Candidate's name.....

Signature:..... Center/Index number:...../.....

P525/3
CHEMISTRY
Paper 3
December 2020
3¼ Hours

JINJA JOINT EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

MOCK EXAMINATIONS, 2020

CHEMISTRY

PRACTICAL

Paper 3

3 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

*Answer **all** the questions.*

Answers are to be written in the spaces provided.

Mathematical tables, slide rulers and non-programmable silent electronic 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 ensure that they have all the chemicals and apparatus they need.*

For examiner's use only

Q.1	Q.2	Q.3	TOTAL

1. You are provided with the following:

DA1, which is sodium thiosulphate solution.

DA2, which is a solution containing 3.5 gl^{-1} of potassium iodate (V).

Solid, R containing the metal (II) ions, M^{2+}.

10% Potassium iodide solution.

2M Sulphuric acid.

2M Nitric acid.

*You are required to standardize the solution of sodium thiosulphate in **DA1** and then use it to determine the percentage of metal, **M** in solid **R**.*

Theory

In acidic solution, potassium iodate (V) reacts with the potassium iodide according to the following equation;

$$IO_3^-(aq) + 6H^+(aq) + 5I^-(aq) \longrightarrow 3I_2(aq) + 3H_2O(l)$$

A solution of the metal (II) ions oxidises iodide ions to iodine according to the following equation;

$$2M^{2+}(aq) + 4I^-(aq) \longrightarrow M_2I_2(s) + I_2(aq)$$

The iodine liberated in both reactions can be titrated with thiosulphate solution according to the following equation;

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

Procedure:

Part I

(a) Pipette 10cc^3 of **DA2** into a clean conical flask, and add an equal volume of 2 M sulphuric acid followed by 10 cm^3 of 10% potassium iodide solution.

(b) Titrate the liberated iodine with **DA1** until the solution in the conical flask turns to pale yellow. Add 4 –5 drops of starch indicator and continue with the titration until the blue-black complex is discharged.

(c) Repeat the titration 2 – 3 times to obtain consistent readings.

(d) Enter your results in the **Table I** below.

Results:

Volume of pipette used = ... cm^3 *(0½ mark)*

Table I *(4½ marks)*

Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of **DA1** used (cm^3)			

Titre values used to calculate the average volume of **DA1** used.....

..... cm^3 *(0½ mark)*

Average volume of **DA1** used .....cm^3 *(2½ marks)*

Questions:

(e) Calculate the;

(i) number of moles of iodate (V) ions in 25 cm^3 of **DA2**. *(2½ marks)*

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(ii) molarity of the thiosulphate ions in **DA1**. *(03 marks)*

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Part II

(a) Weigh accurately about 1.6 g of **R** and transfer it into a 250 cm^3 beaker. Add 50 cm^3 of 2 M nitric acid to it and warm gently for about 5 – 8 minutes until **R** just dissolves. Transfer the contents into a 250 cm^3 volumetric flask and then add distilled water to make up to the mark. Label the resultant solution **DA3**.

(b) Pipette 10 cm^3 of **DA3** into a clean conical flask followed by an equal volume of sodium carbonate solution and add 2-3 drops of ethanoic acid. Shake and then add 10 cm^3 of potassium iodide solution to the resultant mixture. Titrate the mixture with **DA1** until you obtain a cream white colour.

(c) Repeat the titration 2 – 3 times until you obtain consistent readings.

(d) Enter your results in the table **II** below

Results

Mass of empty container + **R** = ...g *(0½ mark)*

Mass of empty container alone = ...g *(0½ mark)*

Mass of **R** used = ...g *(0½ mark)*

Volume of pipette used =..... cm^3 *(0½ mark)*

Table II (4½ marks)

Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of **DA1** used (cm^3)			

Titre values used to calculate average volume of **DA1** used .....

