

Names:.....**Index No:**

School Exam Number:.....**Signature:**.....

*Candidates should **NOT** write their Centre Name
or Centre Number anywhere on this booklet*

P525/3
CHEMISTRY
PRACTICAL
Paper 3
19 July 2022
3 ¼ hours

ENTEBBE JOINT EXAMINATION BUREAU

Uganda Advanced Certificate of Education

CHEMISTRY

Paper 3

3 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

*Attempt **all** questions.*

Answers to all questions are to be written in the spaces provided in this question paper.

Mathematical tables, slide rules and silent non – programmable calculators may be used.

You are not allowed to use any reference books such as textbooks, booklets on qualitative analysis, etc.

FOR EXAMINERS' USE ONLY			
Question 1	Question 2	Question 3	TOTAL

1. You are provided with the following:

FA1; which is a solution containing 11.2 g l⁻¹ of thiosulphate ions, S₂O₃²⁻

FA2; which is a solution containing approximately 0.02M manganate(VII) ions.

Solid T: which is a salt containing iron(II) ions.

2M Sulphuric acid

Starch indicator

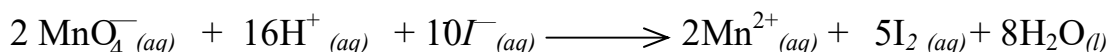
0.5 M Potassium iodide solution

You are required to:

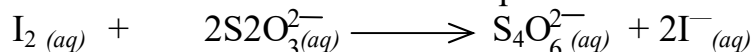
(i) Standardise **FA2**

(ii) Determine the percentage by mass of iron in **T**.

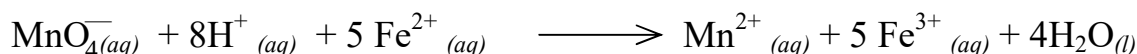
In acidic medium, Manganate(VII) ions react with iodide ions to liberate iodine according to the equation;



The iodine liberated reacts with thiosulphate ions according to the equation:



Manganate(VII) ions react with Iron(II) ions according to the following equation:



Procedure:

(a) Pipette 25.0 cm³ (or 20.0 cm³) of **FA2** into a conical flask and add an equal volume of 2M sulphuric acid using a measuring cylinder, followed by 10 cm³ of 0.5 M potassium iodide solution.

Titrate the iodine liberated with **FA1**, using starch indicator. Repeat the titration until you obtain consistent results.

(i) Record your results in Table I below.

Volume of pipette usedcm³. (½ mark)

Table I

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

(4 ½ marks)

- (ii) State the volumes of **FA1** used to calculate the average volume. ($\frac{1}{2}$ mark)

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- (iii) Calculate the average volume of **FA1**. (2 $\frac{1}{2}$ marks)

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Questions:

- (a) Calculate the number of moles of thiosulphate ions in **FA1** that reacted.
($S = 32, O = 16$) (2 $\frac{1}{2}$ marks)

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- (b) Determine the concentration of **FA2** in mol dm^{-3} . (02 marks)

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Procedure:

- (b) Weigh accurately 5.0 g of *T*. Dissolve it in a minimum amount of distilled water and transfer the solution into a 250 cm³ volumetric flask. Make the solution up to the mark with distilled water and label it *FA3*.

Pipette 25.0 cm³ (or 20.0 cm³) of *FA3* into a conical flask and add an equal volume of 2M sulphuric acid. Titrate the solution with *FA2* from the burette. Repeat the titration until you obtain consistent results.

- (i) Record your results in Table II below.

Results:

Mass of weighing bottle + *T* g. (½ mark)

Mass of empty weighing bottle g (½ mark)

Mass of *T* used. g (½ mark)

Volume of pipette used cm³ (½ mark)

Table II

Final burette reading (cm ³)			
Initial burette reading (cm ³)			
Volume of <i>FA1</i> used (cm ³)			

(4½ marks)

- (ii) State volumes of *FA1* used to calculate the average volume.

