Examiners' Report
Principal Examiner Feedback

October 2020

Pearson Edexcel International Advanced Subsidiary Level
In Chemistry (WCH13)
Paper 1: Practical Skills in Chemistry I

Introduction

Many students were well prepared for this examination and were able to demonstrate that they had a sound knowledge of the topics in the specification.

Question 1

The majority of students were able to identify both gases correctly in the first part of the question, though a significant proportion incorrectly attributed the brown colour to bromine, a mistake that was also seen in part (b), where bromide was a common incorrect answer. Students should be encouraged to consider questions within the context of their knowledge of the specification content: the thermal decomposition of metal nitrates from Topic 8B in this case. The large majority of students were able to correctly identify barium as the cation from the flame colour, though some lost the mark by giving the charge as 1+. The vast majority of students followed the instructions in part (d), identifying the solids by formula, though many lost both marks as a consequence of their incorrect deductions from earlier in the question. Again, some poor knowledge of ion and compound formulae was seen, with $BaNO_3$ a common incorrect answer. Relatively few students scored both marks in part (e), failing to appreciate that this part of the question was testing their knowledge of the trends in solubility of the hydroxides and sulfates of group 2. Of those gaining credit, more scored the sulfuric acid mark, with many (unnecessarily) identifying the white precipitate as barium sulfate. A significant number of students appeared to connect the use of sodium hydroxide to the identification of ammonium ions, failing to appreciate the context of the question. Students are well advised that 'nothing' and 'no observation' are not equivalent statements to 'no change' or 'no reaction'. Further, giving more than once answer is a risky strategy: a significant number of students lost marks for adding 'effervescence' to answers that would otherwise have scored.

Question 2

In the first part of the question, the majority of students were able to successfully apply their knowledge of ion testing to identify at least two of the four compounds. Many annotated the observations in the table or wrote equations to explain the observations, both of which were sensible strategies. Students should be reminded that if they do not want their work to be considered then they should neatly cross this out. Every possible combination of answers was seen, although most incorrect responses confused hydrochloric acid and potassium carbonate, or silver nitrate and sodium chloride. In answering the question, it was probably easiest to first identify B as silver nitrate and D as potassium carbonate as the common solutions causing a white precipitate and effervescence respectively. Only a small proportion chose to identify the compounds using formulae, risking the introducing of needless mistakes as these were not provided in the question.

The second part of the question required students to explain the correct procedures in a flame test, after giving improvements to the method shown. Students commonly referred to their knowledge and experience of conducting flame tests, mentioning the need to clean the wire and/or make a paste for example, rather than give specific improvements to the steps in the method as required by the question. Most recognised the convention of using hydrochloric acid though the majority did not appreciate the reason for this. Of those who knew it is due to volatility, many explained this poorly, commonly referring to the volatility of the hydrochloric acid, chlorine or chloride ions instead of the metal chloride. For Step 1, credit was given for the idea of cleaning the wire, as this was an improvement to the method, but only if this involved both dipping the wire in acid and placing the wire in the flame. Marks were most commonly scored for Step 2, with the majority of students correctly explaining the need to replace the copper wire with nichrome or platinum. Some were not specific enough in their responses, however, simply referring to platinum as being less reactive, or that copper is coloured. For Step 3, many students appreciated that the Bunsen air-hole should be open (or at least not closed), though many did not score the explanation mark, simply saying that the 'colour change' would be easier to see, for example. A surprising number of students demonstrated a poor practical awareness by stating that the air-hole needed to be open to prevent a build of pressure or an explosion. Many students referred to complete or incomplete combustion without connection to the colour or temperature of the Bunsen flame.

Question 3

The large majority of students correctly identified the steamy fumes from Test 1 and almost all the gas produced in Test 2. While many applied this successfully to score both marks in part (a)(iii), a significant number of students lost marks unnecessarily by failing to name the functional groups; giving the correct answers in the wrong order; or through careless naming, using 'hydroxide' for 'hydroxyl' for example. Most students scored both marks for two correct structures in part (a)(iv) though many did not display the O–H bonds. The generic response that the fingerprint regions would be different scored the mark in part (a)(v) though it was clear that students were generally unpractised at answering this type of question, with the majority scoring zero for vague responses referring to just different functional groups causing different peaks, and some not attempting the question at all. The best responses were specific to the actual bonds that could distinguish the molecules by infrared absorption. The modal mark in (b) was three, with many students forgetting to mention either a precipitate or the starting colour of the solution for the Benedict's/Fehling's test. Most students scored both marks for the bromine water test, though some gave the correct observations in the wrong order or incorrectly referred to the colour of bromine water as red. As in Q1(e), some marks were lost for the incorrect inclusion of 'effervescence'.

