THEME: INTEGRITY AND SECURITY IN THE MANAGEMENT OF EXAMINATION IS MY RESPONSIBILITY

Candidate's Name ..... NAHWERA BESIIMA SETH .....

Signature.....

Random No.						Personal No.		
						0	8	2

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

545/3
CHEMISTRY
(PRACTICAL)
Oct. /Nov. 2019
2 hours

UGANDA NATIONAL EXAMINATIONS BOARD

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.*

All your work **must** *be in* **blue** *or* **black** *ink. Any work done in pencil* **except** *drawings will* **not** *be marked.*

You are **not** *allowed to use any 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		
Q.1	25	
Q.2	25	
Total	50	

1. You are provided with the following:

BA1, which is a solution made by dissolving 3.45 g of a hydrated salt $X.nH_2O$ in 250 cm^3 of water.

BA2, which is a 0.1 M hydrochloric acid.

You are required to determine the value of n in the salt.

Procedure:

Pipette 25 cm^3 (or 20 cm^3) of **BA1** into a conical flask. Add 2-3 drops of methyl orange indicator and titrate with **BA2** from the burette.

Repeat the titration until you obtain consistent results.

Record your results in the table below.

Volume of pipette used 25.0 ✗ ½ cm^3. (½ mark)

Final burette reading (cm^3)	29.10	28.00	29.60
Initial burette reading (cm^3)	1.50	0.50	2.10
Volume of **BA2** used (cm^3)	27.60	27.50	27.50

7½

Final burette reading to two decimal places 1 mark @.
Initial burette reading to two decimal places 1mk @
Correct subtraction of volume of BA_2 used ½ @ (7½ marks)

Titre values of **BA2** used for average (01 mark)

27.50 and 27.50 ✓ cm^3. 1mk

Average volume of **BA2** used

$\frac{27.50 + 27.50}{2} = 27.50$ ± 0.1 ± 0.2 ✓ I 0.3 ✓4 ± 0.4 ✓ ± 0.5 4 (2½ marks)

cm^3. 2½

Questions

(a) Calculate the;

(i) number of moles of hydrochloric acid that reacted. (1½ marks)

1000 cm^3 of hydrochloric Acid Contain 0.1 Mole ✓

27.50 cm^3 of hydrochloric Acid Contain $\frac{0.1 \times 27.50}{1000}$ Moles ✓4 ½

= 0.00275 Moles 03

Atleast 4 d.p places

12½

(ii) number of moles of $X.nH_2O$ that reacted. (*1 mole of $X.nH_2O$ reacts with 2 moles of hydrochloric acid*). (*02 marks*)

1 mole of $X.nH_2O$ reacts with 2 moles of hydrochloric Acid

Moles of $X.nH_2O$ that reacted $\frac{1}{2} \times 0.00275$ ✓

$= 0.001375$ Moles ✓ 02

(iii) number of moles of $X.nH_2O$ in 250 cm^3 of **BA1**. (*03 marks*)

25 cm^3 of BA, contain 0.001375 Moles of $X.nH_2O$ ✓

∴ 250 cm^3 of BA, Contain $\frac{0.001375 \times 250}{25}$ moles ✓ 03

$= 0.01375$ Moles ✓

(b) Determine the value of n in $X.nH_2O$. (*5½ marks*)
($H = 1$; $O = 16$; $X = 106$)

0.01375 Moles of $X.nH_2O$ Weigh 3.45g ✓

∴ 1 mole of $X.nH_2O$ weighs $\frac{3.45 \times 1}{0.01375}$ g ✓

$= 250.91$g ✓

Mass of nH_2O $= 250.91 - 106 = 144.91$ ✓

RMM of H_2O $= (1 \times 2) + 16 = 18$ ✓

∴ $18n = 144.91$

$n = \frac{144.91}{18} = 8$ ✓ 05½

$n = 8$ ✓

25

Alternative method

Moles in 1000 cm^3

moles in 250 cm^3 (marking point).

