CANDIDATE'S NAME: .....

SIGNATURE ..... INDEX NO. .....

P525/3

CHEMISTRY

(PRACTICAL)

PAPER 3

JULY/AUGUST 2023

2 HOURS 15 MINUTES

ASSOCIATION OF SECONDARY SCHOOLS HEADTEACHERS OF UGANDA - (ASSHU) NTUNGAMO

Uganda Advanced Certificate of Education

CHEMISTRY

(PRACTICAL)

PAPER 3

2 HOURS 15 MINUTES

Instructions to Candidates:

- *Answer **all** questions. Use **blue** or **black** ink. Any work done in pencil will **not** be marked except drawings.*
- *Record your answers on this question paper in the spaces provided.*
- *Mathematical tables and silent non-programmable scientific calculators may be used.*
- *Reference books (i.e. text books, booklets 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 read the question paper and make sure they have all the apparatus and chemicals that they may need.*

FOR EXAMINERS' USE ONLY			
Q.1	Q.2	Q.3	Total

1. You are provided with the following:

FA1, which is approximately a 0.1M Sodium thiosulphate solution.

Solid **W,** which is potassium iodate.

Z, which is a liquid bleaching agent containing Sodium hypochlorite, NaOCl.

2M Sulphuric acid.

10% Potassium iodide solution.

Starch solution

You are required to standardise **FA1** and use it to determine the concentration of the liquid bleaching agent in grams per litre.

In acidic solution, iodate and hypochlorite ions react with Potassium Iodide to liberate iodine according to the following equations.

$$IO_3^-{}_{(aq)} + 6H^+{}_{(aq)} + 5\,I^-{}_{(aq)} \longrightarrow 3I_{2(aq)} + 3H_2O_{(l)}$$

$$OCl^-{}_{(aq)} + 2I^-{}_{(aq)} + 2H^+{}_{(aq)} \longrightarrow I_{2(aq)} + Cl^-{}_{(aq)} + H_2O_{(l)}$$

And iodine reacts with Sodium thiosulphate according to the following equation:

$$I_{2(aq)} + 2S_2O_3^{2-}{}_{(aq)} \longrightarrow S_4O_6^{2-}{}_{(aq)} + 2I^-_{(aq)}$$

PART I

PROCEDURE

Weigh accurately about 1.0g of **W.** Dissolve it in a minimum volume of distilled water and shake well to mix. Transfer the solution into a 250 cm^3 volumetric flask and make it up to the mark with distilled water. Label the solution **FA2.**

Pipette 25.0 (or 20.0) cm^3 of **FA2** into a conical flask. Add an equal volume of 2M Sulphuric acid, followed by 10 cm^3 of 10% Potassium Iodide Solution.

Titrate the mixture with **FA1** until the solution is pale – yellow. Add 5 drops of starch indicator and continue the titration until the solution turns colourless.

Repeat the titration until you obtain consistent results.

Record your results in Table 1.

RESULTS:

Mass of weighing container + **W** ..... *g.* (½ mk)

Mass of empty weighing container .....g. (½ mk)

Mass of **W** used .....g. (½ mk)

Volume of pipette used .....cm^3. (½ mk)

Table 1

Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of **FA1** used (cm^3)			

(4 mks)

(a) (i) Record the volumes of **FA1** used for calculating the average volume. (½ mk)

..... cm^3.

(ii) Calculate the average volume of **FA1** used. (2½ mks)

.....

..... cm^3.

(b) Calculate the number of moles of iodine liberated by FA2
(O=16, K=39; I=127) (4 mks)

(c) Determine the concentration of FA1 in moldm^{-3}. (2 mks)

PART II

PROCEDURE

Using a measuring cylinder transfer 15 cm^3 of **Z** into a 250 cm^3 volumetric flask and make it up to the mark with distilled water. Label the solution **FA3.**

Pipette 25.0 (20.0)cm^3 of **FA3** into a conical flask.

Add 15cm^3 of 2M Sulphuric acid followed by 10cm^3 of 10% potassium iodide solution.

Titrate the mixture with **FA1** until the solution is pale-yellow.

Add 3 drops of starch indicator and continue the titration until the solution turns colourless.

Repeat the titration until you obtain consistent results.

Record your results in Table 2.

Volume of pipette used .....cm^3 (½ mk)

Table 2

Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of **FA1** used (cm^3)			

(4½ mks)

(a) (i) Record the volumes of **FA1** used for calculating the average volume. (½ mk)

..... cm^3

(ii) Calculate the average volume of **FA1** used. (2½ mks)

.....

