Rewarding Learning

Centre Number

71	

Candidate Number

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2014

Chemistry

Assessment Unit AS 3

assessing

Module 3: Practical Examination

Practical Booklet B

[AC134]

THURSDAY 8 MAY, MORNING

AC134

TIME

1 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Answer **all five** questions.
Write your answers in the spaces provided.

INFORMATION FOR CANDIDATES

The total mark for this paper is 68.
Section A
Question 1 is a practical exercise worth 17 marks.
Question 2 is a practical exercise worth 15 marks.
Section B
Question 3 is a planning exercise worth 20 marks.
Questions 4 and 5 are written questions worth a total of 16 marks, testing aspects of experimental chemistry.
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 (including some data) is provided.
You may not have access to notes, textbooks and other material to assist you.

For Examiner's use only		
Question Number	**Examiner Mark**	**Remark**
1		
2		
3		
4		
5		
Total Marks		

Section A

Examiner Mark	Remark

1 Titration exercise

A back titration was used to calculate the mass of calcium carbonate in an indigestion tablet.

Solution **A** was made by reacting **two** indigestion tablets, total mass 2.64 g, with 25.0 cm^3 of 2.0 mol dm^{-3} hydrochloric acid and then making this up to 250 cm^3.

25.0 cm^3 of this solution was then titrated against 0.10 mol dm^{-3} sodium hydroxide solution and the titre was found to be 23.8 cm^3.

(a) The indicator used was phenolphthalein. State the colour change at the end point of the titration.

_____ to _____ [2]

(b) **(i)** Write an equation for the reaction of calcium carbonate with hydrochloric acid.

_____ [2]

(ii) Write an equation for the reaction of hydrochloric acid with sodium hydroxide.

_____ [1]

Use the following steps to calculate the mass of calcium carbonate in an indigestion tablet.

Examiner Mark	Remark

(c) (i) Calculate the number of moles of sodium hydroxide which reacted with 25.0 cm^3 of solution **A**.

_____ [1]

(ii) Calculate the number of moles of hydrochloric acid in 25 cm^3 of solution **A**.

_____ [1]

(iii) Calculate the number of moles of unreacted hydrochloric acid in 250 cm^3 of solution **A**.

_____ [1]

(iv) Calculate the number of moles of hydrochloric acid added to the indigestion tablets.

_____ [1]

(v) Calculate the number of moles of hydrochloric acid which reacted with the calcium carbonate in the indigestion tablets.

_____ [1]

(vi) Calculate the number of moles of calcium carbonate in the indigestion tablets.

_____ [1]

(vii) Calculate the mass of calcium carbonate in one indigestion tablet.

_____ [1]

Examiner Mark	Remark

(d) (i) The indigestion tablets also contain glucose, sucrose and a flavouring. Suggest why these do not affect the titration value obtained.

_____ [1]

(ii) Explain why the accuracy of the titration is increased by washing the insides of the conical flask with deionised water during the titration.

_____

_____ [1]

(iii) Suggest **one** other way in which the accuracy of the titration can be increased.

_____ [1]

(iv) Suggest **two** ways in which the reliability can be increased.

_____

_____

_____

_____ [2]

2 Observations and deductions.

(a) A mixture of two white salts, labelled **Y**, have a common cation.

The following tests were carried out on **Y** and the observations noted in the table. Complete the table by recording the deductions which can be made from these observations and identify the two salts.

	Test	Observations	Deductions
1	Place a spatula measure of **Y** in a test tube and heat strongly. Test any gas given off with lime water.	*Colourless liquid on sides of test tube* *Limewater turns milky*	[2]
2	Make a solution of **Y** by dissolving a half spatula measure of **Y** in a test tube one third full of dilute hydrochloric acid. Add 1 cm^3 of barium chloride solution to the test tube.	*Effervescence* *No change*	[1] [1]
3	Make a solution of **Y** by dissolving a half spatula measure of **Y** in a test tube one third full of deionised water. Add 1 cm^3 of magnesium sulfate solution to the test tube.	*No change*	[1]
4	Make a solution of **Y** by dissolving a quarter spatula measure of **Y** in a test tube one third full of dilute nitric acid. Add 1 cm^3 of silver nitrate solution and then, in a fume cupboard, 5 cm^3 of dilute ammonia solution.	*White precipitate, precipitate dissolves*	[1]
5	Dip a nichrome wire loop in concentrated hydrochloric acid; touch **Y** with the wire and then hold it in a blue Bunsen flame.	*Lilac flame*	[1]

Name the **two** salts present in **Y**:

_____ and _____ [2]

Examiner Mark	Remark

(b) The following observations were recorded for tests carried out on an organic liquid, labelled **Z**. Complete the deductions.

