Examiners' Report
Principal Examiner Feedback

October 2023

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

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Introduction

The quality of responses on this paper was very varied; some candidates showed a thorough knowledge and understanding of the practical work associated with this Specification while others seemed uncertain of some of the most elementary chemistry and unfamiliar with the core practicals referred to in the specification. Candidates were most assured in dealing with the calculations and the related graphical techniques and they were often able to deal competently with descriptive work based on familiar ideas. However, explaining or deducing the reasons for the use of particular techniques or processes proved much more challenging and many candidates were more likely to rely on generalisations than to address the specific points raised. A significant number of candidates hampered their prospects by appearing to attempt questions without reading them in full and advice given in past series about practising the drawing of diagrams and not rounding intermediate values in calculations does not seem to have been fully absorbed.

Question 1

1(a)(i) There were many word perfect descriptions of the procedure for the flame test; the most common error was failing to put the sample into the flame. Some candidates neglected to specify a metal for the flame test wire or gave an incorrect acid while others referred to use of the cation rather than the sample.

1(a)(ii) The flame colours of sodium and potassium ions were well-known but identifying the cation responsible for the pale green flame colour proved more challenging. Many candidates who realised that the colour indicated the presence of a barium compound showed the ion with a single positive charge.

1(b)(i) The identity of the halide ions was very well known, with most candidates giving the formulae. Identifying the ions as halogens rather than halides was perhaps the most common error.

1(b)(ii)The majority of the candidates who understood what the question required chose to use ammonia to test the precipitates and there were plenty of concise and accurate responses which gained full marks. The most common errors were the omission or confusion of 'dilute' and 'concentrated' and mixing up the solubilities of silver bromide and silver iodide. Candidates who used concentrated sulfuric acid often scored full marks although a number omitted 'concentrated'. A significant number of candidates described the test with silver nitrate given at the start of the question and then stated the colours of the precipitates, a response that gained one mark.

Question 2

2(a) Few candidates demonstrated a reasonable appreciation of how to draw a two-dimensional scientific diagram. Even diagrams which scored full marks often included carelessly implemented joints and delivery tubes; the most common error among these was the omission of water from the measuring cylinder. A substantial minority of candidates drew an apparatus which used a gas syringe to collect the carbon dioxide despite the description in the procedure and the clear requirement, stated in the question, for gas collection over water. Other candidates drew a variety of unsuitable apparatus set-ups including those used in organic preparations.

2(b) Most candidates realised that ethanoic acid was weaker than hydrochloric acid but connecting this to the need for the reaction to proceed quite slowly proved more of a challenge. Candidates often suggested that different gases might be formed or that the production of hydrogen chloride would interfere with the measurement of the gas volume.

2(c) Candidates generally relied on statements about increasing the accuracy of the mass measurement and missed the key point about accounting for any calcium carbonate left in the weighing bottle.

2(d) Most candidates were able to draw the graph correctly and determine the volume of gas required. There were two common errors in constructing the graph: reversing the axes so that mass of calcium carbonate was on the y-axis; using non uniform scales, particularly giving 0.10 g one large square from the origin and then giving two large squares for subsequent increments of 0.10 g. Candidates generally appreciated that the line of best fit would omit the anomalous point but some attempted a line that diverted to include this or just drew a straight line that averaged the full set. The first two marking points in the calculation proved very accessible although some candidates used the molar mass of carbon dioxide rather than that of calcium carbonate. The third marking point proved far more difficult with some candidates unable to see how to use the moles of calcium carbonate calculated and even when this was understood the final answer might be spoiled by incorrect units, often mol dm^{-3}. Some candidates attempted a calculation using the gas molar volume that they were supposed to be determining and unsurprisingly made little progress while others focused on the amount of acid used in the experiment.

2(e) Candidates tended to rely on generalisations such as loss of gas or to ignore the injunction given in the question to assume appropriate conditions and correct experimental procedure. Candidates who were able to think their way through the procedure realised that the bung could not be replaced instantaneously while many were aware that carbon dioxide is soluble in water. A significant number of responses were based on the idea that the result could be affected by carbon dioxide remaining in the boiling tube.

