Rewarding Learning

Centre Number

71

Candidate Number

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2013

Chemistry

Assessment Unit AS 3

assessing

Module 3: Practical Examination 1

[AC131]

MV18

MONDAY 20 MAY, MORNING

TIME

2 hours 30 minutes, plus your additional time allowance.

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 90.

Section A

Question 1 is a practical exercise worth 25 marks.

Question 2 is a practical exercise worth 29 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 at the end of each question indicate the marks awarded to each question or part question.

A Periodic Table of the Elements, containing some data, is included in this question paper.

You may not have access to notes, textbooks and other material to assist you.

Section A

1 Titration exercise

Washing soda ($Na_2CO_3.xH_2O$) crystals lose water of crystallisation when left in the air.

You are required to carry out a titration to find the value of x.

You are provided with:

Hydrochloric acid of concentration 0.10 mol dm^{-3}
A solution containing 11.60 g dm^{-3} of washing soda labelled **R**
Methyl orange indicator

(a) Describe how you would prepare 250 cm^3 of a 11.60 g dm^{-3} washing soda solution from the solid. [4]

(b) Carry out the titration by:

- rinsing out the burette with the 0.10 mol dm^{-3} hydrochloric acid
- filling the burette with the 0.10 mol dm^{-3} hydrochloric acid
- transferring 25.0 cm^3 of the washing soda solution, **R**, to the conical flask
- adding three drops of methyl orange indicator to the solution in the conical flask and titrating until the end point is reached

Present your results in a suitable table and calculate the average titre. [8]

(c) State the colour change at the end point of your titration. [2]

_____ to _____

(d) Write the equation for the reaction of hydrochloric acid with anhydrous sodium carbonate. [2]

_____

(e) **(i)** Calculate the number of moles of hydrochloric acid used in the titration. [1]

_____

(ii) Calculate the number of moles of sodium carbonate in 25.0 cm^3 of the solution. [1]

_____

(iii) Calculate the number of moles of sodium carbonate in 1.0 dm^3 of the solution. [1]

_____

(iv) Calculate the mass of sodium carbonate in 1.0 dm^3 of the solution. [1]

_____

(v) Calculate the mass of water of crystallisation in 11.60 g of washing soda. [1]

_____

(vi) Calculate the value of x in $Na_2CO_3.xH_2O$. [2]

_____

_____

(f) Describe what would be observed when washing soda crystals are heated in a dry test tube. [2]

_____

_____

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(Questions continue overleaf)

2 Observation and deduction

Safety glasses should be worn at all times and care should be taken during this practical examination.

(a) You are provided with a mixture of two salts, labelled **A**, which have a common anion. Carry out the following experiments on the mixture. Record your observations and deductions in the spaces below and identify the two salts.

Experiment	Observations	Deductions
1 Describe **A**.	[1]	[1]
2 Make a solution of **A** by dissolving half a spatula-measure of **A** in a test tube half-full of water. Put 1 cm^3 of the solution into each of two separate test tubes. **(a)** Add three drops of sodium hydroxide solution to the first test tube. Then add a further 2 cm^3 of sodium hydroxide solution to the test tube. **(b)** Add three drops of dilute ammonia solution to the second test tube. Then add a further 2 cm^3 of the ammonia solution to the test tube.	[2] [2]	[2] [2]

Experiment	Observations	Deductions
3 Make a solution of **A** by dissolving a half spatula-measure of **A** in a test tube one third full of dilute hydrochloric acid. Add 1 cm^3 of barium chloride solution to the test tube.	[1] [1]	[1] [1]
4 Add a spatula-measure of **A** to a test tube one third full of sodium hydroxide solution and warm gently. Carefully smell any gas given off and test it with moist Universal Indicator paper.	[2]	[3]

Name the two salts present in **A**: [2]

_____ and _____

(b) You are provided with an organic liquid labelled **B**. Carry out the following experiments on the liquid. Record your observations and deductions in the spaces opposite.

Based on the experiments opposite, suggest:

a functional group which may be present in **B**. [1]

_____

a functional group which may be absent from **B**. [1]