2. You are provided with substance **Q**, which contains **two** cations and **one** anion. Carry out the following tests to identify the cations and the anion present in **Q**. Identify any gas(es) that may be evolved. Record your observations and deductions in the table below. *(25 marks)*

TESTS	OBSERVATIONS	DEDUCTIONS	
(a) Dissolve one spatula end-ful of **Q** in about 5 cm^3 of water. Add excess sodium hydroxide solution; shake well and filter. Keep both the filtrate and the residues.	Brown solution ✓ Brown Residue ✓ ~~or Brown ppt Insoluble~~ ✓ Colourless filtrate ✓	Fe^{3+} ✓ Al^{3+} ✓ Pb^{2+} ✓ Zn^{2+} ✓ Ignore NH_4^+	03½
(b) To the filtrate, add dilute nitric acid until the solution is just acidic. Divide the acidified solution into **five** portions.	White ppt ✓ soluble in excess ✓ White ppt ✓ soluble in excess ✓	~~Al^{3+} Pb^{2+} Zn^{2+}~~ Al^{3+} Pb^{2+} Zn^{2+} (Ignore) Al^{3+} ✓ Pb^{2+} ✓ Zn^{2+} ✓	03½
(i) To the **first** portion of the acidified solution, add dilute sodium hydroxide drop-wise until in excess.			
(ii) To the **second** portion of the acidified solution, add aqueous ammonia drop-wise until in excess.	White ppt ✓ Insoluble ✓ in excess	Al^{3+} ✓ Pb^{2+} ✓ ~~If it appeared in~~	02
(iii) To the **third** portion of the acidified solution, add potassium iodide solution.	No Observable change ✓ No yellow ppt Solution remained colourless	Pb^{2+} absent ✓ Al^{3+} Present ✓ If it appeared in (i) above	02

11½

TESTS	OBSERVATIONS	DEDUCTIONS	
(iv) To the **fourth** portion of the acidified solution, add lead(II) nitrate solution and warm.	White ppt insoluble on warming	SO_4^{2-}	01½
(v) Use the **fifth** portion of the acidified solution to carry out a test of your own to confirm the anion in **Q**. **TEST** Added $Ba(NO_3)_{2(aq)}$ OR $BaCl_{2(aq)}$	White ppt	SO_4^{2-}	03
(c) Dissolve the residue in minimum amount of dilute sulphuric acid and divide the resultant solution into **two** parts. (i) To the **first** part of the solution add sodium hydroxide solution drop-wise until in excess.	Pale brown solution Brown ppt insoluble in excess	Fe^{3+}	02
(ii) To the **second** part of the solution, add 1 small piece of zinc granules and leave the solution to stand for 5 minutes. Divide the solution into **two** portions and use them for part (d).	Pale yellow solution turned green	Fe^{3+} ions reduced to Fe^{2+} ions Accept Fe^{2+} ions	01½

08

TESTS	OBSERVATIONS	DEDUCTIONS
(d) (i) To the **first** part of the solution, add sodium hydroxide solution drop-wise until in excess.	Green ppt ✓ Insoluble ½ ✓ in excess	Fe^{2+} ✓ formed 0/½
(ii) To the **second** part of the solution, add aqueous ammonia drop-wise until in excess.	Green ppt ✓ Insoluble ✓ in excess	Fe^{2+} formed ✓ ∴ Fe^{3+} present in Q ✓ 0 2½

Al^{3+} ✓ Correctly confirmed in b(iii)

(e) (i) The cations in **Q** are ..... Fe^{3+} ✓ Correctly confirmed in c(i) 01½

(ii) The anion in **Q** is ..... and a ... s(ii) 05½

SO_4^{2-} ✓ Correctly confirmed in b(v)

25

Symbols MUST be correctly written
An extra wrong ion Cancels the Correct one
All technical words MUST be Correctly written
eg precipitate, Residue filtrate soluble, Insoluble

No final burette reading: Award for Initial
Deny for volume of BA2 used.
Award for ~~Average~~ ~~if in the range~~
Deny accuracy.

2 Columns filled: Mark normally

1 Column filled: Mark normally only the filled Column

Initial greater than final reading: No Mark

No volume of pipette indicated

- Deny for Final burette reading and Accuracy
(Award the rest.
↳ Award full marks if volume of pipette as reflected in a(iii)