	Test	Observations	Deductions
1	Place 1 cm^3 of **Z** in a test tube and add 1 cm^3 of water, add a bung and shake the test tube.	*Two layers formed*	[1]
2	Place 10 drops of **Z** on a watch glass placed on a heatproof mat and ignite it using a burning splint.	*Yellow, smoky flame*	[1]
3	In a fume cupboard add approximately 0.5 cm^3 of **Z** to a test tube one quarter full of bromine water and mix well.	*Orange bromine water decolourised*	[1]
4	Place 1 cm^3 of **Z** in a test tube and add 1 cm^3 of ethanol and 1 cm^3 of silver nitrate. Place the test tube in a beaker of water heated to just below boiling point. Leave for 5 minutes.	*Yellow precipitate*	[1]

Based on the experiments above, suggest:

two functional groups which may be present in **Z**.

1. _____

2. _____ [2]

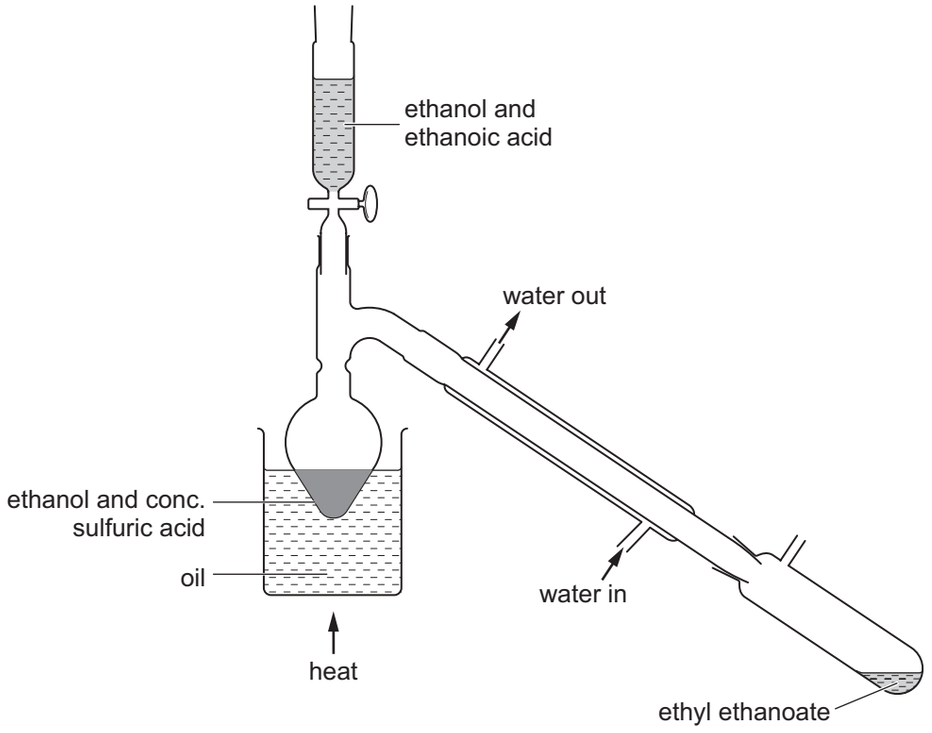
Examiner Mark	Remark

Section B

Examiner Mark	Remark

3 Planning

Ethyl ethanoate can be prepared by reacting ethanol with glacial (pure) ethanoic acid.



Place 5.0 cm^3 of ethanol in the flask, immersing the latter in oil. Add slowly and with gentle stirring 5.0 cm^3 of concentrated sulfuric acid. Set up the apparatus as shown in the diagram.

