

Examiners' Report/
Principal Examiner Feedback

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IAL Chemistry WCH06/01

Unit 6: Chemistry Lab. Skills II

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Introduction

The examiners were privileged to see some very well prepared candidates in centres where practical work had been thoroughly taught. Such candidates drew on their practical knowledge and experience to show both knowledge and understanding of the procedures involved.

Question 1 covered familiar ground in all but the last part.

In part (a) the most common correct answer was to give Ni^{2+} and Fe^{2+} , though Cr^{3+} was also acceptable. Common errors were in the charges like Fe^{3+} or Cr^{2+} . Candidates giving more than two ions were fine if all were correct, but incorrect ions were penalised in the normal way, two correct and one incorrect gives 1 out of 2 marks.

In part (b)(i) the rare errors were to give Fe^{3+} , Cr^{3+} or Ni^{2+} .

In part (ii) transferred error was allowed for nickel but not for chromium.

Part (iii) produced a variety of answers which were deemed to be acceptable as the question of to what extent iron(III) hydroxide dehydrates seems to have an uncertain answer.

Part (iv) was usually answered correctly, whatever had gone before. The only rare wrong answer was 'displacement'.

Part (c) could have been worded differently. As it is most candidates referred to the colour change of the manganate(VII) ion from purple to colourless. Some gave the colour change for the iron solution from green to yellow, which was rewarded. As only a few drops of manganate(VII) were added, green to purple/pink was not accepted. For the same reason colourless (almost true for iron(II) solutions) to purple/pink was not accepted.

Part (d)(i) was usually answered correctly. A few sulphate and nitrate ions were seen.

Part (d)(ii) was the hardest part of the paper. Although the solution **A** was mentioned in the stem, it was usually forgotten. So answers based on the test was unnecessary as the precipitate was white were common, as were answers stating the effect of adding ammonia solution to silver chloride. The best answers explained that the formation of the green precipitate would mask the white precipitate whether it dissolved or not.

Question 2 also covered familiar ground.

Part (a) was generally correct. Various aqueous copper(II) ions were the usual incorrect responses.

Part (b) was easy when candidates recalled the experiment. It was clear when candidates could not – green, white or yellow precipitates were given. Some recalled the formation of a blue precipitate and left it at that.

In part (c)(i) the products of the iodine thiosulfate titration were often not known with a variety of charges on the tetrathionate ion, none, one and four negative charges were common. A useful check with ionic equations is to ensure they balance for charge.

The calculation in (ii) was challenging. The sampling of the solution was often missed resulting in an answer out by a factor of ten. Then there were problems with finding the

concentration of solution **B** given the amount in 20 cm³. Multiplying by 1000/25 was common.

In part (a) though this is a most common way of quenching a reaction, many thought the reason was the reaction was exothermic.

Part (b) resulted in half the candidates choosing the incorrect indicator, methyl orange. Those who chose correctly often failed to relate the key reason of the pH range over which the indicator changed colour needing to coincide with the equivalence point of the reaction.

In part (c)(i) the need to neutralise the hydrochloric acid catalyst was usually missed. Some answers were too vague like 'to show the amount of reactants present at the start'. Answers like 'to provide a rough titre' clearly showed lack of understanding of the procedure. A common wrong answer was that the HCl concentration was decreasing! More understandable was the idea that the alkali was reacting with the ester.

In (c)(ii) a common insufficient response was more products are formed.

Part (d) gave no problem to many candidates who gained full credit. The usual mistake was to just give the time at the end of the second half-life, 15 minutes, omitting to calculate the half-life by subtracting the time at the start of the second half life. Only weak candidates used too small a scale on the y axis or omitted to label axes with quantities and units.

The change in colour in part (e) is well known, almost all giving orange to green.

Many suitable chemical tests for carboxylic acids were offered in part (f)(i). A few did not give an observation for sodium carbonate or a suitable metal saying carbon dioxide or hydrogen was given off without giving any indication of what would be seen. Only very weak candidates used indicators.

The test for a ketone in (ii) needed to lead to positive identification so many gained no credit for negative test for aldehydes.

Only very weak candidates gave secondary or tertiary in (g).

Section (h) generally gave two marks out of three. While the relation between the number of peaks and the number of hydrogen environments was given and the appropriate hydrogen circled, the structure for butan-1-ol was drawn. A few answered the basis on carbon 13 NMR when they could still score for the correct formula, butan-1-ol and the second carbon from the OH group ringed.

The ester preparation in question 4 proved familiar ground to most candidates, though some struggled to apply their knowledge and the information given.

The safety information formed the basis of part (a). Surprisingly many answers suggested new hazards like toxicity or irritancy. Precautions were often insufficient like to avoid fire, or avoid direct heat, rather than avoid naked flames or Bunsen flames.

The diagram in (b) had the unusual feature of requiring a water bath or electric heater or mantel for heating. There were fewer stoppered condensers than in the past which is encouraging. Some candidates need to practise drawing condenser jackets.

The purpose of the anti-bumping granules to prevent superheating or localised heating was not known in part (c), though promoting smooth heating or boiling was allowed on this occasion.

Though many correctly answered part (d), a significant number thought sodium hydrogencarbonate would remove ethanoic anhydride, which had already been reacted with water.

The correct drying agent was usually selected in (e) but the reason rarely referred to its unreactivity with the ester. The reason often given was that it would absorb water but this is true of the other agents in the question.

The temperature range for collecting a liquid in part (f) had not been examined in the past. Various textbooks suggest different ranges depending on the chemical involved. In most cases a range of 2 – 3% of the boiling temperature seems appropriate so temperatures one, two or three degrees either side of the boiling temperature were accepted. There were many ridiculous suggestions with both temperatures below 100°C.

The calculation in part (g)(i) included finding the mass from volume and density which seems difficult. Many who completed the calculation did not give their answer to three significant figures, four or five being common.

Part (g)(ii) was easier and transferred errors were allowed though there was a penalty applied if the yield was above 100%. Some weak candidates working with an expected mass of 8.1g, found by doing the first part of the calculation in (g)(i), inverted the fraction to give a percentage below 100, which of course gained no credit.

To improve their performance candidates should:

- Write clearly, taking particular care with subscripts and superscripts
- Learn the important practical techniques covered in this unit
- Learn the reasons for carrying out practical techniques and how they work
- Practise calculations involving chemical equations and amounts, especially volumes of liquids and solutions.

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