Question 4

Most students clearly expressed that excess sodium hydroxide was required to react all of the hydrochloric acid in part (a)(i). Those failing to score generally referred to limiting reagents or the completeness of reaction without being specific to the acid. Some students referred to measuring the maximum temperature change of the solution, which was missing the point as adding more solution also absorbs more heat. Given the increment on the thermometer of 1°C, it was pleasing to see the vast majority of students correctly recording the temperature to the nearest 0.5°C in part (a)(ii) and few errors in the temperature change were seen. The most common mistake in part (b) was to use an incorrect mass of solution. Incorrect amounts of hydrochloric acid, incorrect units and failing to include a negative sign were other notable errors. Some students did not appreciate that enthalpy changes must be given per mole and stopped after calculating an energy change. Many excellent responses with clearly presented working were seen, however, and around one third of students scored full marks. Most students appeared to have the right idea in part (c) but a disappointingly high proportion failed to express this with sufficient clarity to gain credit, simply referring to heat loss and/or a higher or lower enthalpy change. When comparing the magnitude of enthalpy changes, students should use the terms more or less exothermic/negative (for exothermic processes) and more or less endothermic/positive (for endothermic processes). Many students scored the second mark for recognising that polystyrene is a better insulator than glass. An appreciable number of students stated that the glass beaker absorbed more heat than the polystyrene cup, whereas others lost the mark through failing to make a comparison.

Question 5

The large majority of students gave the correct answer in part (a), though a significant proportion incorrectly thought that a measuring cylinder, or even a beaker, would be accurate enough. While an accurate piece of volumetric glassware, students should appreciate that a burette is typically used to add a variable volume of titrant, and not a specific volume of analyte, to a conical flask. Despite methyl orange being one of only two indicators referred to in the specification, many students did not know the colour of this at the end-point of a titration and/or did not appreciate that the original solution in the conical flask was alkaline. As a consequence, many gave the final colour as red or the correct colours in reverse. A small proportion of students gave the colours associated with phenolphthalein. The calculation in part (c) was, in general, done well. A surprising number of students gave the titre to the second titration as just 25 (cm^3) in part (c)(i) and a significant number also failed to use only the concordant results, although being prompted to do so, when calculating the mean titre in part (c)(ii). The large majority of students correctly considered the stoichiometry and scaling in part (c)(iv) and were able to calculate the molar mass of the hydrated metal carbonate in part (c)(v). The final part of (c) proved most challenging, with many not subtracting both the carbonate and all 10 waters from their molar mass, and some not dividing the difference by two. Over half of the students scored both marks, however, correctly identifying sodium as metal M. Of those who ended up with incorrect final answers, such as V, Rh or Cd, few seemed to consider that the formula of the carbonate suggested a group 1 metal. In part (d), a wide range in quality of response was seen and it was clear that a large number of students had no understanding of the process of crystallisation. Many wanted to evaporate all of the water or heat to constant mass, presumably confused with determining the formula of a hydrated salt. Others thought that using a drying agent to induce crystallisation was appropriate, or even that crystals were already present from the titration. Some students unnecessarily gave details of repeating the titration, with some including an indicator, and others gave confused responses such as dry the crystals before evaporating some water. Some very good responses were seen, however, demonstrating that some students had clearly performed and understood the procedure, mentioning, for example, the use of a glass rod to assess the point of crystallisation.

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
- try to frame questions within the context of the specification content
- write formulae and numbers carefully, checking their legibility
- use 'no change' or 'no reaction' to indicate a negative result to a chemical test
- refer to specific bonds (and wavenumbers) when answering questions on infrared spectra
- use the terms more or less exothermic/negative or more or less endothermic/positive when comparing enthalpy changes
- make sure that comparisons are made when required
- consider if their answers to multistep calculations make sense and check their earlier working if not
- make sure that the order of steps given in a practical procedure makes sense

Grade Boundaries

Grade boundaries for all papers can be found on the website at:
https://qualifications.pearson.com/en/support/support-topics/results-certification/grade-boundaries.html