NAME……RANDOM NO; | | | | | | | | | | |

SIGNATURE……COMBINATION……

P525/3

CHEMISTRY

PRACTICAL

Feb/mar 2024

$3^1/_4$ Hours

UGANDA ADVANCED CERTIFICATE OF EDUCATION

CHEMISTRY

PRACTICAL

PAPER 3

3Hours 15 minutes

Instructions to candidates;

- Answers all questions
- Record your answers on this question paper in the spaces provided.
- Mathematical tables and silent non programmable calculators may be used.
- Reference books **(**i.e textbooks, practical manuals etc**)** should not be used.
- Candidates are **not** allowed to start working with the apparatus for the first 15minutes. This time is to enable candidates to read the questions and make sure they have all apparatus and chemicals they may need.
- Where necessary use; (O=16, H= 1, N=14, Na= 23)

QN 1	QN 2	TOTAL

Turn over

1. You are provided with the following;
   BA1 which is a solution made by dissolving **0.8g** sodium nitrite in 500cm^3 of distilled water.
   BA2 which a solution of potassium manganate(vii) of **unknown** concentration.
   BA3 is a **2M** sulphuric acid
   Solid Q is an acid of the formula, ***X.2H$_2$O***.
   You are required to determine the;
   (a) the concentration of potassium manganate(vii) in BA2 in moles per litre.
   (b) determine the value of **X** in ***X.2H$_2$O***.

Theory,

Potassium manganate(vii) reacts with sodium nitrite according to the equation,

$$2MnO_{4\,(aq)}^{-} + 5NO_{2\,(aq)}^{-} + 6H^{+}_{(aq)} \rightarrow 5NO_{3\,(aq)}^{-} + 2Mn^{2+}_{(aq)} + 3H_2O_{\,(l)}$$

The reaction ratio of $MnO_4^-$and $X.2H_2O$ is 2:5.

Procedure 1;

- Pipette 25cm^3(or 20cm^3) of BA1 into a clean conical flask. Add equal volume of BA3.
- Titrate the resultant solution with BA2 from the burette until the end point is reached.
- Repeat the titration until you obtain consistent results.
- Record your results in the table below.

Table 1

Exp't	1	2	3
Final burette readings(cm^3)			
Initial burette readings(cm^3)			
Volume of BA2 used(cm^3)			

Titre values used to calculate the average volume

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Calculate the average volume of BA2 used.

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Questions,

(a) Calculate the number of moles of;

(i) sodium nitrite in BA1 that reacted.

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(ii) potassium manganate(vii) in BA2 that reacted.

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(b) Determine the concentration of potassium manganate(vii) in BA2 in moles per litre.

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Procedure 2

- Weigh accurately **0.60g** of Q into a clean beaker. Using a measuring cylinder, add 100cm^3 of distilled water and stir to dissolve. Transfer the content into a 250cm^3 volumetric flask and make up to the mark with distilled water. Label the solution **BA4.**
- Pipette 25cm^3(or 20cm^3) of BA4 into a conical flask. Add equal volume of BA3 and heat the mixture up to about **60°c**.
- Titrate the hot solution with BA2 from the burette until the end point is reached.
- Repeat the titrations until you obtain consistent results.
- Record your results in the table below.

Mass of weighing container + solid Q = ……g

Mass of weighing container alone = ……g

Mass of solid Q = ……g

Table II

Exp't	1	2	3
Final burette reading(cm^3)			
Initial burette reading(cm^3)			
Volume of BA2 used(cm^3)			

Titre values used to calculate the average volume of BA2.

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Calculate the average volume of BA2 used.

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Questions.

(a) Calculate the number of moles of;

(i) potassium manganate(vii) that reacted with BA4.

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(ii) acidic compound of the formula $X.2H_2O$ in BA4 that reacted.

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(b) Determine the;

(i) concentration of the acidic compound of the formula $X.2H_2O$ in BA4 in moles per litre.

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(ii) the value of X in $X.2H_2O$.

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2. You are provided with substance Z which contains two cations and two anions. You are required to carry out the following tests on Z to identify the cations and anions present in Z. Record your observations and deductions in the table below. (28 marks)

Tests	**Observations**	**Deductions**
(a). Heat a spatula endful of Z gently and then strongly in a dry test tube until there is no further change.		
(b). Shake a spatula endfuls of Z with about $5cm^3$ of distilled water and filter. Keep both filtrate and the residue. Divide the filtrate into **four** portions.		
(i). To the 1^{st} portion of the filtrate, sodium hydroxide solution dropwise until in excess and warm.		
(ii). To the 2^{nd} portion of the filtrate, add ammonia solution dropwise until in excess		

(iii). To the 3rd portion of the filtrate, add 2-3 drops of lead(ii) nitrate solution, heat and allow to stand.		
(iv). To the 4th portion of the filtrate, add about 1cm^3 od dil.HNO_3 followed by 2-3 drops of silver nitrate solution.		
(c). Wash the residue with distilled water and dissolve in minimum dil.HNO_3 to dissolution. Divide the acidic solution into **four** portions.		
(i). To the 1st portion of the acidic solution, add sodium hydroxide solution dropwise until in excess.		
(ii). To the 2nd portion of the acidic solution, add ammonia solution dropwise until in excess.		
(iii). To the 3rd portion of the acidic solution, add 2-3 drops of dilute sulphuric acid.		

(iv). To the 4^{th} portion of the acidic solution, add 2-3 drops of potassium chromate(vi) solution followed by about $1cm^3$ of ethanoic acid.		

(d). Identify the;

(i). cations in Z. …….. and ……

(ii). anions in Z. …….. and ……

END

CONFIDENTIAL

On additional to the common reagents and apparatus used in chemistry laboratory, each student should be provided with the following;

1 burette of $50cm^3$ capacity

1 pipette of $25cm^3$ (or $20cm^3$)

2 filter papers

1 thermometer

2 conical flasks

1 funnel

1 volumetric flask of $250cm^3$ capacity

6 test tubes

$100cm^3$ of BA1

$200cm^3$ of BA2

$200cm^3$ of BA3

1.0g of Q

2.5g of Z

Easy access to;

Weighing scale

Heat source

Reagents to identify cations and anions, gases and the organic functional group

- BA1 is made by dissolving 1.60g of sodium nitrite; (**$NaNO_2$**) in 1 litre of distilled water.
- BA2 is made by dissolving 3.20g of potassium manganate(vii); **($KMnO_4$)** in 1 litre of distilled water
- BA3 is a 2M sulphuric acid
- Solid Q is Oxalic acid; **($H_2C_2O_4.2H_2O$)**
- Substance Z is a solid mixture of **ammonium carbonate**, **barium carbonate** and **sodium chloride** in the ratio **$1:2:^1/_2$**