Rewarding Learning

Centre Number

Candidate Number

ADVANCED
General Certificate of Education
2016

Chemistry

Assessment Unit A2 3

assessing

Module 3: Practical Examination

Practical Booklet B

[AC234]

FRIDAY 13 MAY, MORNING

AC234

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 blue or black ink only. **Do not write with a gel pen.**
Answer **all three** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 50.
Question 1 is a practical exercise worth 17 marks.
Question 2 is a practical exercise worth 13 marks.
Question 3 is a planning exercise worth 20 marks.
Quality of written communication will be assessed in **Question 3(e)**.
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.

1 The concentration of a potassium iodate(V) solution was determined by pipetting 25.0 cm^3 of the solution into a conical flask, adding 20.0 cm^3 of sulfuric acid followed by 1.5 g (an excess) of potassium iodide. The liberated iodine was titrated with a 0.050 mol dm^{-3} solution of sodium thiosulfate. The average titre was 18.5 cm^3.

(a) With reference to the appropriate indicator, describe the colour changes which occur during this titration.

[5]

(b) **(i)** Write the equation for the reaction of iodine with thiosulfate ions.

[2]

(ii) Calculate the number of moles of iodine liberated in the conical flask.

[2]

(c) **(i)** Write the half-equation for the reduction of iodate(V) ions, in the presence of hydrogen ions, to form iodine.

_____ [2]

(ii) Write the overall ionic equation for the reaction of iodate(V) ions with iodide ions, in the presence of hydrogen ions, to give iodine and water.

_____ [2]

(d) Calculate the concentration of the potassium iodate(V) solution in $g\,dm^{-3}$.

_____

_____

_____

_____

_____

_____

_____ [4]

[Turn over

2 (a) (i) Based on the following observations, make deductions for salts **X** and **Y**.

	Test	Observation	Deductions
1	Dissolve two spatula measures of **X** in 50 cm^3 of water. Keep this solution for use in further tests.	*Green crystals dissolve to produce a green solution.*	[1]
2	Dissolve two spatula measures of **Y** in 50 cm^3 of water. Keep this solution for use in further tests.	*Pink crystals dissolve to produce a pink solution.*	
3	Place 4 cm^3 of the solution of **X** in a test tube. Slowly add an equal volume of sodium hydroxide solution. Add concentrated ammonia.	*A green precipitate forms.* *The precipitate disappears and a blue solution is formed.*	[1]
4	Place 4 cm^3 of the solution of **Y** in a test tube. Slowly add concentrated ammonia until present in excess. Shake the solution.	*A blue precipitate forms. The precipitate disappears and a yellow solution is formed.* *The yellow solution turns brown.*	[1]
5	Place 4 cm^3 of the solution **Y** in a test tube. Add 2 cm^3 of concentrated hydrochloric acid. Add 8 cm^3 of water and shake vigorously.	*Solution turns blue and back to pink.*	
6	Slowly add a solution of 1,2-diaminoethane to the solution of **X** until it is present in excess.	*Solution turns purple.*	

(ii) Give the formula of the green precipitate in Test 3.

_____ [1]

(iii) Give the formula of the species responsible for the blue solution in Test 3.

_____ [1]

(iv) Give the formula of the species responsible for the yellow solution in Test 4.

_____ [1]

(v) Give the equation for the reaction in Test 5.

_____ [2]

(vi) Give the formula of the species responsible for the purple colour in Test 6.

_____ [1]

[Turn over

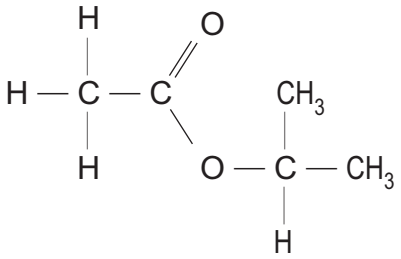
(b) (i) Based on the following observations, make deductions for compound **Z**.

	Test	Observation	Deductions
1	Add 2 cm^3 of **Z** to 2 cm^3 of water.	*One layer formed.*	
2	Add sodium hydrogencarbonate to **Z**.	*No bubbles produced.*	[1]
3	Add a few drops of **Z** to a solution of 2,4-dinitrophenylhydrazine.	*An orange solid forms.*	[1]
4	Heat **Z** with Tollen's reagent.	*The solution remains colourless.*	[1]

(ii) Suggest a possible structure for **Z**.

[1]

3 Isopropyl acetate is an ester with a boiling point of 88 °C.



isopropyl acetate

It can be prepared by refluxing acetic acid with isopropyl alcohol in the presence of a catalyst in a round-bottomed flask. The product is removed from the flask, purified and analysed.

(a) (i) Write an equation for the *equilibrium* reaction between acetic acid and isopropyl alcohol.

_____ [2]

(ii) Name the catalyst added to the flask.

_____ [1]

(iii) What else should be added to the round-bottomed flask?

_____ [1]

(b) Give the IUPAC name for isopropyl alcohol.

_____ [1]

[Turn over

(c) Assuming a 40% yield, what is the minimum mass of isopropyl alcohol required to produce 10.2 g of isopropyl acetate?

[4]

(d) Name the experimental technique used to remove the product from the flask.

[1]

(e) Giving experimental details, describe how the crude product can be purified

(i) Using an aqueous solution of sodium carbonate

[3]

(ii) Using anhydrous calcium chloride.

[3]

Quality of written communication [2]

(f) Suggest how infrared spectroscopy could be used to show that the product did not contain any unreacted acetic acid or isopropyl alcohol.

[1]

(g) State the integration pattern in the nmr spectrum of isopropyl acetate.

[1]

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