

Names:.....Index No:

School Exam Number:.....Signature:.....

*Candidates should NOT write their Centre Name
or Centre Number anywhere on this booklet*

545/4
CHEMISTRY
PRACTICAL
Paper 4
14 August 2023
2 hours



ENTEBBE JOINT EXAMINATION BUREAU

Uganda Certificate of Education

CHEMISTRY

Paper 4

2 hours

INSTRUCTIONS TO CANDIDATES:

Attempt both questions. Answers to all questions are to be written in the spaces provided in this question paper.

You are not allowed to use any reference books such as textbooks, booklets on qualitative analysis, etc.

All working must be shown clearly.

Mathematical tables, slide rules and silent non – programmable calculators may be used.

Na = 23, O = 16, H = 1

FOR EXAMINERS' USE ONLY			
Question 1			
Question 2			
TOTAL			

1. You are provided with the following;

FA1, which is a solution made by dissolving 14.4g of solid **Na₂CO₃.YH₂O** in water to make 500cm³ of the solution.

FA2, which is a **0.3 M** hydrochloric acid solution.

You are required to determine the molar mass of **Na₂CO₃.YH₂O** hence the value of **Y** and the percentage of water of crystallization.

Procedure:

- (a) Pipette 20 or 25 cm³ of **FA1** into a clean conical flask.
- (b) Add 2-3 drops of phenolphthalein indicator.
- (c) Titrate the solution with solution **FA2** from the burette until the end point.
- (d) Record your result in the table below.
- (e) Repeat procedure a) to c) until you obtain consistent results.

Results:

Volume of pipette used cm³ (¹/₂ marks)

Titration number	1	2	3
Final burette reading (cm ³)			
Initial burette reading (cm ³)			
Volume of FA2 used (cm ³)			

(7¹/₂ marks)

Titre values used to calculate the average volume of **FA2** used. (¹/₂ marks)

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Average volume of **FA2** used (2¹/₂ marks)

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Questions:

- (a) Write an ionic equation for the reaction that took place between the acid and the carbonate. (1½ marks)

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- (b) Calculate;

- (i) The number of moles of hydrochloric acid in **FA2** that reacted. (2½ marks)

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- (ii) The number of moles of the $Na_2CO_3 \cdot xH_2O$ in **FA1** that reacted with the acid in **FA2**. (02 marks)

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- (iii) The number of moles of the $Na_2CO_3 \cdot xH_2O$ in **FA1** that reacted in 1000cm³. (2½ marks)

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(b) Determine;

(i) the molar mass of $Na_2CO_3 \cdot YH_2O$.

(3½ marks)

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(ii) value of **Y** in $Na_2CO_3 \cdot YH_2O$ and hence the percentage of water of crystallization. ($Na=23$, $C=12$, $O=16$, $H=1$)

(2½ marks)

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2. You are provided with substance **Q** which contains **two** cations and **one** anion. Carry out the following test on **Q** to identify the cations and anion. Where any gas is evolved, it must be identified and tested. Record your observations and deductions in the table below. (25 marks)

Tests	Observations	Deductions
(a) Heat one spatula endful of Q strongly until there is no further change.		
(b) Dissolve two spatula endful of Q in about 5cm ³ of water. To the resultant solution add sodium hydroxide solution drop wise until in excess. Filter and keep both the filtrate and residue.		
(i) To filtrate, add dilute hydrochloric acid drop wise until the solution is just acidic. Divide the solution into five portions		
(ii) To the first portion of the acidified filtrate, add 2-3 drops of lead(II) nitrate solution and warm.		
(iii) Use the second portion of the acidified filtrate to carry out a test of your own choice to confirm the anion in Q .		

Tests	Observations	Deductions
(iv) To the third portion of the acidified filtrate, add sodium hydroxide solution drop wise until in excess.		
(v) To the fourth portion, add 2-3 drops of potassium iodide solution.		
(vi) To the fifth portion of the acidified filtrate, add ammonia solution drop wise until in excess.		
(c) Wash the residue with sodium hydroxide solution and dissolve it in dilute nitric acid solution. Divide the resultant solution into three portions.		
(i) To the first portion of the solution, add sodium hydroxide solution drop wise until in excess.		
(ii) To the first portion of the solution, add zinc powder little at a time until no further change.		
(iii) To the second portion of the solution, add ammonia solution drop-wise until in excess.		

- (d) (i) Cations in **Q**: and
- (ii) Anion in **Q**: