

Candidate's Name: .....

Signature: .....

Centre No	Personal No

P525/3

CHEMISTRY

Paper 3

(Practical)

3 ¼ hours

### ASSHU ANKOLE JOINT MOCK EXAMINATIONS 2024

Uganda Advanced Certificate of Education

**CHEMISTRY**

**PAPER 3**

**(PRACTICAL)**

**3 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**.

All your answers **must** be written in 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.

You are **not allowed** to start working with the apparatus for the first **15 minutes**. This time is to enable you read the question paper and make sure you have all the apparatus and chemical that you may need.

**For Examiners' Use only.**

Q1	Q2	Q3	TOTAL

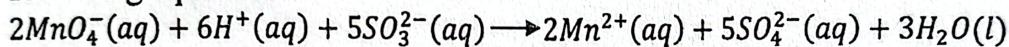
1. You are provided with the following:  
 FA1, which is a solution containing 0.4g of potassium manganate (VII) in 250cm<sup>3</sup>  
 FA2, Which is a solution of sulphite ions of an unknown concentration.  
 Solid Z, which is a salt of the formula MYO<sub>4</sub>  
 1M sulphuric acid  
 5% potassium iodide solution.  
 Starch solution.

You are required to;

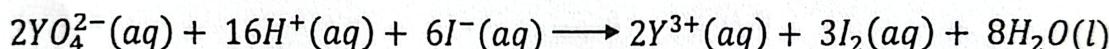
- i) Standardize the solution of sulphite ions, FA2.
- ii) Determine the percentage by mass of element Y in solid Z.

### Theory:

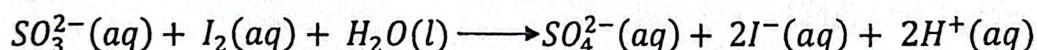
In acidic medium, Manganate(VII) ions react with sulphite ions according to the following equation.



Ions in solid Z oxidize potassium iodide solution in acidic medium to liberate iodine according to the following equation.



The iodine liberated reacts with sulphite ions according to the following equation.



### PART I

#### Procedure:

- a) Using a burette, transfer exactly 25.0cm<sup>3</sup> of FA2 into an empty beaker followed by 75cm<sup>3</sup> of distilled water. Mix well and label the resultant solution FA3.
- b) Pipette 25.0(or 20.0)cm<sup>3</sup> of FA1 into a conical flask, followed by an equal volume of 1M sulphuric acid. Titrate the mixture with FA3 from the burette until the endpoint. Repeat the titration until you obtain consistent results.
  - i) Record the volume of pipette used and burette readings in table 1 below.

Volume of pipette used .....cm<sup>3</sup> (*½ mark*)

**Table 1**

Titration number	1	2	3
Final burette reading (cm <sup>3</sup> )			
Initial burette reading (cm <sup>3</sup> )			
Volume of FA3 used (cm <sup>3</sup> )			

*(4 ½ marks)*

- ii) Record the volumes of FA3 that you will use to calculate the average volume. *( ½ mark)*
- .....

- iii) Calculate the average volume of FA3 used. *(2 ½ marks)*
- .....
- .....

**Questions.**

Calculate the;

- i) Number of moles of sulphite ions contained in 100cm<sup>3</sup> of FA3 (K = 39, Mn = 55, O = 16) *(4 ½ marks)*
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- ii) Molar concentration of sulphite ions in FA2 **(2 marks)**

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## PART II

### Procedure:

- c) Weigh accurately 2.6g of Z. Dissolve it in about  $100\text{cm}^3$  of distilled water and transfer the solution into a  $250\text{cm}^3$  volumetric flask. Make the solution up to the mark with distilled water and label it FA4.
- d) Pipette  $25.0$  (or  $20.0$ ) $\text{cm}^3$  of FA4 into a conical flask, add an equal volume of 1M sulphuric acid using a measuring cylinder, followed by  $15\text{cm}^3$  of 5% potassium iodide solution. Titrate the iodine liberated with FA2 from the burette using starch as indicator

Repeat the titration until you obtain consistent results.

