Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

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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 topics in the specification and could apply this to the questions with just a few errors or omissions. A significant minority of candidates found the paper very challenging and would benefit from much more preparation to ensure that they know the basic practical skills, can express their ideas clearly and carry out calculations, showing their working.

Question 1

The majority of candidates correctly identified Cr^{3+} as the cation in **A**. A few candidates did not read the part of the question that told them that the precipitate dissolves in excess sodium hydroxide to form a green solution and they identified the cation as Fe^{2+}. The majority of candidates knew that chloride ions form a white precipitate with acidified silver nitrate solution, although other colours were seen. Candidates found it more difficult to give the formula of the anion responsible for the green colour of the final solution and many just wrote 'OH^-' rather than the formula of a complex ion, such as $[Cr(OH)_6]^{3-}$. Candidates do need to check the position of the brackets in their formulae carefully as $[Cr(OH_6)]^{3-}$ is incorrect. The ionic equation for the formation of silver chloride was generally well-answered, although some candidates gave an incorrect charge for the silver ion and some omitted the state symbols.
Many candidates scored 3 marks for completing the table in (b)(i). A few lost marks as they also mentioned fizzing with the formation of the white precipitate and some did not know that it would dissolve in excess aqueous sodium hydroxide to form a colourless solution. Many candidates struggled to write balanced equations for the reactions in Test **3**, particularly for dissolving the precipitate. $Zn(OH_2)$ was a common incorrect formula for the precipitate. Candidates who included water ligands in the ions were usually less successful as they often failed to balance the equations.

Question 2

The majority of candidates identified the gas produced in (a)(i) as hydrogen chloride, although a few gave chlorine, ammonia or hydrogen. Many candidates then worked out that a hydroxyl group was present in both **D** and **E**. Some candidates just wrote alcohol but it is not possible to deduce this just from the test in (a) as it could be an alcohol or a carboxylic acid.
The majority of candidates deduced that **D** is a primary or secondary alcohol.
The majority of candidates used the molecular ion peak data to deduce that **D** has three carbon atoms. Those who used the low resolution proton nmr spectrum data then deduced that **D** is propan-2-ol.
The majority of candidates were able to identify that carbon dioxide is given off from a carboxylic acid and then deduce that **E** is ethanoic acid.

Many candidates were able to combine their structures of **D** and **E** together to give the formula of the ester **C**, although some who identified propan-2-ol then gave an ester from propan-1-ol.

Question 3

Many candidates knew that aqueous manganese(II) ions react with aqueous sodium hydroxide to give a pale brown precipitate that darkens on exposure to air, although many other colours were seen, including pink and purple.
The majority of candidates could select the correct two half-equations needed to calculate the E_{cell} value and realised that the reaction does not occur because it is negative. Those candidates who calculated a positive value should have checked their working as they were told that the reaction does not take place. There were some very good explanations about the effect of using concentrated alkali. However, many candidates wrote vague answers and did not make it clear which of the three half-equations they were writing about. Some candidates showed the working for E_{cell} to be negative for the formation of manganate(VI) ions under standard alkaline condition but they then wrote a positive sign so the reaction could be feasible.
The majority of candidates knew that starch indicator is used for thiosulfate titrations and could give the correct colour change at the end-point. A few incorrect colours were seen, such as purple or brown and some candidates gave an acid-base indicator. The calculation in (c)(ii) was carried out successfully by many candidates. The most common error was to calculate an answer twice as large as it should have been due to using an incorrect mole ratio.

Question 4

The most common answer to (a) was that benzene is flammable. This is true but we use many flammable chemicals in school laboratories. Many candidates did know that benzene is toxic but fewer knew the most important reason for not using benzene is that it is carcinogenic.
The majority of candidates knew that reactions involving concentrated acids are exothermic.
Although a few good diagrams were seen in (c), the majority of candidates had a least one error in their diagram. Common errors included: drawing a filter funnel and adding a tap to it to make it into a tap funnel, drawing apparatus that was sealed, not drawing the thermometer long enough so that the bulb is under the surface of the liquid in the flask, not including an ice-bath or adding an electric heater instead. Some candidates did not read the question carefully and they drew apparatus for heating under reflux or distillation.
Many candidates realised that more than one substitution could take place if the temperature is allowed to rise and they used the molar mass of the product to deduce that a methyl dinitrobenzoate would be formed.
The majority of candidates knew that filtration under reduced pressure is faster than normal pressure and that it dries the crystals better.

Many candidates have a good knowledge of recrystallization and have obviously carried this out as they knew the reasons for the errors in the description of Student 1. Others would benefit from more experience with this practical technique. Many candidates knew that the minimum amount of hot methanol should be used but all of them knew that this was to make a saturated solution. The use of hot filtration to remove the insoluble impurities was known by many candidates. The method described by the student to dry the crystals is seen frequently written by candidates when they are describing recrystallization. It was interesting to see that some candidates understood why this would not work.
The calculation in (g) was well-answered by many candidates, with just a small number scoring 0 as they did not convert masses into moles and vice versa. Candidates should be encouraged to keep all the significant figures in their calculators during the interim steps in a calculation. Some candidates rounded these numbers to 1 significant figure and lost a mark.
Many candidates were able to describe how to use the apparatus shown in (h) to determine the melting temperature range of methyl 3-nitrobenzoate. Some candidates seemed unfamiliar with this apparatus and thought the capillary tube would break or decided to measure the temperature of the water at 1 minute intervals. Some candidates confused melting temperature with boiling temperature or thought that the crystals were dissolving in the water.

Summary

In order to improve their performance, candidates should:

- read the question carefully to make sure that you are answering the question that has been asked and use the information given in the question
- practice how to write ionic equations for the reactions of transition metal ions and aqueous hydroxide ions
- show all your working for calculations, clearly label each intermediate step to state what you are calculating and do not round answers to intermediate steps to 1 significant figure
- carry out as many experiments as you can or watch demonstrations from your teacher or videos so that you are familiar with all the techniques in the specification
- make sure that you understand the reason for each step in the procedure of an experiment