P525/3
Chemistry
Paper 3
Jan – Feb 2021
3 ¼ hours

UGANDA MUSLIM TEACHERS' ASSOCIATION

UMTA RESOURCE PAPERS – 2021

Name ……..

Centre/Index No. …….Signature ……..

UGANDA ADVANCED CERTIFICATE OF EDUCATION

Chemistry

Paper 3

3 hours 15 Minutes

INSTRUCTIONS TO CANDIDATES:

- *This paper consists of three compulsory questions.*
- *All questions must be answered in the spaces provided.*
- *Mathematical tables (3 – figure tables) and silent non-programmable scientific electronic calculators may be used.*
- *Candidates are advised to read through the paper and cross check with the apparatus and chemicals provided in the first fifteen minutes.*

For Examiners' use only			
Q. 1	Q. 2	Q. 3	Total

Q1. You are provided with the following:

- FA_1 which is a solution containing potassiumiodate (KIO_3) and oxalic acid ($H_2C_2O_4.H_2O$)
- FA_2 which is 0.1M sodium thiosulphate.
- FA_3 which is 0.05M sodium hydroxide solution.

You are required to determine the percentage composition of FA1

Theory:

The hydrogen ion can be analysed by titration with standard base

$$0H^-_{(aq)} + H^+_{(aq)} \longrightarrow H_2O_{(l)}$$

While the iodate ions can be reduced to iodine by reaction with excess acidified potassium iodide.

$$10^-_{3\,(aq)} + 5I^-_{(aq)} + 6H^+_{(aq)} \longrightarrow 3\,I_{2\,(aq)} + 3H_2O_{(l)}$$

And the liberated iodine analysed by reaction with standard sodium thiosulphate solution.

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

Procedure 1

Pipette $10cm^3$ of FA_1 into a conical flask add 2 – 3 drops of phenolphalein indicator and shake well. Titrate this solution with FA_3 from the burette. Repeat the titration until you obtain consistent readings and record your results in table A.

Results for Table A:

Volume of pipette used _____cm^3.

Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of **FA_3** used (cm^3)			

Values used to calculate average volume of FA_3 used. _____, _____

Average volume of FA_3 …….

Questions:

(a) Calculate the molar concentration of **FA_1** with respect to **H^+** ions hence mass per litre of oxalic acid.

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Procedure II

Empty the burette, wash it clean and rinse it with distilled water. Then fill it with **FA_2**. Pipette **$10cm^3$** of FA_1 into a conical flask, add **$10cm^3$** of **2M** sulphuric acid by use of a measuring cylinder and add $10cm^3$ of 10% potassium iodide then shake well and titrate the liberated iodine with FA_2 from the burette until the solution is pale yellow. Then add $2cm^3$ of starch indicator and complete the titration when the blue black colour of the solution just becomes colourless.

Repeat the titration to obtain consistent results and record your results in the table B - below.

Results for Table B:

Volume of pipette used _____cm^3.

Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of **FA_2** used (cm^3)			

Values of **FA_2** used to calculate average volume used _____, _____

Average volume of **FA_2** …….

Questions:

(b) Calculate the molar concentration of **FA_1** with respect to **IO_3^-** ions hence mass per litre of potassium iodate.

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(c) Calculate percentage composition by mass of **FA1**

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2. You are provided with substance **E,** that contains <u>two</u> cations and <u>two</u> anions. Carryout the following tests to identify the ions in E. Identify any gas evolved.

TEST	**OBSERVATION**	**DEDUCTION**
(a) Heat aspatula endful of **E** strongly in the dry test tube.		
(b) Place 2 spatula endfuls of **E** in a test tube, add 3 drops of concentrated sulphuric acid and heat.		
(c) Place two spatula endful of **E** in a test tube, add water to dissolve and filter, keep the residue. Divide the filtrate into <u>three</u> portions.		
(i) To the **1st** portion, add lead **(II)** nitrate solution and then dilute nitric acid.		
(ii) To the **2nd** portion, add silver nitrate solution; then dilute nitric acid.		
(iii) To the third portion add bleaching powder and then 3 drops of dilute sulphuric acid solution followed by carbon tetra chloride. Shake and leave it to settle.		
(d) To the spatula endful of E add dilute nitric acid to dissolve, then add excess sodium hydroxide solution and filter. Keep the residue and the filtrate.		

(e) To the filtrate, add dilute nitric acid until it is just acidic and 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 aqueous ammonia till in excess.		
(iii) Using the third portion carryout a test of your own choice to confirm the cation in the filtrate. ……		
…… …… ……		
(f) To the residue in **(d)** add dilute nitric acid to dissolve. Divide the resultant solution into four parts.		
(i) To the first part, add sodium hydroxide dropwise until in excess.		
(ii) To the second part, add aqueous ammonia solution dropwise until in excess.		

(iii) To the third part, add dilute sulphuric acid		
(iv) To the fourth part, add, ammonium oxalate solution followed by ethanoic acid		

Cations in **E** are ……..and ……

Anions in **E** are ……and ……..…….

3. You are provided with solid **T** which is an organic compound. You are required to carry out the tests below to determine the nature of **T.**

TEST	**OBSERVATIONS**	**DEDUCTIONS**
(a) Burn a little of T on aspatula end.		
(b) Add sodium hydroxide solution to a little of **T** in a test tube and shake well.		
(c) To a little of **T** in a test tube add about **5cm^3** of water and heat. Test the mixture with litmus paper. Divide the mixture into five parts.		
(i) To the first part, add sodium carbonate solution.		

(ii) To the second part, add neutral iron **(III)** chloride solutions.		
(iii) To the third part add Bradys reagent		
iv. To the fourth part add sodium hydroxide solution then three drops of concentrated sulphuric acid followed by ethanoic acid and warm. Pour the mixture in cold water.		
v. To the fifth part add an equal volume of ethanol and then three drops of concentrated sulphuric acid and warm.		

Comment on the nature of T.

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End