Name ……………………………………………………Center/Index No. …………………………..........

Signature………………………………………………....

P525/3

CHEMISTRY

(PRACTICAL)

<div align="center">

Paper 3

$3\frac{1}{4}$Hours

Uganda Advanced Certificate of Education

S.6 MOT II EXAMINATION-2023

CHEMISTRY

Practical

3 hours and 15 minutes

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INSTRUMENTS TO CANDIDATES:

- Answer all questions.
- Record your answers on this question paper in the spaces provided.
- Mathematical tables, slide rules and silent-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 candidate to read the question paper and make sure they have all the apparatus and chemicals that they may need.

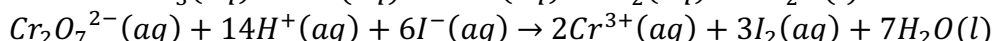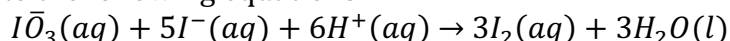| FOR EXAMINER'S USE ONLY			
Q.1	Q.2	Q.3	Total

Question 1

You are provided with the following:
- **FA1**; which is approximately a 0.1 M sodium thiosulphate solution.
- **FA2**; which is a solution containing 2.4 gdm^{-3} of potassium iodate.
- Solid **Y**, which is a salt containing dichromate ions.
- 1M sulphuric acid solution
- 5% potassium iodide solution
- Starch solution.

You are required to standardize FA1 and use it to determine the percentage by mass of chromium in Y.

In acidic solution, iodate and dichromate (VI) ions react with potassium iodide to liberate iodine according to the following equations.

$$I\bar{O}_3(aq) + 5I^-(aq) + 6H^+(aq) \rightarrow 3I_2(aq) + 3H_2O(l)$$
$$Cr_2O_7{}^{2-}(aq) + 14H^+(aq) + 6I^-(aq) \rightarrow 2Cr^{3+}(aq) + 3I_2(aq) + 7H_2O(l)$$

The iodine liberated in both cases reacts with thiosulphate ions according to the following equation.

$$I_2(aq) + 2S_2O_3{}^{2-}(aq) \rightarrow 2I^-(aq) + S_4O_6{}^{2-}(aq)$$
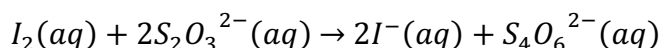
Procedure I

(a) Pipette $25.0cm^3$ or $20.0cm^3$ of FA2 into a conical flask and add an equal volume of 1M sulphuric acid using a measuring cylinder, followed by 10 cm^3 of 5% potassium iodide solution.
Titrate the iodine liberated with FA1, using starch solution as indicator.
Repeat the titration until you obtain consistent results.

(i)   Record your results in Table I below.

Table I

Volume of pipette used...cm^3 $(0 \, ^1/_2 \, mark)$

Experiment trail	1	2	3
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of FA1 used (cm^3)			

$(04 \, ^1/_2 \, marks)$

(i) Volumes of FA1 used for calculating average volume: ....cm^3

$(0 \, ^1/_2 \, mark)$

Average volume of FA1 used $(02 \, ^1/_2 \, marks)$

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Questions

(a) Calculate the number of moles of iodine liberated by FA2. $\left(02\,^1/_2\ marks\right)$

(O=16; K=39; I=127)

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(b) Determine the concentration of FA1 in $mol\ dm^{-3}$. $(02\ marks)$

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Procedure II

(b) Weigh accurately 1.2 g of Y. Dissolve it in a minimum amount of distilled water and transfer the solution into a $250cm^3$ volumetric flask. Make the solution up to the mark with distilled water and label it FA3.

Pipette $25.0cm^3$ or $20.0cm^3$ of FA3 into a conical flask and add an equal volume of 1M sulphuric acid using a measuring cylinder, followed by $10cm^3$ of 5% potassium iodide solution.

Titrate the iodine liberated with FA1 using starch as indicator.

Repeat the titration until you obtain consistent results.

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

Mass of weighing bottle +Y ....g $\left(0\,^1/_2\ mark\right)$

Mass of empty weighing bottle ....g $\left(0\,^1/_2\ mark\right)$

Mass of Y used ....g $\left(0\,^1/_2\ mark\right)$

Volume of pipette used..cm^3 $\left(0\,^1/_2\ mark\right)$

Table II

Run	1	2	3
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of FA1 used (cm^3)			

$$(04\,^1/_2\ marks)$$

(ii) Volumes of FA1 used for calculating average volume: ...., ...cm^3

$$(0\,^1/_2\ mark)$$

(iii) Average volume of FA1 used $\qquad(02\,^1/_2\ marks)$

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Questions

    (a) Calculate the number of moles of iodine liberated by FA3. $\qquad$ (02 marks)

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    (b) Determine the:

    (i)   Concentration of FA3 in $mol\ dm^{-3}$ $\qquad(02\,^1/_2\ marks)$

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(ii) mass of chromium in Y and hence its percentage. (Cr=52) $\left(03 \frac{1}{2} \ marks\right)$

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Question 2

You are provided with substance X which contains two cations and two anions. Carry out the following tests on X to identify the cations and anions in X. Record your observations and deductions in the table below. (28 *marks*)

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Heat a spatula endful of X gently then strongly until no further change.		
(b) Dissolve two spatula endfuls of X in about 5 cm^3 of distilled water, shake and filter. Keep both filtrate and the residue. Divide the filtrate into 5 portions.		
(c) (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 own choice to identify one of the cations in X. ………………………………………...… ………………………………………….… ………………………………………….…		
(iv) To the fourth portion, add lead (II) acetate solution and warm.		
(v) Use the fifth portion to carry out a test of your own choice to identify one of the anions in X. …………………………………....… ……………………………………..... ………………………………………..		

(d) Wash the residue. Dissolve the residue in a minimum dilute nitric acid. Divide the resultant solution into 3 portions.		
To the first portion, add dilute sodium hydroxide solution drop wise until in excess.		
(ii) To second portion, add dilute ammonia solution drop wise until in excess.		
(iii) To the third portion, add 2-3 drops of potassium chromate (VI) solution followed by ethanoic acid.		

(a) Identify the

(i)   Cations in X…………………………………and ……………………………

(ii)   Anions in X …………………………………and ……………………………

Question 3
You are provided with substance **K** which is an organic compound. You are required to determine the functional group and comment on the nature of substance **K.**
Carry out the following tests on k and record your observation and deductions in the table below.
Identify any gas (es) evolved.

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Burn a small amount of K on a spatula end/ a porcelains dish.		
(b) To about $3cm^3$ of k in a test tube, add about $2cm^3$ of water and shake. Test with litmus paper. Divide the resultant mixture into 6 portions.		
(i) To the first portion, add 3-4 drops of sodium carbonate solution.		
(ii) To the second portion, add 3-4 drops of neutral iron (III) chloride solution.		
(iii) To the third portion, add 2-3 drops of Brady's reagent.		
(iv) To the fourth portion, add 2-3cm³ of acidified potassium permanganate solution and heat. Divide the resultant mixture into two portions		

To the first portion, add 3-4cm^3 of Brady's reagent.		
To the second portion, add Tollen's reagent and warm.		
(v) To the fifth portion of the solution from (b), add 2-3 drops of concentrated sulphuric acid followed by 1cm³ of ethanoic acid and heat. Allow to cool.		
(vi) To the sixth portion, add iodine solution drop wise until in excess and then add dilute sodium hydroxide solution drop wise until the brown color of iodine just disappears then warm and allow to cool.		

(c) Comment on the nature of K.

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END