Examiners' Report
Principal Examiner Feedback

January 2023

Pearson Edexcel International Advanced Level In Chemistry (WCH13) Paper 01: Practical Skills in Chemistry I

General Comment

The paper emphasises practical techniques, including a number of core practical's and organic and inorganic analysis. There was evidence that some learners were not familiar with some common practical activities and procedures.

The standard of mathematical calculations was generally very good, but unfortunately marks were frequently lost because learners did not read the question carefully. There was no evidence of students running out of time.

Question 1.

1a This was generally very well answered with many students correctly identifying the functional group and suggesting a name for the compound.

1b Many correct answers were seen that identified both ions clearly. The anion was misidentified more frequently than the Group 1 metal ion.

1c(i) Responses that constructed the full displacement equation and then cancelling of spectator ions were frequently correct. Many correct ionic equations gained the first mark but failed to score the second by showing the added bromine as a liquid and/or the iodine produced as a solid. A careful reading of the question might have prevented either of these slips.

1cii Very few responses gained M1 by mentioning two layers. Many candidates revisited the test for unsaturation from part 1(a) failing to realise that the iodine had been produced in 1(c)(i) and would be more soluble in the organic(hexene) layer than the aqueous layer. The red-brown colour of iodine in the aqueous layer would therefore fade and the iodine dissolved in hexene would be purple. The mark available for recognising the fading of the red-brown colour was often negated by guesses about bubbling, precipitation or even restoration of the colour.

Question Two.

2ai Many learners realised that heat loss was the issue, but a large proportion of these thought that it could be prevented rather than just reduced. Those that discussed the stability of the flame or the likelihood of a draught extinguishing the flame were more successful.

2aii This was generally well answered with many representing a flame of some description.

2bii A good proportion of answers were perfect. The most frequent error was the substitution of the mass of ethanol for the mass of water but TE was available. It is unfortunate when a failure to include a sign or give the answer to an appropriate number of significant figures causes marks to be lost.

2biii Some responses suggested that learners had not read the question carefully and had failed to understand that the ethanol continued to burn without heating the water. Some suggested that there would be a higher temperature change so no difference or a higher value for the enthalpy change.

2biv This percentage uncertainty calculation was frequently correct, the most common error being a failure to recognize that **two** readings of the temperature were taken.

2ci This question was answered correctly in most cases, in that learners linked increasing temperature or mass to a reduced percentage uncertainty.

2cii This was less well answered and a high proportion of responses failed to gain credit. There seemed to be considerable confusion between accuracy, uncertainty, precision, reliability and validity – all of which were mentioned in some responses. Suggestions of improvements to the procedure or equipment were offered despite not being requested.

Question 3.

3ai It was clear that many learners did not understand the principles of making a standard solution. Responses that failed to score referred to the removal of impurities or that there would be a difference in concentration without stating whether it would increase or decrease.
3aii Many learners were able to correctly identify that the inversion was to ensure a uniform solution concentration but some had failed to appreciate that a solution rather than a solid was being dispersed and referred to dissolving.
3aiii It was surprising to read so many references to the sodium hydroxide solution as acid. Also, many responses identified a solution of sodium hydroxide with a concentration of less than 0.3 mol dm^{-3} as toxic or corrosive and discussed burns or fumes and the dangers of inhalation.
3aiv Many learners scored at least one mark for the correct colours although not necessarily in the correct order.
3av The table was completed successfully by most learners, with very few mistakes, but then the instruction to use all concordant titres in the calculation of the mean was sometimes ignored.
3avi The majority of learners gained this mark. The most common non-scoring responses simply stated that the first titres were similar rather than concordant. Statements about later titrations also being concordant or not affecting the mean failed to appreciate that, once two concordant titres have been obtained, further titrations are unnecessary. Some focussed on the initial burette reading being inconsistent or not zero.
3avii Many learners were concerned about safety (the reaction would be too vigorous) or the acid might be too dangerous. Some thought dilution would slow down the reaction or might be necessary to see the colour change in the indicator. There were few responses that linked the tenfold dilution, detailed in the experimental procedure, to the idea that the titre would be considerably larger than the capacity of the burette.
3bi Balancing the equation was almost always completed correctly.
3bii Some answers to the calculation were very good with clear steps. TE was available from 3av and most responses scored M1. The mole ratio was also correctly applied in most cases scoring M2 but M3, M4 and M5 were done in every combination available, with M4 not surprisingly the most frequently overlooked. It was unfortunate when rounding errors and failure to quote the answer to 3SF lost marks.
3biii Many responses failed to relate their calculated value to 200 g dm^{-3}. Calculated values of 19.7 g dm^{-3}, which were often seen, were rarely described as <u>much</u> lower, so much less effective. Many responses failed to score because they were vague and referred merely to a difference in concentration/effectiveness. Answers based on a correct calculation were expected to conclude that the slight difference in concentration would not affect the performance of the descaler. Reponses that calculated the % difference were almost always successful.

Question 4

4a This was generally well answered with the addition of PCl_5 or sodium the most common test. Where reference to formation of an ester was made, the first mark was often not awarded due to the omission of heating.
4bii This response also often scored the mark. Some learners just referred to a tertiary alcohol or including butanol/propanol in the name incorrectly.
4biii This question was answered quite well but a number of learners offered butan-1-ol as L, forgetting that the correct answer would be an isomer of butan-1-ol. There were also mistakes with too many bonds added to the odd carbon atom or forgetting to add hydrogen bonds on.
4biv The precipitate/solid was sometimes omitted although the colour change to red was remembered. The dichromate solution often missed the required acid but the colour change was given accurately. Tollen's reagent responses were usually answered well.

Summary

In order to improve their performance, students should:

- read the question carefully and make sure that they are answering the question that has been asked
- make sure that procedures in the core practicals are carefully learned
- show all working for calculations, minimise rounding errors by leaving intermediate step values in their calculator and give final answers to an appropriate number of significant figures
- consider suitable precautions when working with hazardous substances
- use all information given in the question
- consider carefully before offering any additional information as marks already gained may be lost by incorrect guesses