Question 3

3(a)(i) While the flammable symbol was well known, some candidates used synonyms such as combustible, which were not accepted for so common a symbol. The symbol for ‘harmful to the environment’ was unfamiliar to most candidates, although roughly equivalent statements were allowed. Many chose descriptions, such as toxic and corrosive, that were clearly incorrect.

3(a)(ii) Sensible methods for reducing the risk of using flammable reagents were often suggested, although some still relied on unsuitable general precautions such as carrying out the experiment in a fume cupboard. The risk reduction mark for the use of cyclohexene depended on their having correctly identified the symbol or given a near miss in (a)(i). The idea of controlling the disposal of the waste was appreciated by many of these candidates.

3(b) The many correct answers were evenly split between controlling the size of the bubbles and distributing the heat evenly. Some candidates suggested that anti-bumping granules prevented the formation of bubbles altogether or acted catalytically; others simply reiterated the statement that they made the liquids boil more smoothly.

3(c) Candidates frequently appreciated that fractional distillation would give better separation or a purer product than simple distillation but the idea of increasing the reaction time proved elusive. Candidates rarely used the data provided to deduce that the difficult separation would be of water and cyclohexene. Some candidates seemed unfamiliar with laboratory fractional distillation and wrote about the production of different fractions as in the use of fractional distillation in the treatment of crude oil.

3(d) A number of candidates seemed unfamiliar with the appearance of a separation funnel and drew a simple filter funnel, often complete with filter paper. Even when the general features of a separation funnel were known, the diagrams were often poorly executed, omitting the tap or, more frequently, the capacity of the funnel to be sealed with a bung or a stopper. The positions of the layers were usually correct although cyclohexanol was sometimes included.

3(e) The role of calcium chloride as a drying agent was widely known but the observation associated with its use was not. Most of the incorrect responses seemed to be pure guesswork but some referred to the colour change when anhydrous copper(II) sulfate or cobalt(II) chloride are hydrated. Some candidates referred incorrectly to calcium chloride acting as a dehydrating agent.

3(f) Few candidates were able to select an appropriate temperature range for distillation, with almost all the possible combinations of numbers between 25 and 200°C being offered. Even the idea of a range centred on 83°C was quite rare and a significant number of candidates gave a single temperature. The most common incorrect response was 83–162°C, the boiling temperatures of cyclohexene and cyclohexanol.

3(h) The test for the carbon-carbon double bond with bromine water was known by most candidates, although some gave the starting colour of the reagent as red or red-brown. The observations for the addition of phosphorus(V) chloride to cyclohexene and cyclohexanol were much less familiar.

Question 4

4(a) The candidates who scored full marks on this were a minority. Candidates who scored one mark were most likely to get one colour correct while some reversed the correct colours. Some candidates gave the colour change for phenolphthalein.

4(b Most candidates read the burette correctly, the most incorrect value being 24.60 cm^3.

4(c) Fully correct responses to this question were relatively rare. Some candidates appeared to have ignored the first sentence and just gave a detailed description of a titration procedure which did not address the specific point of the question. Otherwise, the common errors were the omission of the appropriate use of the rough titration and failure to mention the need to mix the reagents during the addition of the acid. The need for drop-by-drop addition of acid was the mark most likely to be scored.

4(d) Most candidates were able to tackle this calculation confidently. The most likely reasons for losing a mark were incorrect use of the volumes of the reagents and omitting or inverting the reacting ratio.

Paper Summary

Based on their performance on this paper, candidates are offered the following advice:

- read all the question carefully and use the information provided to help you to frame your answer
- state the purpose of each step in calculations, showing your working
- do not round intermediate values of calculations
- give the final answer of a calculation to an appropriate number of significant figures or decimal places, with units if needed
- learn the conventions for drawing diagrams of scientific apparatus and practise drawing the apparatus used in AS experiments
- make sure that you are familiar with the core practicals given in the Advanced level Specification
- learn the hazard symbols and their meanings for the substances used in the Advanced level Specification
- if your answer extends beyond the allotted space, indicate clearly where you have continued your answer.

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