(½ mark)

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- (iii) Calculate the average volume of *FA1*.

(2½ marks)

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(c) Determine the:

(i) concentration of ***FA3*** in mol dm^{-3}

(4½ marks)

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(ii) mass of iron in ***T*** and hence its percentage. (*Fe* = 56) (3½ marks)

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2. You are provided with substance **R** which contains **three** cations and **one** anion. You are required to carry out tests below on **R** and identify the cations and anion in **R**. Identify any gas(es) evolved. Record your observations and deductions in the table below.

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Heat two spatula endfuls of R strongly in a dry test tube until there is no further change. Allow to cool.		
(b) To about 6cm ³ of water, add 2 spatula endfuls of R and shake well. Filter the mixture and keep both the residue and filtrate.		
(c) Divide the filtrate into six portions. (i) To the first portion of the filtrate, add dilute sodium hydroxide solution dropwise until in excess.		
(ii) To the second portion of the filtrate, add dilute ammonia solution dropwise until in excess.		
(iii) To the fourth portion of the filtrate, add ammonium oxalate solution followed by ethanoic acid and warm.		
(iv) Use the fifth portion of the filtrate to carry out a test of your own choice to confirm the first cation in R . Test:		

TESTS	OBSERVATIONS	DEDUCTIONS
(v) To the sixth portion of the filtrate, add lead(II) nitrate solution followed by dilute nitric acid.		
(vi) Use the seventh portion of the filtrate to carry out a test of your own to confirm the anion in <i>R</i> . Test:		
(d) Wash the residue with a little distilled water and add dilute nitric acid to dissolve. Add dilute ammonia solution dropwise until in excess. Filter and keep both the filtrate and residue.		
(e) To the filtrate, add dilute nitric acid dropwise until the filtrate is just acidic. Divide the acidic filtrate into two portions.		
(i) To the first portion of the acidic filtrate, add dilute sodium hydroxide solution dropwise until in excess.		
(ii) Use the second portion of the acidic filtrate to carry out a test of your own to confirm the second cation in <i>R</i> . Test:		

TESTS	OBSERVATIONS	DEDUCTIONS
(f) Wash the residue and add dilute nitric acid to the residue in small portions to dissolve. Divide the resultant solution into four portions.		
(i) To the first portion of the solution, add dilute sodium hydroxide dropwise until in excess.		
(ii) To the second portion of the solution, add dilute ammonia solution dropwise until in excess.		
(iii) To the third portion of the solution, add dilute sulphuric acid.		
(iv) To the fourth portion of the solution, add potassium chromate(VI) solution followed by dilute sodium hydroxide dropwise until in excess.		

(g) Identify the:

(i) cations in ***R***.

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(ii) anion in ***R***.

3. You are provided with an organic compound **X**. You are required to carry out tests below on **X** and describe the nature of **X**. Record your observations and deductions in the table below.

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Burn a small amount of X on a spatula end or porcelain dish.		
(b) Shake 1 cm ³ of X with about 2 cm ³ of water. Divide the mixture into four parts.		
(i) To the first part, add a spatula endful of sodium hydrogen carbonate.		
(ii) To the second part, add neutral iron(II) chloride solution.		
(iii) To the third part, add 2 – 3 drops of acidified manganate(VII) solution and heat.		
(iv) To the fourth part, add 2,4-dinitrophenylhydrazine solution.		
(c) To 1 cm ³ of X , add an equal volume of ethanoic acid followed by 3 drops of concentrated sulphuric acid. Heat the mixture and pour the products in a beaker of cold water.		
(d) To 1 cm ³ of X , add Lucas reagent and allow to stand.		
(e) To 1 cm ³ of X , add concentrated sulphuric acid and heat the mixture. Test the gaseous products with acidified potassium manganate(VII) solution.		

(f) Describe the nature of X .

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