

Candidate's name.....

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

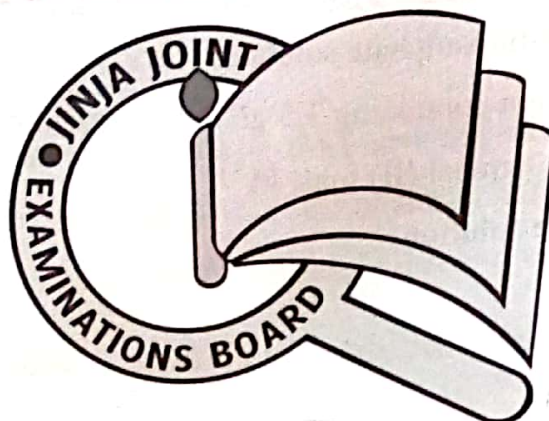
P525/3

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 g l^{-1} of potassium iodate (V).

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

10% Potassium iodide solution.

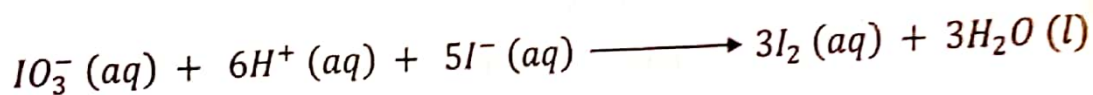
2M Sulphuric acid.

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;



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



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



Procedure:

Part I

- (a) Pipette 10cc³ of DA2 into a clean conical flask, and add an equal volume of 2 M sulphuric acid followed by 10 cm³ 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 = cm³ (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.....

..... cm³ (0½ mark)

Average volume of DA1 usedcm³ (2½ marks)

Questions:

(e) Calculate the;

(i) number of moles of iodate (V) ions in 25 cm³ of DA2. (2½ marks)

.....

.....

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

(03 marks)

Part II

- (a) Weigh accurately about 1.6 g of **R** and transfer it into a 250 cm³ beaker. Add 50 cm³ 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 cm³ volumetric flask and then add distilled water to make up to the mark. Label the resultant solution **DA3**.
- (b) Pipette 10 cm³ 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 cm³ 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 = cm³ (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
cm³ (0½ mark)

Average volume of DA1 usedcm³ (2½ marks)

Questions:

(e) Calculate the;

(i) number of moles of metal (II) ions, M²⁺ in 25 cm³ of DA3. (2½ marks)

.....

(ii) concentration in $g\ l^{-1}$ of the metal ions in **DA3**. ($M = 60$) ($2\frac{1}{2}$ 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 | | |
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| vigorously to dissolve. | | |

| | | |
|---|--|--|
| <p>(d) To 1 cm³ of the solution from (c), add 2 – 3 drops of the Iron (III) chloride solution and heat to boiling.</p> | | |
| <p>(e) To 1 cm³ of the solution from (c), add a few pieces of the copper turnings followed by 4 – 5 drops of concentrated sulphuric acid and heat.</p> | | |
| <p>(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.</p> | | |
| <p>(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.</p> | | |

| | | |
|---|--|--|
| (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 phosphate 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. | | |

| | | |
|--|--|--|
| <p>(i) To the first part of the acidic solution, add dilute sodium hydroxide drop-wise until in excess.</p> | | |
| <p>(ii) To the second part of the acidic solution, add dilute ammonia drop-wise until in excess. Leave the mixture to stand.</p> | | |
| <p>(iii) To the third part of the acidic solution, add 3 – 4 drops of dilute sulphuric acid.</p> | | |
| <p>(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:</p> | | |

| | | |
|--|--|--|
| | | |
|--|--|--|

(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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