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ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2017

Centre Number

Candidate Number

Chemistry

Assessment Unit AS 3
assessing
Module 3: Basic Practical Chemistry

Practical Booklet B (Theory)

[SCH32]

SCH32

FRIDAY 9 JUNE, AFTERNOON

TIME

1 hour 15 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
You must answer the questions in the spaces provided.
Do not write outside the boxed area on each page or on blank pages.
Complete in black ink only. **Do not write with a gel pen.**
Answer **all six** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 55.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
A Periodic Table of Elements, containing some data, is included with this question paper.

1 A sample of hydrated sodium carbonate, $Na_2CO_3.xH_2O$, was analysed by titration to determine the amount of water of crystallisation. 2.79 g of the hydrated sodium carbonate were dissolved in 250.0 cm^3 of deionised water. 25.0 cm^3 of this solution were titrated with 0.10 mol dm^{-3} sulfuric acid. The mean titre was 22.5 cm^3.

The following reaction occurred:

$$Na_2CO_3 + H_2SO_4 \rightarrow Na_2SO_4 + H_2O + CO_2$$

(a) **(i)** Describe how the 250.0 cm^3 solution of sodium carbonate could be prepared.

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____ [4]

(ii) Name a suitable indicator for this titration, and state the colour change at the end point.

Indicator ____

Colour change from ____________________ to ____________________ [3]

(b) Use the following headings to calculate the value of x in the hydrated sodium carbonate.

Number of moles of sulfuric acid added

Number of moles of sodium carbonate in 25.0 cm^3 of solution

Number of moles of sodium carbonate in 250.0 cm^3 of solution

Mass of sodium carbonate in 250.0 cm^3 of solution

Mass of water in the hydrated sodium carbonate

Moles of water in the hydrated sodium carbonate

Value of x

[5]

(c) An alternative method to determine the amount of water of crystallisation in hydrated salts is to heat the hydrated compound in a crucible until it reaches constant mass.

The following masses were obtained using this method.

mass of crucible	11.60 g
mass of crucible + hydrated copper(II) sulfate before heating	16.60 g
mass of crucible + contents after heating for ten minutes	14.93 g
mass of crucible + contents after heating for fifteen minutes	14.93 g

(i) Draw a labelled diagram of the apparatus used to heat a sample of hydrated copper(II) sulfate.

[3]

(ii) Outline one safety precaution required when the weighings are taken after heating.

____ [1]

(iii) Calculate the percentage, by mass, of water in the hydrated copper(II) sulfate.

____

____

____

____ [2]

2 Propanone may be prepared by the following method:

A solution containing 15 g of sodium dichromate(VI) in 100 cm^3 of dilute sulfuric acid is added dropwise to 11.5 cm^3 of propan-2-ol (density 0.79 g cm^{-3}). This mixture is refluxed for 20 minutes. The apparatus is then rearranged for distillation, collecting the distillate below 60 °C. The distillate is then dried using anhydrous sodium sulfate. A yield of 7.0 g is obtained.

(a) **(i)** Define the term **reflux**.

____

____ [1]

(ii) Describe, giving practical details, how the distillate is dried and how the sodium sulfate is removed.

____

____

____

____ [3]

(b) Calculate the percentage yield of propanone.

