Rewarding Learning

71

Candidate Number

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2010

Chemistry

Assessment Unit AS 3

assessing

Module 3: Practical Examination 2

[AC132]

AC132

TUESDAY 18 MAY, AFTERNOON

TIME

2 hours 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 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 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.

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

Section A

1 Titration exercise

Some liquid drain cleaners contain potassium hydroxide.

You are required to carry out a titration and use the results to calculate the concentration of the potassium hydroxide in a liquid drain cleaner.

You are provided with:

Hydrochloric acid of concentration 0.10 mol dm^{-3}
A solution containing 25.0 cm^3 of drain cleaner diluted to 500 cm^3 with distilled water
Methyl orange indicator

(a) Give an account of how you would prepare the diluted solution of drain cleaner and then how you would safely transfer 25.0 cm^3 of the diluted solution to a conical flask.

_____

_____

_____

_____

_____

_____ [4]

(b) Carry out the titration by:

- rinsing out a 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 diluted drain cleaner to the conical flask
- adding 2–3 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.

[12]

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

_____ to _____ [1]

(d) Write the equation for the reaction of hydrochloric acid with potassium hydroxide.

_____ [1]

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

_____

_____ [1]

(ii) Calculate the number of moles of potassium hydroxide in 25.0 cm^3 of diluted drain cleaner.

_____ [1]

(iii) Calculate the number of moles of potassium hydroxide in 500 cm^3 of diluted drain cleaner.

_____ [1]

(iv) Calculate the number of moles of potassium hydroxide in 25.0 cm^3 of the undiluted drain cleaner.

_____ [1]

(v) Calculate the concentration of potassium hydroxide in the undiluted drain cleaner in mol dm^{-3}.

_____ [1]

(vi) Calculate the concentration of potassium hydroxide in the undiluted drain cleaner in g dm^{-3}.

_____ [1]

(vii) Assuming the drain cleaner has a density of 1.0 g cm^{-3} calculate the percentage of potassium hydroxide by mass in the drain cleaner.

_____

_____ [1]

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(Questions continue overleaf)

2 Observation/deduction

Safety glasses must 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 X, which have a common cation. 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 Make a solution of X by dissolving half a spatula-measure of X in a test tube half-full of water. Transfer 1 cm^3 of this solution into each of two separate test tubes. **(a)** Add a few drops of sodium hydroxide solution to the first test tube. Then add a further 10 cm^3 of the sodium hydroxide solution to the test tube. **(b)** Add a few drops of dilute ammonia solution to the second test tube. Then add a further 5 cm^3 of the ammonia solution to the test tube.		
2 Make a solution of X by dissolving half a spatula-measure of X in a test tube half-full of nitric acid solution. Transfer 1 cm^3 of this solution into each of two separate test tubes. **(a) (i)** Add a few drops of silver nitrate solution to the first test tube. **(ii)** Then add about 5 cm^3 of dilute ammonia solution to the same test tube. **(b)** Add a few drops of barium chloride solution to the second test tube.		

Name the two salts present in X:

_____

_____

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

Experiment	Observations	Deductions
1 Place 10 drops of Y in a test tube and add 1 cm^3 of water.		
2 Place 10 drops of Y on a watch glass placed on a heat proof mat and ignite it using a splint.		
3 Add approximately 10 drops of Y to a test tube one quarter full of bromine water and mix well.		
4 Add 10 drops of Y to 2 cm^3 of acidified potassium dichromate solution in a test tube. Warm the mixture gently.		

Based on the above tests, suggest:

a functional group which may be present in Y.

_____

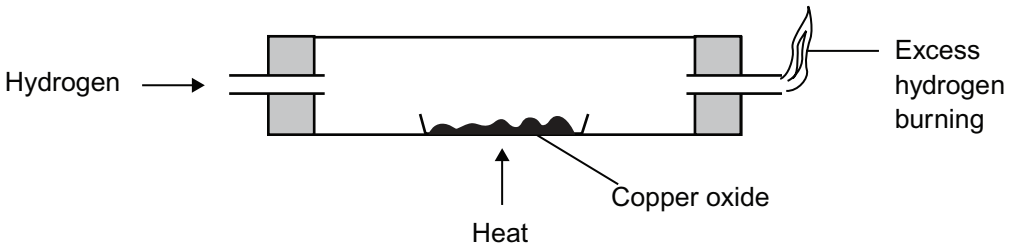
a functional group which is absent from Y.

_____ [29]

Section B

3 Planning

(a) The empirical formula of an oxide of copper can be found by reducing the copper oxide using the apparatus below.



(i) What weighings should be taken before heating?

_____

_____ [2]

(ii) In addition to wearing safety glasses, suggest and explain **one** other safety precaution which should be taken.

_____

_____

_____ [2]

(iii) What steps would you take to ensure that all of the oxygen has been removed from the copper?

_____

_____ [2]

(iv) Explain why the hydrogen continues to be passed through the apparatus after all the copper oxide has been reduced.

_____

_____ [2]

(b) When 2.16 g of the copper oxide was reduced, 1.92 g of copper was formed.

(i) What mass of oxygen was present in the copper oxide?

_____ [1]

(ii) How many moles of oxygen were present in the copper oxide?

_____ [1]

(iii) How many moles of copper were formed?

_____ [1]

(iv) Calculate the empirical formula of the copper oxide.

_____

_____ [2]

(c) Copper can be extracted from its ore, chalcopyrite, $CuFeS_2$.

The chalcopyrite is converted to copper(I) sulphide, Cu_2S. Some of the copper(I) sulphide is converted to copper(I) oxide, Cu_2O, and sulphur dioxide by heating in air. The copper(I) oxide then reacts with the remaining copper(I) sulphide to form copper and sulphur dioxide.

(i) Write the equation for the formation of the copper(I) oxide and sulphur dioxide.

_____ [2]

(ii) Write the equation for the formation of the copper.

_____ [1]

(iii) A sample of chalcopyrite weighing 25.86 g contains 34.8% by mass of $CuFeS_2$.

Calculate the percentage of copper in the sample of chalcopyrite using the following headings.

Mass of $CuFeS_2$ in the sample

_____

Percentage of copper in $CuFeS_2$

_____

Mass of copper in the sample

_____

Percentage of copper in the sample

_____ [4]

4 2-bromobutane (boiling point 91 °C) can be prepared by firstly mixing sodium bromide, butan-2-ol and water in a pear-shaped flask. Concentrated sulphuric acid is then added slowly and the mixture gently refluxed.

(a) Explain what is meant by **refluxed**.

_____ [1]

(b) After refluxing, the mixture is distilled and an impure sample of the 2-bromobutane collected.

(i) Describe how acid impurities could be removed from the impure sample.

_____

_____ [2]

(ii) Describe how any trace of water could be removed from the impure sample.

_____

_____ [2]

(iii) Describe how a pure sample of the 2-bromobutane could be obtained from the remaining liquid.

_____

_____ [2]

5 A white solid is thought to be either potassium chloride or potassium iodide.

(a) Describe how you would carry out a flame test to show the presence of potassium ions in the white solid. State the flame colour expected.

_____

_____

_____

_____ [3]

(b) Describe how you would confirm the presence of chloride or iodide ions using dilute nitric acid and silver nitrate solution. State any observations expected.

_____

_____

_____

_____ [3]

(c) Describe how silver chloride and silver iodide react with dilute and with concentrated ammonia solutions. State any observations expected.

_____

_____

_____

_____ [3]

THIS IS THE END OF THE QUESTION PAPER