MARKING GUIDE

NAME:..... Index number:.....

Signature:.....

545/3
Chemistry
Paper 3
2 Hours

UNNASE MOCK EXAMINATION 2022

Uganda Certificate of Education

CHEMISTRY PRACTICAL

Paper 3

2 hours

INSTRUCTIONS TO CANDIDATES:

- Answer **all** the questions.
- All questions carry equal marks.
- Answers are to be written in the spaces provided **ONLY**.
- You are not allowed to use any reference books.
- Mathematical tables, slide rulers and non-programmable silent electronic calculators may be used.
- You will be penalized for untidy work.
- Do **not** use a pencil. Use a blue or black pen only

Q.1	Q.2	TOTAL
25	25	50

1.You are provided with the following:

BA1, which is a **0.1M** solution of **sodium hydroxide.**

BA2, which is a solution made by dissolving **4.7g** of an organic acid **X-CH_2COOH** in **500cm^3** of water.

You are required to determine the atomic mass of X.

Procedure:

Pipette **20.0 or 25.0 cm^3** of **BA1** into a clean conical flask, add 2-3 drops of phenolphthalein indicator and titrate the contents with **BA2** from the burette until the indicator changes colour. Repeat the titration 2 -3 times until you obtain consistent results. Record your results in the table below.

Table of results:

Volume of pipette used 25 ✓X ..... cm^3 ($\frac{1}{2}$ mark) 0½

	1	2	3
Final burette reading (cm^3)	25.00	49.90	24.90
Initial burette reading(cm^3)	0.00	25.00	X.00
Volume of BA2 used (cm^3)	25.00	24.90	24.90

07½

Accept Values of BA2 from (7 $\frac{1}{2}$ marks)
19.90 —— 29.90

Titre values used for calculating the average volume of BA2 used: (1 mark)

24.90, ✓ 24.90 Agree ±0.2 01

Average volume of BA2 used 24.90±0.1✓ cm^3 (2 $\frac{1}{2}$ marks) 02½

±0.2✓
±0.3✗
±0.4✓
±0.5✗

11½

...ons:

...a). Calculate the

(i). number of moles of sodium hydroxide in BA1 that reacted

1000 cm³ of BA1 contain 0.1 mole of NaOH

25 cm³ of BA1 contain $\left(\frac{0.1 \times 25}{1000}\right)$ mole of NaOH

= 0.0025 mole of NaOH

Accept 3 or more decimal places.

The statements must have meaning. 03

(ii). number of moles of acid X-CH_2COOH that reacted.

(1 mole of BA1 reacts with 1 mole of BA2)

1 mole of BA1 reacts with 1 mole of BA2

Moles of Acid X-CH_2COOH that reacted

= 0.0025

Accept atleast 3 decimal place 02

(iii). Number of moles of acid X-CH_2COOH in 500cm³ of BA2 that reacted.

24.9 cm³ of BA2 contain 0.0025 mole of X-CH_2COOH

500 cm³ of BA2 contain $\left(\frac{0.0025 \times 500}{24.9}\right)$ mole of X-CH_2COOH

= 0.0502 mole of X-CH_2COOH

Accept atleast 2 decimal places 03

(iv). Molecular mass of acid X-CH_2COOH

0.0502 mole of X-CH_2COOH weighs 4.7 g

1 mole of X-CH_2COOH weighs $\frac{4.7}{0.0502}$ g

= 93.6255 g

Accept atleast 1 decimal place 03

(b) Determine the atomic mass of X. (C=12, H=1, O=16)

RFM of X-CH_2COOH = 93.6255

X + (12×2) + 3 + (16×2) = 93.6255

X + 59 = 93.6255

X = 93.6255 − 59

= 34.6255

≈ 35

Accept atleast 1 decimal place. 02½

13½

Values of X should range from 32 —— 37

Subtotal = 25

2. You are provided with substance V which contains **two** cations and **one** anion. Carry out the following tests on V to identify the cations and anion. Identify any gases evolved. Record your results in the table below. (25 marks)

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Heat one spatula endful of V in a dry test tube, first gently then strongly until there is no further change.	Green solid Colourless Liquid turns white $CuSO_4$ blue Colourless gas with a choking smell turns wet blue litmus paper red and orange acidified $K_2Cr_2O_7$ solution green Reddish brown residue	Fe^{2+} or Cu^{2+} Hydrated salt. SO_2 : SO_3^{2-} max 2 Fe_2O_3.
(b). To two spatula endfuls of V in a test tube add 5 cm^3 of water and shake to dissolve. To the resultant solution add sodium hydroxide solution drop-wise until in excess and filter. Keep both the filtrate and residue.	Pale green solution Dirty green ppt insoluble in excess or Green residue Colourless filtrate	Fe^{2+} 03½ Al^{3+} Zn^{2+} or Pb^{2+}
(c). To the filtrate from (b), add dilute nitric acid drop wise until the solution is just acidic. Divide the acidic solution into five portions	White ppt Soluble in acid to form Colourless solution Ignore	Al^{3+} Zn^{2+} or Pb^{2+} Ignore 08½

TS	OBSERVATIONS	DEDUCTIONS
(i). To the **first** portion of the acidic solution, add dilute sodium hydroxide solution drop- wise until in excess.	White ppt soluble in excess to form a colourless solution	Al^{3+} Pb^{2+} Any two or Zn^{2+} 02½
(ii). To the **second** portion of the acidic solution, add dilute ammonia solution drop- wise until in excess.	White ppt soluble in excess to form a colourless solution	Zn^{2+} confirmed 02
(iii). To the **third** portion of the acidic solution, add 2-3 drops lead (ii) nitrate solution	White ppt	SO_4^{2-} or Cl^- 01½
(iv). To the **fourth** portion of the acidic solution, add 2-3 drops silver nitrate solution	No observable change	Cl^- absent Reject SO_4^{2-} 01
(v). Use the **fifth** portion of the acidic solution to carry out a test of your own to confirm the anion in **V**. Test: Add 3-4 drops of $Ba(NO_3)_2$ solution	White ppt	SO_4^{2-} ppt confirmed. 02

09½

TESTS	OBSERVATIONS	DEDUCTIONS
(d) Wash the residue and dry it. Dissolve the residue in a minimum amount of dilute sulphuric acid. Divide the resultant solution into three portions.	Pale green solution Ignore	Fe^{2+} Ignore.
(i). To the **first** portion of the acidic solution, add dilute sodium hydroxide solution drop- wise until in excess and leave it to stand.	Dirty green ppt Insoluble in excess turns brown on standing	Fe^{2+} oxidised by air to Fe^{3+} 02
(ii). To the **second** portion of the acidic solution, add 3-4 drops of hydrogen peroxide solution.	Green solution turns to yellow or brown solution	Fe^{2+} oxidised to Fe^{3+} 01
(iii). To the **third** portion of the acidic solution, add dilute ammonia solution drop- wise until in excess	Dirty green ppt Insoluble in excess	Fe^{2+} confirmed 01

confirmed in (c)(ii) — Zn^{2+}

(e) (i) The cations in V are Fe^{2+} and 01

(ii) The anion in V is SO_4^{2-}

confirmed in (a), (b), (d)(i), d(ii) or d(iii)

Confirmed in (a) or (c)(iv) 07

Sub total 25