____

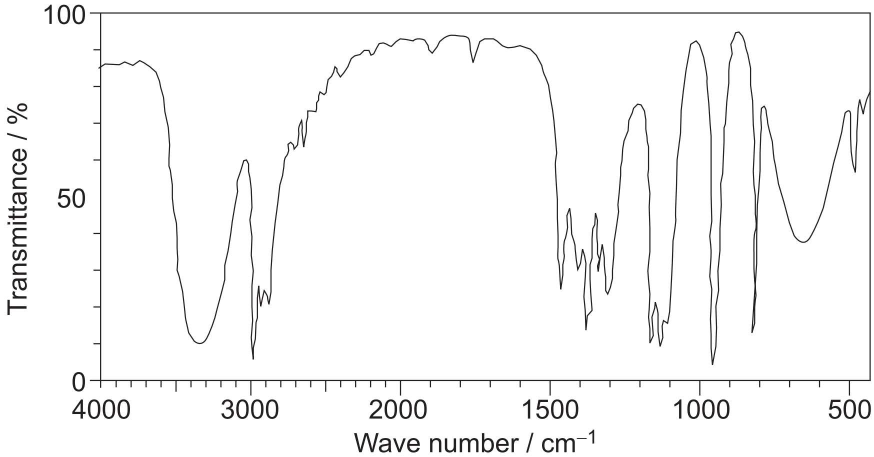
____

____

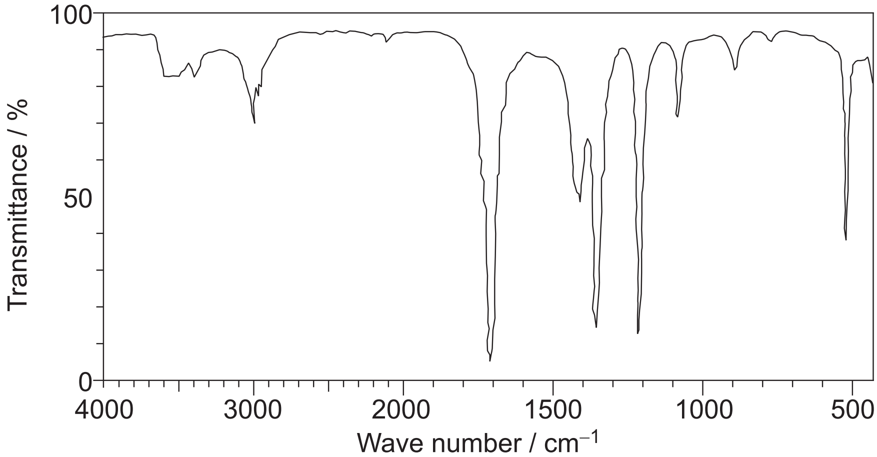
____ [3]

(c) The infrared spectra for propan-2-ol and the distillate are shown below:

Propan-2-ol



Distillate



Explain, through the identification of specific functional groups and their peaks, what evidence there is in the spectra showing that propan-2-ol has been completely converted into propanone.

____

____

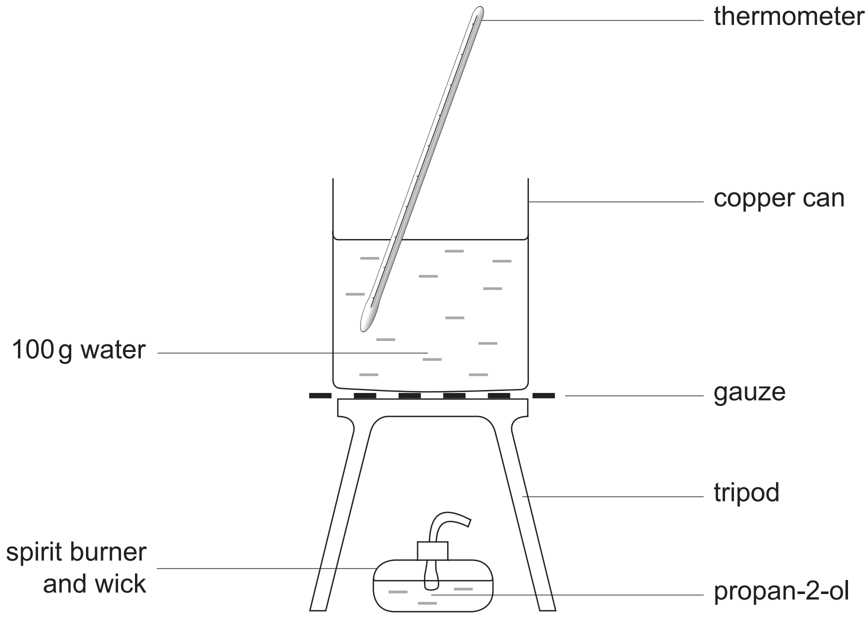
____ [3]

(d) Suggest why reflux would not be suitable in the preparation of propanal from propan-1-ol.

____ [1]

[Turn over

3 The enthalpy of combustion of propan-2-ol, C_3H_8O, can be determined using the apparatus shown below.



(a) (i) Define the term **enthalpy of combustion**.

____

____ [2]

(ii) Write an equation for the complete combustion of propan-2-ol.

____ [2]

(iii) Why is a copper can used?

____

____ [1]

(iv) Why should the water be stirred throughout the experiment?

____ [1]

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(b) (i) When completely burned, 0.60 g of propan-2-ol caused 100 g of water to increase in temperature by 36 °C. Calculate the enthalpy of combustion of propan-2-ol. The heat capacity of water is 4.2 J g^{-1} K^{-1}.

