Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

October 2019

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

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Introduction

Some candidates were very well-prepared for this examination and scored high marks. Many candidates were able to demonstrate that they had a sound knowledge of the practical skills in the specification and could apply this to the questions with just a few omissions or errors. Other candidates found the paper challenging and would benefit from more preparation to ensure that they know the basic practical skills, can express their ideas clearly and carry out calculations, explaining their working.

Question 1

(a) The majority of candidates could identify ammonia gas but many did not realise that the cation must be an ammonium ion. Some that did identify ammonium lost the mark as they gave an incorrect formula.

(b) Many candidates identified the iron(II) ion, but fewer identified the brown solid **C** as iron(III) hydroxide.

(c) The majority of candidates identified the sulfate(VI) ion from the barium chloride test.

(d) Many candidates struggled to combine NH_4^+, Fe^{2+} and SO_4^{2-} ions to give an overall neutral formula. Many candidates ignored the ammonium ions and just wrote $FeSO_4$. Most candidates would benefit from more practice at this skill.

(e) It was pleasing to see many correct calculations that were explained clearly. There was more than one method for this calculation and any correct method was acceptable. Some candidates just calculated the numbers of moles of water combined with 0.025 mol **A** and did not work out how much water would be combined with 1 mol of the anhydrous solid.

Question 2

(a) Many candidates were able to complete the table correctly.
A few were not familiar with the very smoky flame produced when arenes are burned and a few thought that phenol would decolourise bromine, even though there was no mention of a white precipitate in the observations. Most candidates were familiar with the use of phosphorus(V) chloride as a test for an OH group but some candidates were not given the mark as they just mentioned an alcohol or a carboxylic acid. A few thought that hydroxide ions were present, and they did not score the mark.
Some candidates were unable to identify sodium carbonate or sodium hydrogencarbonate as the test for a carboxylic acid.

(b) The majority of candidates worked out the *m* / *e* value for $C_6H_5^+$ as 77. More candidates struggled to work out that $C_8H_7^+$ is responsible for the peak at 103.

(c) It was surprising that a lot of candidates did not know that six peaks shows six proton environments. Only a minority of candidates deduced that the peak areas show the ratio of protons in the different proton environments so there were four protons on their own and two sets of two protons. Many answers referred to the number of hydrogen atoms on adjacent carbon atoms and splitting patterns even though the question stated that this was the **low** resolution proton nmr spectrum.

(d) Candidates were expected to use the results of the tests in (a) and the data from the spectra in (b) and (c) to deduce the structure of **W**. Many candidates ignored the benzene compound in (a)(i) and the peak due to $C_6H_5^+$ in (b)(i) and tried to draw structures with multiple double bonds. Candidates who drew any structure containing a benzene ring, an alkene and a carboxylic acid scored 1 mark. Those who used the data from the spectra and the information that **W** exists as two geometric isomers scored both marks. Candidates should check their structures carefully to make sure that they have not shown any pentavalent carbon atoms.

Question 3

(a) The majority of candidates completed the table correctly and calculated the mean titre. However, some candidates included the rough titre and others calculated the mean of all four titrations.
The calculation was carried out correctly by the majority of candidates, although some did not read the instruction to give their answer to **three** significant figures, so they lost the last mark. Some candidates confused the volumes of the two solutions. Many candidates calculated the percentage uncertainty correctly. However, some did not take into consideration that two burette readings are needed for each titre and some used the titre value for a different titration. A few candidates incorrectly rounded 0.4975 to 0.49%

(b) Nearly all candidates labelled the voltmeter, with just a few thinking it was a cell or battery. Many labelled the platinum electrode in the beaker with the vanadium ions, although a significant minority thought that it was vanadium. Many labelled the electrode in the beaker on the left of the diagram as zinc, but some thought that would be platinum, and most knew there would be Zn^{2+} ions in the beaker, although some added zinc as well. Although many realised that potassium hydroxide could not be used in the salt bridge as it would react with the zinc ions to form a precipitate, many wrote general answers that were not specific enough to scores a mark, such as, 'it would react with the solutions in the beakers'.
Many correct equations were seen for the cell reaction, but some candidates ignored the information that zinc was oxidised so write the equation in reverse and some completely mixed up the ions. Some candidates wrote all the correct species but did not balance the equation in terms of charges as well as species. A few just wrote the half-equation for the oxidation of zinc.
Many candidates calculated the electrode potential correctly, although some had a positive sign, and some added the electrode potential of zinc to the E_{cell} value. Many candidates could substitute the correct values into the equation for the first mark. Only those candidates who calculated a realistic value for the concentration of V^{3+} ions were awarded the second mark. It was pleasing to see that many candidates who initially calculated an extremely high or low values for the concentration realised that this was incorrect, and they crossed out their work and calculated the correct value. Some candidates were unable to rearrange the equation and others evaluated $e^{-1.02}$ instead of $10^{-1.02}$.

(c) Candidates found this the most difficult item in the paper to answer. There were many vague answers about non-standard conditions and errors in the titration. Candidates should be encouraged to read all of the information given in the questions. In Method **2**, they are clearly told that 50 cm^3 of the solution containing V^{2+} ions is mixed with 50 cm^3 of solution **X**, which contains V^{3+} ions.

Question 4

(a) Many candidates knew the correct reagents and conditions to convert phenylamine into benzene diazonium chloride. Common errors included: use of heat or reflux instead of 0 - 10°C, sodium nitrate or nitric acid instead of sodium nitrite or nitrous acid and reagents used for reactions of benzene such as concentration nitric and sulfuric acids.

(b) Many candidates suggested that potassium iodide is added slowly because the reaction is exothermic or vigorous and scored the mark in (i). Other answers were too vague or incorrect for the mark.
The labelling of the diagram for steam distillation was done well by many candidates. Some candidates confused the water directions in the condenser. The most common error was for label **A** where many candidates did not know that water is in the first flask so that it can be heated to produce the steam for the steam distillation. The purpose of the part of the apparatus labelled **E** was generally known to prevent the build-up of pressure.
Many candidates used the data to deduce that as iodobenzene is denser than water, it will form the lower layer so they can be separated using a separating funnel. Some suggested using a drying agent and

others fractional distillation, which were not given any credit. Some candidates suggested a suitable drying agent in (v), although many did not realise that the cloudiness was caused by water, so they suggested substances that are not drying agents, for example, sodium hydroxide and sodium carbonate. A suitable temperature range for collecting the distillate was given by many candidates but some gave too large a range, some gave a range that stopped below the boiling temperature of iodobenzene and others started above the boiling temperature.

(c) There were many ways of carrying out this calculation and they were all acceptable, provided the candidates explained their working. Some candidates lost a mark as they used 70% incorrectly and others did not use the 70% yield.

Paper Summary

In order to improve their performance, candidates should:

- read the question carefully and make sure that you are answering the question that has been asked
- learn the tests for the ions in the specification
- practise working out the formulae of compounds from their constituent ions
- learn the tests for the organic functional groups in the specification
- revise how to determine the standard electrode potential of an electrochemical cell, including labelling a diagram
- practise substituting numbers into equations and rearranging the equations
- explain all your working for calculations
- learn the reagents and conditions for the organic reactions in the specification
- revise the techniques involved in preparing organic compounds.

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