

Candidate's Name:

Signature:

Random No.					Personal No.		

(Do not write your School / Centre Name or Number anywhere on this booklet.)

P525/3
CHEMISTRY
Paper 3
(Practical)
Nov./Dec. 2024
3¼ hours



UGANDA NATIONAL EXAMINATIONS BOARD
Uganda Advanced Certificate of Education

CHEMISTRY

Paper 3
(Practical)

3 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

This paper consists of three questions.

All questions are compulsory. Use blue or black ink. Any work done in pencil except drawings, will not be marked.

Write your answers in the spaces provided. No additional sheet(s) of paper should be inserted in this booklet.

Mathematical tables and silent non-programmable scientific calculators may be used.

Reference books (i.e. text books, booklets on qualitative analysis etc.) should not be used.

You are not allowed to start working with the apparatus for the first 15 minutes. This time is to enable you to read the question paper and make sure you have all the apparatus and chemicals that you require.

For Examiners' Use Only			
Q.1	Q.2	Q.3	Total

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Turn Over

1. You are provided with the following:

FA1, which is approximately 0.1 M sodium thiosulphate solution.

FA2, which is 2 M sulphuric acid.

FA3, which is 10 % potassium iodide solution.

FA4, which is a solution made by dissolving 1.2 g of potassium iodate in 250 cm³ of distilled water.

Solid W, which is impure copper(II) oxide.

Starch solution.

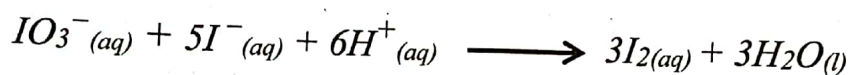
You are required to determine the;

(i) molarity of FA1.

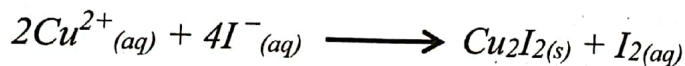
(ii) percentage purity of W.

Theory:

In acidic solution, potassium iodate reacts with potassium iodide according to the following equation:



Copper(II) sulphate reacts with potassium iodide solution according to the following equation:



Iodine reacts with sodium thiosulphate solution according to the following equation.



PART I

Procedure

Pipette 25.0 cm³ (or 20.0 cm³) of FA4 into a clean conical flask, add 10 cm³ of FA3 followed by 20 cm³ of FA2.

Titrate the resultant solution with FA1 from the burette using starch indicator. Repeat the above procedure to obtain consistent results.

Record your results in Table 1.

Volume of pipette used cm³ ($\frac{1}{2}$ mark)

Table 1

Titration Number	1	2	3
Final burette reading (cm ³)			
Initial burette reading (cm ³)			
Volume of FA1 used (cm ³)			

(4½ marks)

- (a) (i) Record the volume of FA1 used for calculating the average volume. (½ mark)

.....cm³

- (ii) Calculate the average volume of FA1 used. (2½ marks)

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..... cm³

- (b) Calculate the number of moles of;

- (i) FA4 that reacted. (02 marks)
(K = 39, O = 16, I = 127)

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(ii) FA1 that was reacted.

(02 marks)

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(c) Determine the molarity of FA1.

(1½ marks)

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PART II

Procedure

Weigh accurately 2.0 g of W and add it to 100 cm³ of FA2. Warm the mixture while stirring to dissolve, cool and transfer the resultant solution to a 250 cm³ volumetric flask and make up the solution to the mark using distilled water. Label the solution FA5.

Results:

Mass of weighing bottle + Wg (½ mark)

Mass of empty weighing bottleg (½ mark)

Mass of W weighedg (½ mark)

PART III

Procedure

Pipette 25.0 cm³ (or 20.0 cm³) of FA5 into a clean conical flask, add 10 cm³ of FA3 followed by 10 cm³ of FA2.

Titrate the liberated iodine with FA1 from the burette using starch indicator.

Repeat the titration to obtain consistent results.

Record your results in Table 2.