____

____

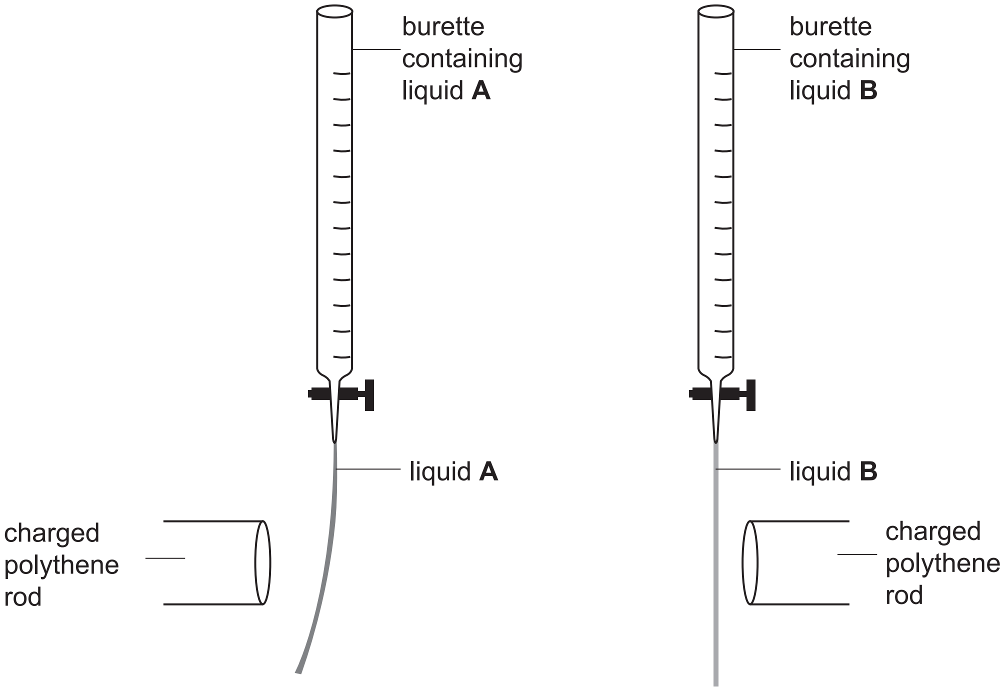
____

____ [3]

(ii) A data book gives the enthalpy of combustion as –2006 kJ mol^{-1}. Suggest a reason why this value differs from the value found in **(b)(i)**.

____ [1]

4 An experiment was carried out to test for polarity in the molecules of two liquids, **A** and **B**.



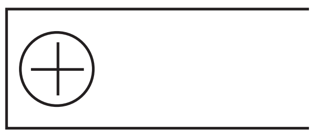
(a) Explain the difference in the results observed.

____

____

____ [2]

(b) Complete the diagram to show how a molecule of water is attracted to the charged rod shown below.



[1]

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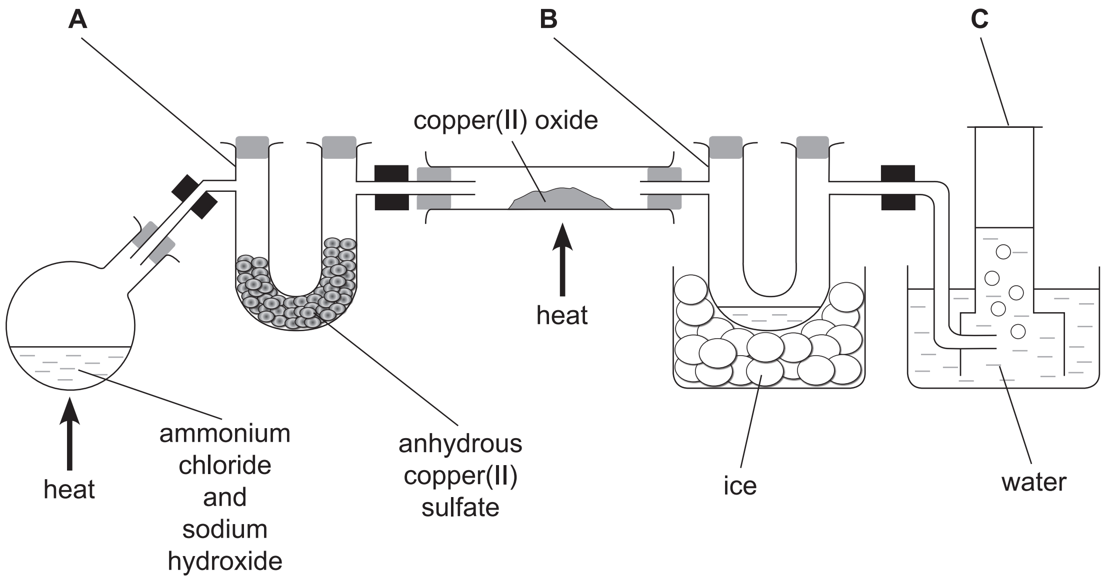
5 The apparatus below was set up to investigate the reduction of copper(II) oxide by ammonia gas.



(a) Suggest an equation for the reaction between ammonium chloride and sodium hydroxide to form ammonia.

____ [1]

(b) Name the piece of apparatus labelled **A**.

____ [1]

(c) State the purpose of the anhydrous copper(II) sulfate in **A**.

____ [1]

(d) What will be observed in **A** during the experiment?

____ [1]

(e) The solution that collects in **B** turns Universal Indicator blue. Explain what causes this change.

____

____ [2]

(f) The gas collected in **C** is a product of the reduction of the copper(**II**) oxide. Suggest the name of this gas.

____ [1]

6 Calcium carbonate is used in toothpastes as an abrasive. Describe, giving practical details, how laboratory tests can be performed to identify the ions in a sample of calcium carbonate and state the expected results.

calcium ion

____

____

____

____ [3]

carbonate ion

____

____

____

____ [3]

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Question Number	Marks	
	Examiner Mark	Remark
1		
2		
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Total Marks		