..... cm^3

(b) Calculate the number of moles of iodine liberated by **FA3.** (2 mks)

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(c) Determine the;

(i) Concentration of Sodium hypochlorite in Z in $moll^{-1}$. (2½ mks)

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(ii) Concentration of Sodium hypochlorite in **Z** in gl^{-1}. (2 mks)

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2. You are provided with substance **T** which contains **two** cations and **two** anions.
You are required to carry out the tests below on **T** and identify the cations and anions in **T**.
Identify any gas(es) evolved.
Record your observations and deductions in Table **3**. (32 mks)

Table 3

Tests	Observations	Deductions
(a) Heat one spatula end-ful of T strongly in a dry test tube until there is no further change.		
(b) To one spatula end-ful of T in a dry test tube add 5 drops of concentrated sulphuric acid and warm.		

(c) To **two** spatula end-fuls of **T** in a boiling tube, add dilute nitric acid until there is no further change, and warm. To the resultant solution, add dilute sodium hydroxide solution drop-wise until in excess. Shake well and filter. Keep both the filtrate and residue.		
(d) To the filtrate from (c) above, add dilute nitric acid little at a time until the solution is just acidic. Divide the acidified filtrate into **five** parts.		
(i) To the **first** part of the acidified filtrate, add dilute sodium hydroxide dropwise until in excess.		
(ii) To the **second** part of the acidified filtrate, add dilute ammonia solution drop-wise until in excess.		
(iii) Use the third of the acidified filtrate to carry out a test of your own choice to confirm the first cation in **T**.		

Test:		
(iv) To the **fourth** part of the acidified filtrate, add 2-3 drops of Lead (II) nitrate solution.		
(v) Use the fifth part of the acidified filtrate to carry out a test of your own choice to confirm one of the anions in **T**. **Test:**		

(e) Dissolve the residue from (c) in dilute hydrochloric acid and divide the resultant solution into **four** parts.		
(i) To the **first** part of the resultant solution, add dilute Sodium Hydroxide solution drop-wise until in excess.		
(ii) To the **second** part of the resultant solution, add dilute ammonia solution drop-wise until in excess.		
(iii) To the **third** part of the resultant solution, add 2-3 drops of dilute sulphuric acid.		

(iv) Use the **fourth** part of the resultant solution to carry out a test of your own choice to confirm the second cation in **T**. **Test:**		

(f) (i) The cations in **T** are .....

(ii) The anions in **T** are .....

3. You are provided with an organic compound **R**.

You are required to identify the nature of **R**.

Carry out the following tests on **R** and record your observations and deductions in Table **4**.

Tests	Observation	Deduction
(a) Burn a small amount of **R** on a spatula end or in a porcelain dish.		
(b) Shake 1 cm3 of **R** with about 2 cm^3 of water and divide the mixture into **two** parts.		
(i) To the first part of the mixture, add 2- 3 drops of Sodium carbonate solution.		
(c) To about 0.5 cm^3 of **R**, add 3-4 drops of 2,4-dinitrophenyl hydrazine solution (Brady's reagent)		

(d) To about 1 cm^3 of R, add 2-3 drops of acidified potassium dichromate (VI) solution and heat. Then add 1 cm^3 of ethanol followed by 4-5 drops of concentrated sulphuric acid and heat. Pour the mixture into a small beaker of cold water.		
e) To about 0.5 cm^3 of R, add about 4 cm^3 of iodine solution followed by dilute sodium hydroxide solution dropwise until the solution is pale-yellow. Warm the mixture and cool under tap water.		
) To about 0.5 cm^3 of R, add about 6 drops of Tollen's reagent and heat gently.		

g) Comment on the nature of **R**.

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CHEM3 UACE

1 Burette
1 pipette
2 conical flasks
1 Volumetric flask
1 measuring cylinder ($100cm^3$ or $50cm^3$)
2 beakers
1 boiling tube.
8 test tubes
1 Filter funnel
600 cm^3 of distilled water
150cm^3 of FA1 347.2g in 1l Sodium thiosulphate-5-wa
20cm^3 of Z
150cm^3 of 2M sulphuric Acid 1,540l in 1l
80cm^3 of 10% potassium Iodide solution 800g in 8L
Freshly prepared Starch solution.
1.8g of W
3.0g of T
10cm^3 of R

FA1 is prepared dissolving 24.8g of Sodium thiosulphate - 5 - water in distilled water to make 1 litre of solution

Z Jik 3.5% (m/v)

W Solid Potassium Iodate

T Mixture of Zinc Carbonate, Barium Carbonate & Sodium Chloride in ratio of 3:2:1 respectively

R Acetaldehyde