Volume of pipette usedcm³ ($\frac{1}{2}$ mark)

Table 2

Titration Number	1	2	3
Final burette reading (cm ³)			
Initial burette reading (cm ³)			
Volume of FA1 used (cm ³)			

($4\frac{1}{2}$ marks)

- (a) (i) Record the volume of FA1 used for calculating the average volume. ($\frac{1}{2}$ mark)

.....cm³

- (ii) Calculate the average volume of FA1 used. ($2\frac{1}{2}$ marks)

..... cm³

- (b) Calculate the number of moles of;

- (i) iodine liberated by FA5. (02 marks)

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- (ii) Copper(II) ions in 250 cm³ of FA5. (02 marks)

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(c) Determine the;

(02 marks)

- (i) mass of pure copper(II) oxide in **W**.
($Cu = 63.5$; $O = 16$)

- (ii) percentage purity of **W**.

(01 mark)

2. You are provided with substance **Q** which contains **two** cations and **two** anions. Carry out the tests in Table 3 to identify the cations and anions present in **Q**. Identify any gas(es) evolved.

Record your observations and deductions in the table.

(30 marks)

Table 3

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Heat a spatula end-ful of Q in a dry test tube strongly until there is no further change.		
(b) To three spatula end-fuls of Q in a boiling tube, add about 8 cm ³ of distilled water and shake thoroughly. Filter, keep both the filtrate and the residue. Divide the filtrate into seven portions.		
(i) To the first portion, add dilute sodium hydroxide solution drop-wise until in excess.		

TESTS	OBSERVATIONS	DEDUCTIONS
(ii) To the second portion, add dilute ammonia solution drop-wise until in excess.		
(iii) To the third portion, add 2-3 drops of dilute sulphuric acid.		
(iv) Use the fourth portion to carry out a test of your own choice to confirm one of the cations in Q . Test:		
(v) To the fifth portion, add copper turnings followed by 3-4 drops of concentrated sulphuric acid and warm.		
(vi) To the sixth portion, add 3-4 drops of lead(II) nitrate and heat.		

TESTS	OBSERVATIONS	DEDUCTIONS
(vii) To the seventh portion, add 3-4 drops of silver nitrate solution followed by ammonia solution drop-wise until in excess.		
(c) Wash the residue with water and dissolve it in about 5 cm ³ of dilute hydrochloric acid. Divide the solution into four portions.		
(i) To the first portion, add dilute sodium hydroxide solution drop-wise until in excess.		
(ii) To the second portion, add dilute ammonia solution drop-wise until in excess.		
(iii) To the third portion add ammonium oxalate solution.		
(iv) To the fourth portion, add half a spatula of solid ammonium chloride and shake to dissolve. Then add 3-4 drops of disodium hydrogen phosphate solution followed by dilute ammonia solution drop-wise until in excess.		

- (d) (i) The cations in Q areand
- (ii) The anions in Q areand

3. You are provided with substance **Z** which is an organic compound. Carry out the tests in Table 4 to determine the nature of **Z**.
Record your observations and deductions in the table. (20 marks)

Table 4

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Burn a small amount of Z on a spatula end or on a porcelain dish.		
(b) To 0.5 cm ³ of Z in a test tube, add about an equal volume of water, shake and test the mixture with litmus paper. Divide the resultant mixture into three portions.		
(i) To the first portion of the mixture, add a half a spatula end-ful of sodium carbonate.		
(ii) To the second portion of the mixture, add 2-3 drops of neutral iron(III) chloride solution.		

TESTS	OBSERVATIONS	DEDUCTIONS
(iii) To the third portion of the mixture, add 2 cm ³ of 2,4-dinitro phenylhydrazine solution (Brady's reagent). Shake and leave to stand.		
(c) To 0.5 cm ³ of Z , add 1-2 drops of acidified potassium dichromate solution.		
(d) To 0.5 cm ³ of Z , add about an equal volume of ethanoic acid followed by 2-3 drops of concentrated sulphuric acid and heat the mixture.		
(e) To 3 cm ³ of silver nitrate solution in a clean test tube, add 3 drops of sodium hydroxide solution then dilute ammonia solution drop-wise until the precipitate just dissolves, finally add 3 drops of Z and warm gently while shaking.		

TESTS	OBSERVATIONS	DEDUCTIONS
(f) To 0.5 cm ³ of Z , add 2 cm ³ of sodium hydroxide solution followed by aqueous iodine drop-wise until in excess. Warm the mixture and leave it to stand.		

(g) Describe the nature of **Z**.

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