Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2015

Centre Number

Candidate Number

Chemistry

Assessment Unit AS 3
assessing
Module 3: Practical Examination

Practical Booklet B

AC134

[AC134]

WEDNESDAY 27 MAY, MORNING

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.
Answer **all five** questions.
Write your answers in the spaces provided.

INFORMATION FOR CANDIDATES

The total mark for this paper is 66.
Section A
Question 1 is worth 14 marks.
Question 2 is worth 16 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

The percentage of calcium carbonate in toothpaste can be determined by back titration using the following method.

- Weigh out 2.0 g of toothpaste and place in a beaker.
- Pipette 40.0 cm^3 of 0.5 mol dm^{-3} hydrochloric acid into the beaker and add about 20 cm^3 of deionised water.
- Heat and stir the mixture until the reaction is complete.
- When the mixture has cooled to room temperature filter it into a 250 cm^3 volumetric flask and make up to the mark with deionised water.
- Titrate 25.0 cm^3 portions of this mixture against 0.1 mol dm^{-3} sodium hydroxide solution using an appropriate indicator.

A set of results is recorded in the following table.

	initial burette reading (cm^3)	**final burette reading (cm^3)**	**titre (cm^3)**
Rough	0.0	12.7	12.7
1st accurate	0.0	12.0	12.0
2nd accurate	12.0	24.0	12.0

Average titre = 12.0 cm^3

(a) (i) Why is the mixture heated?

____ [1]

(ii) How would you know when the reaction of toothpaste with hydrochloric acid is complete?

____ [1]

(b) Write equations for the following reactions:

(i) Calcium carbonate with hydrochloric acid

____ [2]

(ii) Sodium hydroxide with hydrochloric acid

____ [1]

(c) State a suitable indicator for this titration and give the colour change at the end point.

____

____ [3]

Examiner Mark	Remark

(d) Use the following headings to calculate the percentage of calcium carbonate in the 2.0 g sample of toothpaste.

Number of moles of hydrochloric acid added to the toothpaste

____

Number of moles of sodium hydroxide required for neutralisation

____

Number of moles of hydrochloric acid in the 25.0 cm^3 portion

____

Number of moles of hydrochloric acid in the 250 cm^3 mixture

____

Number of moles of hydrochloric acid reacting with calcium carbonate in the toothpaste

____

Number of moles of calcium carbonate present in the 2.0 g sample of toothpaste

____

Mass of calcium carbonate present in the 2.0 g sample of toothpaste

____

Percentage of calcium carbonate in the toothpaste

____ [6]

Examiner Mark	Remark

2 Observation/Deduction

(a) The following tests were carried out on solid barium chloride, **X**. The table below is an incomplete set of observations and deductions for the tests. Complete the empty boxes in the table.

Test	Observations	Deductions
1 Add a spatula measure of **X** to a boiling tube half filled with deionised water. Retain for Tests **2**, **3** and **5**.	[1]	
2 Pour 1 cm^3 of the solution from Test **1** into a test tube. **(a)** Add 5 drops of silver nitrate solution. **(b)** Add 4 cm^3 of dilute ammonia solution.	 [2] [1]	 *Chloride ions present* *Chloride ions confirmed*
3 Pour 1 cm^3 of the solution from Test **1** into a test tube. **(a)** Add 5 drops of potassium chromate solution. **(b)** Add 5 cm^3 of dilute hydrochloric acid.	 [2] [1]	 *Barium ions present*
4 Dip a nichrome wire loop in concentrated hydrochloric acid, touch sample **X** with the wire, then hold it in a blue Bunsen flame.	[1]	*Confirms barium ions present*
5 Place 1 cm^3 of magnesium sulfate solution in a test tube and add 5 drops of the solution from Test **1**.	[2]	

Examiner Mark	Remark

(b) The following tests were carried out on the organic liquid, **Y**, and the observations recorded in the table. Complete the deductions section of the table for each test.

Test	Observations	Deductions
1 To 10 drops of **Y** in a test tube add 1 cm^3 of water.	*Two layers formed*	[1]
2 Place 10 drops of **Y** on a watch glass on a heatproof mat and ignite it using a burning splint.	*Burns with a yellow, smoky flame*	[1]
3 Add approximately 10 drops of **Y** to a test tube quarter full of bromine water and mix well.	*Orange bromine water is decolourised*	[1]
4 Add 10 drops of **Y** to 2 cm^3 of acidified potassium dichromate solution in a test tube and warm gently.	*Orange colour remains*	[1]

Examiner Mark	Remark

From Test 3 what functional group is present in **Y**?

____ [1]

From Test 4 what functional group may be absent from **Y**?

