on rate of the concentration of hydrogen ions also needed to be determined.

Question 4
Parts (a) and (b) are standard questions and most candidates were able to score the marks.
In (a) a number of candidates focused on the reaction of the concentrated sulfuric acid, not taking into account that only a small amount is present in the reaction mixture; this was not penalised but the idea that the individual compounds were exothermic did lose the mark.
The calculation in 4(c) was generally very well done, with only a small number of candidates unable to see a correct method. There were a number of valid approaches adopted, all of which could gain full credit. A few candidates lost the final mark by failing to make an appropriate comparison. Most candidates were able to identify two of the errors in the diagram shown in 4(d) with the incorrect flask being the one most likely to be overlooked. Common incorrect suggestions include the need for a thermometer, for direct heating and for more anti-bumping granules. A few candidates suggested four or even five errors.
The mark in 4(e) was almost always awarded for a reference to increasing the amount of crystals of aspirin forming. The common incorrect answer mentioned quenching or stopping the reaction. The advantages of filtration under reduced pressure for 4(f) were well understood although many candidates referred to the crystals being dry rather than drier while some confused the residue and the filtrate. The use of melting temperature to assess the purity of an organic compound was well known although candidates needed to refer the melting temperature being sharp *and* close to the book value to score the second mark. The most comment incorrect responses referred to measurement of the boiling temperature or calculation of the yield.

Summary
Based on the performance in this paper students should:

- ensure that they are familiar with the sixteen core practicals included in the Specification and as many of the further recommended practicals as possible
- read each question carefully and try to ensure that their answers match the requirements of the question. In questions comprising a series of closely linked items, such as
  Question 1 on this paper, it is beneficial to read the entire question before making a start
- ensure that they are familiar with the requirements for constructing graphs. These are clearly indicated in mark schemes
- avoid generic responses to questions that refer to the choice of a particular method or technique
- avoid giving extra answers to a question. Additional incorrect responses will be penalised.

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