- i) Record the volume of pipette and burette readings in table 2 below  
**Results.**

Mass of weighing bottle + z = ..... g ( $\frac{1}{2}$  mark)

Mass of empty weighing bottle = ..... g ( $\frac{1}{2}$  mark)

Mass of Z weighed = ..... g ( $\frac{1}{2}$  mark)

Volume of pipette used = .....  $\text{cm}^3$  ( $\frac{1}{2}$  mark)

**Table 2**

Titration number	1	2	3
Final burette reading ( $\text{cm}^3$ )			
Initial burette reading ( $\text{cm}^3$ )			
Volume of FA2 used ( $\text{cm}^3$ )			

**(4  $\frac{1}{2}$  marks)**

- i) Record the volumes of FA2 that you will use to calculate the average volume. *(½ mark)*

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**Questions**

- a) Calculate the;

- i) Number of moles of iodine liberated by FA4 *(2 marks)*

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- ii) Molar concentration of FA4. *(2 marks)*

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- b) Determine the mass of element Y in one mole of Z and hence its percentage. ( $M = 79$ ,  $O = 16$ ) *(4 marks)*

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

Record your observations and deductions in table 3 below. *(30 marks)*

**Table 3**

<b>Tests</b>	<b>Observations</b>	<b>Deductions</b>
a) Heat two spatula endfuls of W in a dry test tube strongly until there is no further change.		
b) To two spatula endfuls of W in a test tube add about 4cm <sup>3</sup> of distilled water, shake		

<p>thoroughly and filter. Keep both the filtrate and residue.</p> <p>Divide the filtrate into four parts.</p>		
<p>i) To the first part, add 2 – 3 drops of barium nitrate solution</p>		
<p>ii) To the second part, add silver nitrate solution, followed by dilute nitric acid</p>		
<p>iii) To the third part, add 3 -4 drops of copper (II) sulphate solution and allow to stand.</p>		
<p>iv) Use the fourth part to carry out a test of your own choice so as to confirm one of the anions in W</p>		
<p>Test:..... .....</p>		

.....		
c) Wash the residue in (b) with little distilled water and dissolve it in dilute nitric acid. Add dilute sodium hydroxide solution drop wise until the alkali is in excess and then filter.  Keep the residue for use in part (e)		
d) To the filtrate from part (c), add dilute nitric acid dropwise until the solution is just acidic. Divide the solution into four parts		
i) To the first part of the acidified filtrate, add dilute sulphuric acid.		
ii) To the second part of the acidified filtrate add aqueous ammonia solution		

dropwise until in excess		
iii) To the third part of the acidified filtrate, add 3 – 4 drops of potassium hexacyanoferrate (II) solution		
iv) Use the fourth part of the solution to carry out a test of your own choice to confirm one of the cations in W.  Test: ..... ..... ..... .....		
e) Wash the residue from (c) with dilute sodium hydroxide, transfer it into a test tube and add dilute nitric acid to dissolve. Divide the resultant solution into four parts.		

i) To the first part, add 2 – 3 drops of dilute sulphuric acid		
ii) To the second part, add aqueous ammonia solution dropwise until in excess		
iii) To the third part, add half a spatula of solid ammonium chloride followed by disodium hydrogen phosphate solution, then aqueous ammonia solution dropwise until in excess.		
iv) Use the fourth part to carry out a test of your own choice to confirm the second cation in W.  Test: ..... ..... ..... .....		

f) Identify the:

- i) Cations in W .....
- ii) Anions in W .....

3. You are provided with substance Y which is organic. You are required to identify the nature of Y. Carry out the following tests on Y and record your observations and deductions in table 4 below. **(18 marks)**

Tests	Observations	Deductions
a) Burn a small amount of Y on a spatula end or porcelain dish.		
b) To 1cm <sup>3</sup> of Y add about 4cm <sup>3</sup> of distilled water, shake and divide the mixture into three parts.		
i) To the first part, add a spatula endful of magnesium powder.		
ii) To the second part, add neutral iron (III) chloride solution		
iii) To the third part, add Fehling's solution and warm.		
c) To 1cm <sup>3</sup> of Y, add		

acidified potassium dichromate (VI) solution and heat. Keep the products for part (d)		
d) To the products from (c), add Fehling's solution and heat.		
e) Use a portion of Y to carry out a test of your own choice to confirm the class of the functional group of Y  Test: ..... ..... .....		
f) To about 1cm <sup>3</sup> of Y add an equal volume of ethanoic acid followed by 3 drops of concentrated sulphuric acid and warm the mixture.  Pour the products in a beaker of cold		

water.		
g) To $1\text{cm}^3$ of Y, add $3\text{cm}^3$ of iodine solution followed by sodium hydroxide solution drop wise until the colour of iodine is discharged, and allow to stand for 2 minutes.		
h) To $1\text{cm}^3$ of Y, add 3 drops of concentrated sulphuric acid and heat the mixture. Pass the vapour through alkaline potassium manganate(VII) solution		
i) To $1\text{cm}^3$ of Y, add, 2, 4-dinitrophenyl hydrazine solution.		

j) Describe the nature of Y.

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- END -