____ [1]

Section B

Examiner Mark	Remark

3 Planning

Magnesium reacts with copper(II) sulfate solution in a displacement reaction.

$$Mg(s) + CuSO_4(aq) \rightarrow MgSO_4(aq) + Cu(s)$$

The enthalpy change for the reaction can be determined using the following method:

- *Prepare 250 cm^3 of 1.0 mol dm^{-3} copper(II) sulfate solution.*
- *Transfer 50 cm^3 of the 1.0 mol dm^{-3} copper(II) sulfate solution into a polystyrene cup.*
- *Place a thermometer in the cup and record the temperature of the solution.*
- *Add 2.0 g of magnesium powder to the copper(II) sulfate solution in the cup.*
- *Use the thermometer to stir the reaction mixture and record the highest temperature reached.*

(a) **(i)** Calculate the mass of hydrated copper(II) sulfate ($CuSO_4.5H_2O$) required to make 250 cm^3 of a 1.0 mol dm^{-3} solution.

____

____

____ [2]

(ii) Describe how you would prepare 250 cm^3 of a 1.0 mol dm^{-3} solution of copper(II) sulfate from hydrated copper(II) sulfate crystals using a volumetric flask.

____

____

____

____

____

____

____ [4]

Examiner Mark	Remark

(b) Which piece of apparatus should be used to measure out 50 cm^3 of copper(II) sulfate solution?

______________________________ [1]

(c) Explain why the reaction is carried out in a polystyrene cup.

______________________________ [1]

(d) Suggest **two** observations for this reaction other than the production of heat.

____

______________________________ [2]

(e) **(i)** Calculate the number of moles of each reactant used.

____

______________________________ [2]

(ii) Why is the number of moles of magnesium not used in the calculation of the enthalpy change?

______________________________ [1]

(f) When magnesium was reacted with 50 cm^3 of 1.0 mol dm^{-3} copper(II) sulfate solution a temperature rise of 35 °C was recorded.

(i) Assuming copper(II) sulfate solution has a density of 1.0 g cm^{-3} calculate the amount of heat energy given out in kJ.

The specific heat capacity of the copper(II) sulfate solution is 4.2 J g^{-1} $°C^{-1}$

You may ignore the effect of the added magnesium on the mass of the contents of the cup.

____

____

______________________________ [2]

(ii) Calculate the enthalpy change for the reaction in kJ mol^{-1}.

____

____ [1]

(g) State **one** practical way to prevent heat loss in this experiment.

____ [1]

(h) Describe how you would confirm the presence of copper(II) ions in a solution of copper(II) sulfate.

____

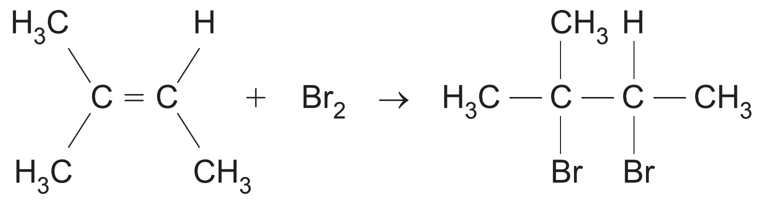
____

____ [3]

Examiner Mark	Remark

4 Bromination of an alkene

Bromine reacts with 2-methylbut-2-ene to produce 2,3-dibromo-2-methylbutane.



The following is a method used to prepare 2,3-dibromo-2-methylbutane.

In a fume cupboard set up the apparatus for reflux with a dropping funnel for addition. Place 10 g of 2-methylbut-2-ene and 20 cm^3 of water in the flask. Place 36 g of bromine (an excess) in the dropping funnel. Open the tap allowing the bromine to slowly drip into the flask. After all the bromine has been added heat the mixture under reflux.

Rearrange the apparatus for distillation. The distillate will include an aqueous layer; determine which layer is the aqueous layer and remove it using a separating funnel. Place the organic layer in a boiling tube, add anhydrous calcium chloride and shake well. Remove the calcium chloride and measure the mass of product before calculating the percentage yield.

(a) Why is the reaction carried out in a fume cupboard?

____ [1]

(b) Suggest why the bromine is added slowly.

____ [1]

(c) What is meant by the term **reflux**?

____

____ [1]

(d) What is the purpose of the anhydrous calcium chloride?

____ [1]

Examiner Mark	Remark

Examiner Mark	Remark

(e) Describe practically how you would carry out the following parts of the method:

(i) "Determine which layer is the aqueous layer"

____

____ [1]

(ii) "Remove the calcium chloride"

____

____ [1]

(f) After following the method a student reported that 26.3 g of 2,3-dibromo-2-methylbutane had been formed.

Use the following headings to calculate the percentage yield.

Number of moles of 2-methylbut-2-ene used

____

____

Theoretical number of moles of 2,3-dibromo-2-methylbutane produced

____

Theoretical mass of 2,3-dibromo-2-methylbutane produced

____

____

Percentage yield

____ [4]

5 Tutton's salts are soluble double salts consisting of two different cations and sulfate ions. One example is ammonium magnesium sulfate, $(NH_4)_2Mg(SO_4)_2.6H_2O$.

Sodium hydroxide solution can be used to test for both the ammonium ion and the magnesium ion in a sample. Describe how the tests are carried out, stating any other required reagents and the expected observations.

Ammonium ion ____

____

____

____

____ [3]

Magnesium ion ____

____

____

____

____ [3]

Examiner Mark	Remark

THIS IS THE END OF THE QUESTION PAPER

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