_____

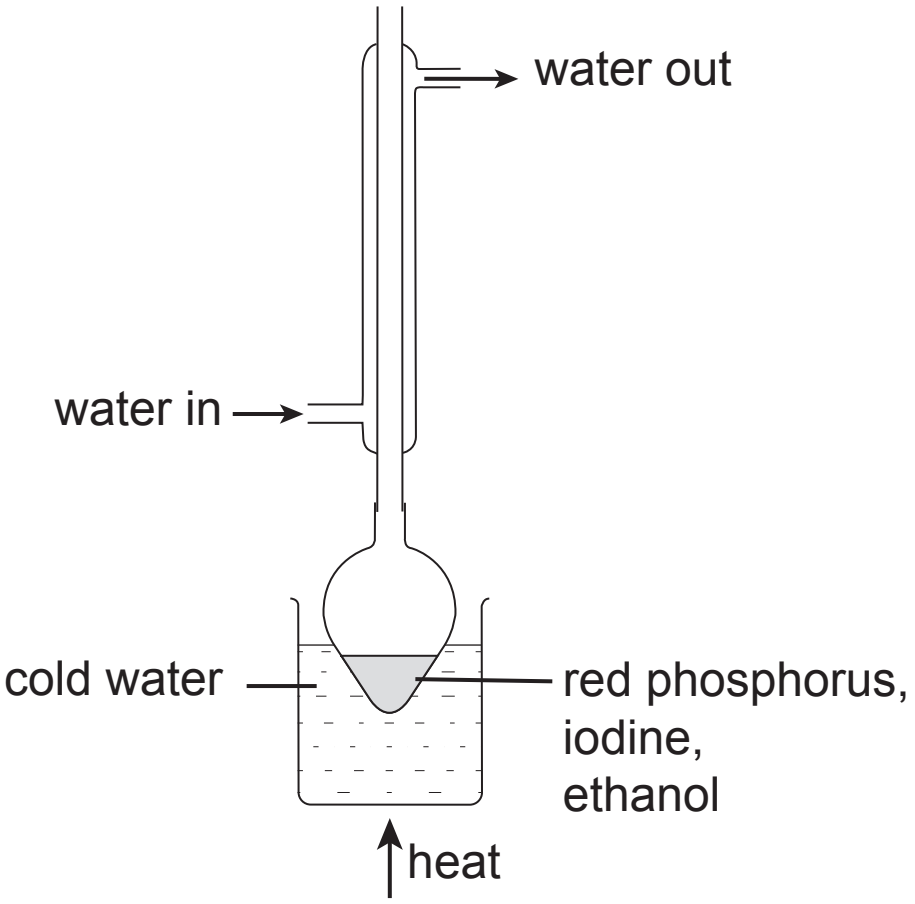
max [29]

Experiment	Observations	Deductions
1 Place 1 cm^3 of **B** in a test tube and add 1 cm^3 of water. Stopper and shake the mixture.	[1]	[1]
2 Place 10 drops of **B** on a watch glass placed on a heatproof mat and ignite it using a burning splint.	[1]	[1]
3 In a fume cupboard, add approximately 1 cm^3 of **B** to a test tube one quarter full of bromine water and shake the mixture.	[1]	[1]
4 Add six drops of **B** to 1 cm^3 of potassium dichromate solution in a test tube and acidify by adding 1 cm^3 of dilute sulfuric acid. Warm the mixture gently.	[2]	[2]

Section B

3 Planning

Iodoethane can be prepared in the laboratory by the following method.



$2P + 3I_2 \rightarrow 2PI_3$

$3C_2H_5OH + PI_3 \rightarrow 3C_2H_5I + H_3PO_3$

Place 0.5 g of red phosphorus and 5 g of iodine in a flask. Immerse the flask in a beaker of cold water and, using a dropping pipette, add 5 cm^3 of ethanol, in 1 cm^3 portions, down the reflux condenser. When all the ethanol has been added, slowly bring the water in the beaker to the boil. Allow the contents of the flask to reflux for an hour.

Allow the apparatus to cool and adjust the condenser for distillation. Bring the water in the bath gently to the boil and maintain at this temperature until no more oily drops of impure distillate are obtained.

Purify, dry and redistil the iodoethane. Collect the fraction boiling in the range 68–73 °C.

(a) Excess red phosphorus was used in the experiment and 4.85 g of iodoethane were obtained.

Use the following steps to calculate the percentage yield of iodoethane.
The density of ethanol is 0.80 g cm^{-3}.

(i) Number of moles of iodine, I_2, used. [1]

_____

(ii) Number of moles of phosphorus(III) iodide formed. [1]

_____

(iii) Mass of ethanol used. [1]

_____

(iv) Number of moles of ethanol used. [1]

(v) Theoretical number of moles of iodoethane formed. [1]

(vi) Theoretical mass of iodoethane formed. [1]

(vii) Percentage yield of iodoethane. [1]

(b) (i) Explain what is meant by the term **reflux**. [2]

(ii) Suggest why the flask is kept in a beaker of cold water as the ethanol is added. [1]

(iii) Name **two** inorganic impurities which will be present after refluxing. [2]

(iv) Describe, giving practical details, how phosphoric(V) acid may be removed from the distillate using a separating funnel. [3]

(v) Name a suitable reagent for drying the impure distillate and suggest how it may be removed. [2]

(vi) Suggest why a water bath can be used to heat the mixture during the refluxing. [1]

(vii) State **two** reasons why the range 68**–**73 °C is used to collect the distillate. [2]

4 Dolomite contains calcium and magnesium carbonates and may be represented by the formula $CaCO_3.MgCO_3$.

(a) Describe a test, including expected observations, which would show the presence of carbonate ions in dolomite. [3]

(b) Describe how you would carry out a flame test, including expected observations, to show the presence of calcium ions in dolomite. [3]

(c) Describe a test, including expected observations, which would show the presence of magnesium ions in dolomite. [4]

5 Potassium chlorate(V) decomposes when heated.

$2KClO_3 \rightarrow 2KCl + 3O_2$

The decomposition is catalysed by manganese(IV) oxide.

(a) Describe a test to show the presence of oxygen gas. [2]

_____

_____

(b) A 4.0 g mixture of potassium chlorate(V) and manganese(IV) oxide formed 365 cm^3 of oxygen on complete decomposition at room temperature and pressure.

Use the following headings to calculate the mass of manganese(IV) oxide in the mixture. [4]

Moles of oxygen

_____

Moles of potassium chlorate(V)

_____

Mass of potassium chlorate(V)

_____

Mass of manganese(IV) oxide

_____

THIS IS THE END OF THE QUESTION PAPER

Question Number	Marks	
	Teacher Mark	Examiner Check
1		
2		
3		
4		
5		
Total Marks		