Examiners' Report
Principal Examiner Feedback

October 2023

Pearson Edexcel International Advanced Level In Chemistry (WCH16)
Paper 01: Practical Skills in Chemistry II

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General Comment

The paper had an emphasis on experimental chemistry and there were good opportunities for all candidates to demonstrate their chemical understanding in the context of practical situations. The mean mark was 25.4 which was similar to June 2023. Many candidates had clearly prepared well for this paper and were able to apply their knowledge of practical work successfully to familiar and novel situations. However, it appeared that a significant number did not seem to have an understanding of simple qualitative tests for the identification of both inorganic and organic compounds. It was also apparent that many candidates had only a basic grasp of organic techniques, particularly nitration of benzene derivatives and recrystallisation. Nevertheless, calculation questions were done with impressive accuracy by the majority as were plotting and interpreting graphs. There was no evidence of candidates running out of time.

Q1(a)(i) This question was answered well by the majority of candidates as they were able to correctly identify ammonia from the litmus test. However, a surprising number were unable to deduce the ammonia gas was produced from the ammonium cation so did not score (a)(ii).

Q1(b)(i) Many candidates understood the nature of both of these tests, although some got them round the wrong way. A few gave the same answer for both, presumably, as they could not remember which was which. For the sodium hydroxide reaction 'deprotonation' was well known, but the 'acid/base' and 'neutralisation' options were occasionally seen and scored the mark.

Q1(b)(ii) About half the candidates correctly identified the Cr^{3+} ion, but Cr^{2+}, Cr^{+} and other random wrong ions were also noted. These wrong ions did not score but allowed access to (d) via transferred error.

Q1(c) Almost all candidates correctly identified the sulfate ion from the barium chloride test in (c)(i) However, very few were able to explain clearly why hydrochloric acid had to be added in (c)(ii).

Q1(d) Although this mark was available via transferred error using the ions identified in the previous parts of this question, it proved elusive for many candidates. Some gave compounds that did not contain three ions and others a charged species, rather than a neutral compound.

Q2(a) About half of the candidates were able to name both functional groups and scored two marks. However, some identified more than two groups which cost at least one mark and a significant number gave the formula, not the name. The carboxylic acid group proved to be the hardest to identify as some candidates thought it was composed of an aldehyde and alcohol group.

Q2(b) Most candidates were able to score well on these simple observation questions. The most frequent error in 2(b)(i) was stating carbon dioxide would be produced, instead of giving a suitable observation, such as bubbles would be seen. While the colour of acidified potassium dichromate(VI) solution was extremely well known in 2(b)(ii), few candidates

appreciated there would be no colour change as the ketone could not be oxidised. In 2(b)(iii) a significant majority scored the mark, but a number of candidates got the colour correct but omitted 'precipitate' and so did not score. Another common wrong answer was the formation of a white precipitate, possibly as the candidates were confused with the chloride or sulfate test. Most candidates were able to recall the result of the iodine and sodium hydroxide test in 2(b)(v) with some very complete answers that included the antiseptic smell.

Q2(c) There were many fully correct answers and almost all candidates correctly identified the aldehyde group. However, the ester group proved to be more challenging and carboxylic acid or alcohol functional groups were often drawn instead. Unfortunately, a number of structures were seen that contained atoms with the wrong number of bonds.

Q3(a) Many candidates found this question quite challenging and answers often highlighted differences in reactivity or boiling points instead of solubility. Where solubility was included, candidates generally scored full marks.

Q3(b)(i) Whilst there were many excellent answers to this question, it proved to be quite challenging to the majority of candidates. Although most appreciated the cerium titration was self-indicating, a significant number of candidates got the colour change the wrong way round. The sodium hydroxide titration required an indicator and those candidates who selected phenolphthalein generally scored both marks. However, the colour change using the indicator methyl orange was less well known and a number of candidates did not use an indicator at all but just gave a random colour change. It was disappointing that a significant number of candidates only described one of the end points, despite both being asked for in the question.

Q3(b)(ii) This calculation was well understood with large numbers of totally correct, well-presented answers seen. However, a number of candidates used the volume of the ethanedioic solution (25.0 cm^3) instead of the titre value (20.60 cm^3) and some omitted the dilution factor. But overall, this question scored really well and it was pleasing that few candidates lost a mark for the wrong number of significant figures.

Q3(c) In this calculation to find the number of water molecules in the hydrated crystals, over half the candidates scored full marks(three). However, a number got the final ratio the wrong way round and scored two marks but even candidates who found this question more challenging were usually able to calculate the number of moles of ethanedioic acid so scored one mark.

Q4(a)(i) The corrosive symbol was well known to almost all candidates, but the oxidising agent symbol was unfamiliar to the majority with most stating flammable as their incorrect answer.

Q4(a)(ii) Most candidates new the correct safety precaution when handling concentrated nitric acid.

Q4(b) This proved to be one of the more challenging questions on the paper. Although many correctly noted the reaction was exothermic very few were able to explain why the nitrating mixture had to be added slowly. Common wrong answers included to prevent spitting, to keep the temperature low and to prevent decomposition.

Q4(c)(i) Very few candidates were able to explain why methanol was a suitable solvent for recrystallisation. Many mentioned solubility but made no reference to the change in solubility at different temperatures and many common wrong answers focused on the lack of reactivity of methanol.

Q4(c)(ii) The candidates who scored full marks on this were a minority. Candidates who scored one mark tended to score it for the first filtration, but the second mark was more problematic. Many thought the second filtration was simply to isolate or obtain the crystals and so did not score.

Q4(c)(iii) Most candidates understood the crystals were washed to remove the soluble impurities and so scored the first mark. However, the reason why the solvent was ice-cold was less well understood and common answers involving reactivity and melting did not score.

Q4(d)(i) Most candidates were able to tackle this calculation with confidence. The most likely reasons for losing a mark were inverting the calculation or only using 1 significant figure in their final answer.

Q4(d)(ii) The reasons why the yield was lower than 100% were well known and the full range of acceptable answers were seen. However, a significant number of responses were too vague and did not score. These included handling errors, impurities and transfer losses.

Q5(a) Fully correct responses to this question were very rare. Many candidates thought the sodium thiosulfate acted as a catalyst, an indicator or quenched the reaction. Other wrong ideas mentioned sodium thiosulfate reacting with iodide ions or starch.

Q5(b)(i) Most candidates were able to plot the points correctly and draw an accurate line of best fit. However, the two most common errors were reversing the axes and plotting the point at 15cm^3 incorrectly, using 0.0101 s^{-1} instead of 0.011 s^{-1}. Occasionally the scale did not include the origin but this was not penalized if the points and line best fit line were correct.

Q5(b)(ii) Deducing the order of the reaction from the graph was well done by the majority of candidates. However even with a correct graph, some thought the reaction showed second or zero order kinetics.

Q5(c) Few candidates demonstrated an understanding of why the concentration of potassium iodide was significantly lower than hydrogen peroxide and sulfuric acid. Although some stated that the concentrations of the hydrogen peroxide and sulfuric acid would effectively remain constant, they did not develop their answer further to score the mark.

In order to improve their performance, students should

always read the information in the question carefully, noting the command words and instructions in bold type

ensure they learn and understand the procedures in the core practicals

learn the techniques used in the preparation and purification of organic compounds and understand why they are used

learn the qualitative tests to identify organic groups and inorganic ions.

shown working when carrying out calculations and only round the final answer

learn the hazard symbols and their meanings

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