.....cm^3 *(0½ mark)*

Average volume of **DA1** used.....cm^3 *(2½ marks)*

Questions:

(e) Calculate the;

(i) number of moles of metal (II) ions, M^{2+} in 25 cm^3 of **DA3**. *(2½ marks)*

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(ii) concentration in gl^{-1} of the metal ions in **DA3**. (**M = 60**) *(2½ marks)*

(iii) percentage of metal **M** in solid **R**. *(02 marks)*

You are provided with the substance **S** which contains **two cations** and **two anions**. You are required to carry out the following tests on **S** to identify the **cations** and **anions** in it. Record your observations and deductions in the table below. Where a gas (es) is evolved, it must be identified. ***(32 marks)***

	TESTS	*OBSERVATIONS*	*DEDUCTIONS*
(a)	Heat one spatula end-ful of **S** strongly in a dry test tube until there is no further change.		
(b)	To one spatula end-ful of **S** in a test tube, add 2 –3 drops of the concentrated sulphuric acid and warm.		
(c)	To two spatula end-fuls of **S** vigorously to dissolve.		

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(d) To 1 cm^3 of the solution from **(c)**, add 2 – 3 drops of the Iron (III) chloride solution and heat to boiling.		
(e) To 1 cm^3 of the solution from **(c)**, add a few pieces of the copper turnings followed by 4 –5 drops of concentrated sulphuric acid and heat.		
(f) To the remaining solution from **(c)**, add dilute sodium-hydroxide solution drop-wise until in excess. Shake and filter. **Keep both the filtrate and residue.**		
(g) To the filtrate in **(f)**, add dilute nitric acid drop-wise until the solution is just acidic. **Divide the acidified filtrate into three portions.**		

(i)	To the **first** portion of the acidified filtrate, add dilute sodium hydroxide solution drop-wise until in excess.		
(ii)	To the **second** portion of the acidified filtrate, add dilute ammonia solution drop-wise until in excess.		
(iii)	To the **third** portion of the acidified filtrate, add half a spatula end-ful of the solid ammonium chloride then followed by 4 –5 drops of Disodium hydrogen phosp- hate and then ammonia drop-wise until in excess.		
(h)	Wash the residue from **(f)** and then dissolve it in dilute nitric acid. **Divide the acidic solution into four parts.**		

(i)	To the **first** part of the acidic solution, add dilute sodium hydroxide drop-wise until in excess.		
(ii)	To the **second** part of the acidic solution, add dilute ammonia drop-wise until in excess. **Leave the mixture to stand.**		
(iii)	To the **third** part of the acidic solution, add 3 – 4 drops of dilute sulphuric acid.		
(iv)	Use the **fourth** part of the acidic solution to carry out a test of your **own choice** to **confirm one of the cations** in **S**. Record your test and observations. **Test:**		

(i) Identify the;

(i) cations in **S**.....and .....

(ii) anions in **S**..... and.....

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

TESTS	*OBSERVATIONS*	*DEDUCTIONS*
(a) Burn a small amount of **H** on a spatula end or in a porcelain dish.		
(b) To 1 cm^3 of **H** in a test tube, add about 4 cm^3 of water and shake. Test the solution with litmus paper. **Divide the solution into two parts.**		

(i) To the **first** part of the solution, add 2 –3 drops of neutral Iron (III) chloride solution.		
(ii) To the **second** part of the solution, add 2 –3 drops of acidified potassium-dichromate (VI) solution and warm.		
(c) To 2 – 3 drops of **H** in a test tube, add 4 – 5 drops of the 2, 4-dinitrophenylhydrazine solution.		
(d) Dissolve 0.5 cm^3 of **H** in about 1 cm^3 of methanol. To the solution, add 4 cm^3 of iodine solution followed by sodium hydroxide solution drop-wise until the solution is pale yellow. **Heat the mixture and allow**		

	to stand.		
(e)	To 1 cm^3 of **H** in a test tube, add an equal volume of the Fehling's solution and heat the mixture.		
(f)	To 3 cm^3 of the silver nitrate solution, add 2 drops of dilute sodium hydroxide solution. Then add ammonia solution drop-wise until the precipitate formed just dissolves. Then add 5 cm^3 of **H** and warm. **Leave the mixture to stand.**		

(f) Comment on the **nature** of **H.**

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End