Place a mixture of 5.0 cm^3 ethanol and 12 cm^3 of ethanoic acid in the dropping funnel. Raise the temperature of the oil bath to 140 °C, then run the mixture dropwise into the flask. Add the mixture at the same rate as the ethyl ethanoate distils over.

Transfer the distillate to a separating funnel. Add 10 cm^3 of sodium carbonate solution and shake, removing the stopper from time to time. Discard the lower aqueous layer.

Run the upper layer into a beaker and add a suitable drying agent. Redistil the liquid collecting the fraction which boils between 75–79 °C.

(a) Write an equation for the reaction of ethanol with ethanoic acid.

_____ [1]

Examiner Mark	Remark

(b) Suggest why the apparatus must not contain water.

_____

_____ [2]

(c) **(i)** Give **two** safety precautions when handling concentrated sulfuric acid.

_____

_____ [2]

(ii) Why is the concentrated sulfuric acid added slowly?

_____ [1]

(iii) Name **two** substances which remain in the flask after the first distillation.

_____

_____ [2]

(d) **(i)** What is the purpose of adding the sodium carbonate solution to the separating funnel?

_____ [1]

(ii) Why must the stopper be removed from the separating funnel 'from time to time'?

_____ [1]

(e) **(i)** Name a suitable drying agent for the ethyl ethanoate.

_____ [1]

(ii) How would you know, from its appearance, when the ethyl ethanoate is dry?

_____ [1]

(iii) How could you separate the ethyl ethanoate from the drying agent?

_____ [1]

(f) The mass of ethanol used was 7.90 g and that of ethanoic acid 12.60 g.

(i) Calculate the number of moles of ethanol used.

_____ [1]

(ii) Calculate the number of moles of ethanoic acid used.

_____ [1]

(iii) Calculate the theoretical yield of ethyl ethanoate in grams.

_____

_____ [1]

(iv) 8.2 cm^3 of ethyl ethanoate were collected. The density of ethyl ethanoate is 0.92 g cm^{-3}. Calculate the mass of ethyl ethanoate collected.

_____

_____ [1]

(v) What is the percentage yield of the ethyl ethanoate?

_____ [1]

(vi) State **two** reasons why the percentage yield is less than 100%.

_____

_____ [2]

Examiner Mark	Remark

Examiner Mark	Remark

4 When an ionic solid dissolves in water there may be a temperature change.

A student placed 100 cm^3 of water in a polystyrene beaker and then recorded the temperature. He dissolved powdered hydrated copper(II) sulfate, $CuSO_4.5H_2O$ in the water and recorded the temperature again.

Mass of hydrated copper(II) sulfate added = 2.07 g
Initial temperature = 18.0 °C
Final temperature = 17.8 °C
Specific heat capacity of water is 4.2 J $°C^{-1}$ g^{-1}

(a) Why is the hydrated copper(II) sulfate powdered?

_____ [1]

(b) Calculate the enthalpy change on dissolving the hydrated copper(II) sulfate in the water.

_____

_____ [2]

(c) Calculate the enthalpy change, in kJ mol^{-1} on dissolving one mole of hydrated copper(II) sulfate in water.

_____

_____ [2]

(d) The actual value is 11.7 kJ mol^{-1}. Give **one** source of error in the student's experiment and suggest how it could be reduced.

_____

_____ [2]

(e) When anhydrous copper(II) sulfate is added to water the temperature rises. Explain why.

_____

_____ [1]

Examiner Mark	Remark

5 Ammonium nitrate, NH_4NO_3, decomposes on heating forming nitrogen, oxygen and water.

(a) Write an equation for the decomposition of ammonium nitrate.

_____ [2]

(b) Describe a test to show the presence of oxygen.

_____

_____ [2]

(c) Calculate the volume of gas produced at 20 °C and one atmosphere pressure by decomposing 1.25 g of ammonium nitrate.

_____

_____ [2]

(d) Ammonium nitrate reacts with sodium hydroxide solution to form ammonia gas. Describe a test to show the presence of ammonia.

_____

_____ [2]

THIS IS THE END OF THE QUESTION PAPER

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