Name:

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Signature: .... Index No.....................................

545/3
CHEMISTRY
PRACTICAL
Paper 3
July/August 2023

2 hours

WESTERN JOINT MOCK EXAMINATIONS

Uganda Certificate of Education

CHEMISTRY PRACTICAL

Paper 3

2 Hours

INSTRUCTIONS TO CANDIDATES:

*Answer **both** questions.*
*Answers are to be written in the spaces provided in this booklet. Use **blue** or **black***
*ink ball pen only. Any work done in **pencil** will **not** be marked except drawings.*
*You are **not** allowed to use reference books. (i.e. text books, booklets on qualitative*
analysis etc).
All working must be clearly shown.
Mathematical tables and silent non-programmable calculators may be used.

For Examiners' Use Only		
	Marks	Examiners Initials
Q.1		
Q.2		
Total		

1. You are provided with the following:

**BA₁**, which is a solution containing 12.3 grams per litre of the metal sulphate, $YSO_4 \cdot nH_2O$.

BA₂, which is a solution of sodium hydroxide solution.

BA₃, which is a 0.1M hydrochloric acid solution.

The metal sulphate reacts with sodium hydroxide solution according to the following equation:

$$YSO_4\ (aq) + 2NaOH\ (aq) \longrightarrow Y(OH)_2\ (s) + Na_2SO_4\ (aq)$$

Then insoluble hydroxide reacts with hydrochloric acid according to the following equation:

$$Y(OH)_2\ (s) + 2HCl\ (aq) \longrightarrow YCl_2\ (aq) + 2H_2O\ (l)$$
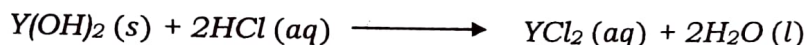
You are required to determine the number of moles of water of crystallization in the metal sulphate, $YSO_4 \cdot nH_2O$.

Procedure:

Pipette 25.0 cm³ (or 20.0 cm³) of **BA₁** into a clean conical flask. Using a measuring cylinder, transfer an equal volume of **BA₂** as in the procedure above into the conical flask containing **BA₁**, shake the contents of the conical flask thoroughly for about 10 seconds and allow it to stand.

Label the resultant mixture **BA₄**. Titrate the mixture **BA₄** using solution **BA₃** from the burette while shaking gently until the precipitate just dissolves to form a colourless solution.

Repeat the procedure until you obtain consistent results.

Record your results in the table below.

RESULTS

Volume of pipette used.. cm³ (½ mark)

Final burette reading (cm³)			
Initial burette reading (cm³)			
Volume of **BA₃** used (cm³)			

(7½ marks)

(a) (i) State the volumes of **BA₃** used to calculate the average volume.   (01 mark)

....

(ii) Calculate the average volume of **BA₃** used.   (2½ marks)

....

....

.... cm³

(b) Calculate the number of moles of;

(i) hydrochloric acid in **BA₃** that reacted with the metal hydroxide in **BA₄**.

(02 marks)

....

....

....

....

(ii) metal hydroxide in **BA₄** that reacted with the hydrochloric acid in **BA₃**.

(02 marks)

....

....

....

....

(iii) metal sulphate that reacted with the sodium hydroxide in **BA₂**. (02 marks)

....

....

....

....

(iv) metal sulphate ($YSO_4 \cdot nH_2O$) in one litre of solution.

(02 marks)

....

....

....

(c) Determine the value of n in the formula $YSO_4 \cdot nH_2O$.
($H = 1$, $O = 16$, formula mass of $YSO_4 = 120$)

(04 marks)

....

....

....

....

2. You are provided with substance **Y**, which contains **two** cations and **one** anion. Carry out the following tests to identify the cations and anion in **Y**. Identify any gas(es) that may be evolved. Record your observations and deductions in the table.
(*29 marks*)

Tests	Observation	Deduction
(a) Heat **two** spatula end-fuls of **Y** strongly in a dry boiling tube and then allow it to cool.		
(b) To the residue obtained in (a), add 5 cm³ of dilute nitric acid and shake well or warm to dissolve. Add dilute sodium hydroxide solution drop-wise until in excess. Filtrate and keep both the filtrate and the residue.		

(c) Wash the residue from (b) and then add dilute nitric acid drop-wise until the residue just dissolves. Divide the solution into four parts and test as follows: (i) To the **first** part of the solution, add dilute sodium hydroxide solution drop-wise until in excess.		
(ii) To the **second** part of solution, add 4-5 drops of dilute sodium hydrogen carbonate solution and heat		
(iii) To the **third** part of solution, add 4-5 drops of dilute sodium sulphate solution.		
(iv) Use the **fourth** part to carry out a test of your own choice to confirm the cation in the residue. **TEST**		
(d) To the filtrate obtained in **(b)**, add dilute nitric acid drop-wise until the solution is just acidic. Divide the acidic solution into five parts: (i) To the **first** part of the acidic solution, add dilute sodium hydroxide solution drop-wise until in excess.		
(ii) To the **second** part of the acidic solution, add dilute ammonium hydroxide solution drop-wise until in excess.		
(iii) To the **third** part of the acidic solution, add 3-4 drops of dilute lead (II) nitrate solution.		
(iv) To the **fourth** part of the acidic solution, add dilute hydrochloric acid followed by excess barium chloride solution.		
(v) Use the **fifth** part of the acidic solution to carry out a test of your own choice to confirm the anion in **Y**.		

(e) (i) The cations in **Y** are...

(ii) The anion in **Y** is...

END