Name .... Centre / Index No ..../............

School .... Signature ....

P525/3
CHEMISTRY
(PRACTICAL)
Paper 3
July/August 2023
3¹/₄ hours

WAKISSHA JOINT MOCK EXAMINATIONS

Uganda Advanced Certificate of Education

CHEMISTRY
PRACTICAL

Paper 3

3 hours 15 minutes

Instructions to Candidates:

- *Answer* **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, books on qualitative analysis etc.) should* **not** *be used.*

- *Candidates are* **not** *allowed to start working with the apparatus for the first 15 minutes. This time is to enable candidates to read the question paper and make sure they have all apparatus and chemicals that they may need.*

- *Where necessary use (Na = 32, N = 14, H = 1, O = 16)*

| For Examiners' Use Only			
Q.1	**Q.2**	**Q.3**	**Total**

1. You are provided with the following;

   GA₁, which is a solution made by dissolving 0.4 g sodium nitrite in 250 cm³ of distilled water.

   GA₂, which is a solution of potassium permanganate of unknown concentration.

   GA₃, which is 2.0 M sulphuric acid.

   Solid **Z** which is an acid of a formula, **T. nH₂O**.

   You are required to determine the:
   i) the concentration of potassium permanganate in **GA₂** in moles per litre.
   ii) find the value of **n** in **T.nH₂O**.

   Theory

   Potassium permanganate reacts with sodium nitrite according to the equation

   $$2MnO_4^-{}_{(aq)} + 5NO_2^-{}_{(aq)} + 6H^+{}_{(aq)} \longrightarrow 5NO_3^-{}_{(aq)} + 2Mn^{2+}{}_{(aq)} + 3H_2O_{(l)}$$
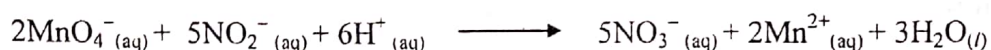
   The ratio of reaction between MnO_4^- : $T.nH_2O$ is 2:5.

   Procedure 1

   Pipette **20 or 25 cm³** of **GA₁** into a clean conical flask. Add equal volume of **GA₃**.
   Titrate the resultant solution with **GA₂** from the burette until the end point is reached.
   Repeat the titration until you obtain consistent results.
   Record your results in the table below.
   Volume of pipette used ……………………………………………………………..……cm³. *(½ mark)*

   Table I

Experiment Number	1	2	3
Final burette reading (cm)³			
Initial burette reading (cm³)			
Volume of **GA₂** used (cm³)			

   (4½ marks)

   Titre values used for calculating average volume. *(01 mark)*

   …………………………………………………………...………………………………….

   Calculate the average volume of **GA₂** used. *(2½ marks)*

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   Questions
   (a) Calculate the number of moles of
       (i) Sodium nitrite in **GA₁** that reacted. *(2½ marks)*

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(ii)   Potassium permanganate in **GA₂** that reacted.   (01mark)

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(b)   Determine the concentration of potassium permanganate in **GA₂** in moles per litre.
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Procedure 2
Weigh accurately **0.6 g** of **Z** into a clean beaker. Using a measuring cylinder add **100 cm³** of distilled water and stir to dissolve. Transfer the content into a **250 cm³** volumetric flask and make up to the mark with distilled water. Label this solution **GA₄**.

Mass of container + **Z**   = ...g   (½ mark)

Mass of container alone   = ...g   (½ mark)

Mass of solid **Z**   = ...g   (½ mark)

Pipette **20** or **25 cm³** of **GA₄** into a conical flask. Add equal volume of **GA₃** and Heat the mixture up to **70⁰C**. Titrate the hot solution with **GA₂** from the burette until the end point is reached. Repeat the titrations until you obtain consistent results. Record your results in the table below.
Volume of pipette used = ...cm³.   (½ mark)

Table II

Experiment Number	1	2	3
Final burette reading (cm³)			
Initial burette reading (cm³)			
Volume of **GA₂** used (cm³)			

                                                                                    (4½ marks)

Titre values for calculating average volume.   (01 mark)

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Calculate the average volume of **GA₂** used.

<div align="right">*(2½ marks)*</div>

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Questions

(a)   Calculate the number of moles of

(i)   potassium permanganate in **GA₂** that reacted with **GA₄**.   *(01 mark)*

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(ii)   acidic compound of a formula **T. nH_2O** in **GA₄** that reacted.   *(01 mark)*

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(b)   Determine the;

(i)   concentration of acidic compound of a formula **T. nH_2O** in **GA₄** in moles per litre.   *(01 mark)*

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(ii)   the value of **n** in **T. nH_2O**.

$(T = 90, H = 1, O = 16)$ *(03 marks)*

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2.   You are provided with substance **T** which contains **two** cations and **two** anions. Carry out the following tests on **T** to identify the cations and anions present. Identify any gases evolved.

(33 marks)

Tests	Observations	Deductions
(a) Heat one spatula endful of **T** strongly in a test tube.		
(b) To one spatula end full of **T,** add 3 drops of concentrated sulphuric acid and warm.		
(c) Dissolve one spatula endfull of **T** in 6 cm^3 of distilled water. Divide the resultant solution into **three** portions.		

(i) To the **first** portion add few drops of Lead(II) nitrate followed by dilute nitric acid and heat.		
(ii) To the **second** portion add Barium nitrate solution, followed by dilute nitric acid.		
(iii). To the **third** portion add an equal volume of ethanol followed by 3-4 drops of concentrated sulphuric acid and heat, pour the hot content in a beaker of cold water.		
d) Dissolve two spatula endful of **T** in 6 cm^3 of distilled water. To the resultant solution add aqueous ammonia solution dropwise until in excess. Filter and keep both the residue and the filtrate.		
e) To the filtrate obtained in (d) add dilute nitric acid until it is just acidic. Divide the resultant solution into **three** portions.		
(i) To the **first** portion add sodium hydroxide solution dropwise until in excess.		
(ii) To the **second** portion add ammonia solution dropwise until in excess.		
(iii) Use the **third** portion to carry out a test of your choice to confirm the cation in **T** **Test:**		

f) Wash the residue with distilled water and dissolve it in dilute nitric acid. Divide the resultant solution into **three** portions.		
(i) To the **first** portion, add sodium hydroxide solution dropwise until in excess.		
(ii) To the **second** portion add 1 cm^3 of sodium sulphate solution.		
iii) Use the **third** portion to carry out a test of your own choice to confirm the cation in the residue.		

g) Identify the
   (i) Cations in T .... and ....

   (ii) Anions in T.................................... and ....

3. You are provided with substance Q which is an organic compound. Carry out the following tests on Q to identify its nature and functional group.

(18marks)

Tests	Observations	Deductions
(a) Burn a small amount of Q on a spatula end or crucible.		
(b) To about 2 g of Q, add 5 cm^3 of water and shake. Divide the resultant solution into eight portions.		
(i) Test the **first** portion with litmus paper.		
(ii) To the **second** portion add four drops of iron (III) chloride solution.		

Turn Over

(iii) To the **third** portion add little solid sodium carbonate.		
(iv) To the **fourth** portion add 3 drops of acidified potassium permanganate and heat.		
(v) To the **fifth** portion add 1 cm^3 of 2, 4-dinitrophenyl-hydrazine solution.		
(vi) To the **sixth** portion of solution add 1 cm^3 of Fehling's solution and heat.		
(vii) To the **seventh** portion of solution add acidified solution of potassium dichromate(VI) and heat, cool and then add Brady's reagent.		
(viii) To the **eighth** portion add Lucas' reagent.		

(c)   Comment on the nature of Q

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END