

Name.....Center/Index number...../.....

P525/3
CHEMISTRY
Paper 3
August, 2023
3¼ hours



JINJA JOINT EXAMINATIONS BOARD

Uganda Advanced Certificate of Education
MOCK EXAMINATIONS –AUGUST, 2023

CHEMISTRY

PRACTICAL

Paper 3

3 hours 15 minutes

INSTRUCTIONS TO CANDIDATES

- Answer **all** questions.
- Answers are to be written in the spaces provided.
- You are not allowed to use any reference books.
- Mathematical tables, slide rulers and non-programmable silent electronic calculators may 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 may need.
- Atomic masses: C=12, O=16, H=1, N=14, Cl=35.5

For Examiner's Use Only

Q1	Q2	Q3	TOTAL

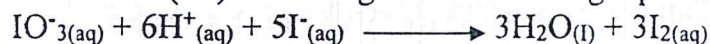
1. You are provided with the following;
 FA1; which is a solution containing 45g l^{-1} of impure potassium dichromate (VI), $\text{K}_2\text{Cr}_2\text{O}_7$
 FA2; Which is sodium thiosulphate solution of unknown concentration.
 FA3; which is 10% Potassium iodide solution.
 1M hydrochloric acid solution
 Solid W which is Potassium iodate, KIO_3

You are required to

- (a) Standardise solution FA2 using solid W
 (b) Determine the percentage purity of potassium dichromate in FA1

Theory:

Iodide ions in solution are oxidized to Iodine by acidified solutions of Iodate(V) and dichromate(VI) according to the following equations



The iodine liberated quantitatively reacts with sodium thiosulphate solution.

Procedure

Part A:

- (a) Weigh accurately about 2.7g of W and place it in a beaker containing about 20cm^3 of distilled water. Stir to dissolve and transfer the contents of the beaker into a 250cm^3 volumetric flask. Add more distilled water to make up to the mark and label the resultant solution FA4.
 (b) Pipette 10cm^3 of FA4 into a clean conical flask then add an equal volume of 1M hydrochloric acid followed by 10cm^3 of solution FA3 to liberate iodine.
 (c) Titrate the liberated iodine using solution FA2 from the burette until the solution turns pale yellow. Add 5 drops of starch indicator and continue the titration until the blue black complex is discharged.
 (d) Repeat the procedure 2-3 times to obtain consistent readings and enter your results in table I below.

RESULTS:

Mass of container + W =g (1 ½ marks)

Mass of Container alone =g

Mass of W used =g (½ mark)

Volume of pipette used = cm^3

Table I

(4 ½ marks)

Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of FA2			

Values of FA2 used to calculate average volume=.....($\frac{1}{2}$ mark)

.....

\therefore Calculate average volume of FA2=.....(3 marks)

Questions:

(a) Calculate the number of moles of

(i) Iodate(V) ions in 10cm^3 of FA4

(2 marks)

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

(ii) Thiosulphate ions, $\text{S}_2\text{O}_3^{2-}$ in 1dm^3 of FA2

($3\frac{1}{2}$ marks)

PART B

- Pipette 10cm^3 of FA1 into a clean conical flask, then add an equal volume of 1M hydrochloric acid followed by 10cm^3 of solution FA3 to liberate iodine.
- Titrate the liberated iodine using solution FA2 from the burette until the solution turns pale yellow. Add 5 drops of starch indicator and continue the titration until you obtain a green solution.
- Repeat the procedure 2-3 times to obtain consistent readings and enter your results in table II below.

RESULTS:

Volume of pipette used =.....($\frac{1}{2}$ mark)

Table II

Volume of pipette used = (½ mark)
 (4½ marks)

Final burette reading (cm ³)			
Initial burette reading (cm ³)			
Volume of FA2 used (cm ³)			

Values of FA2 used to calculate average volume.....

..... (½ mark)

∴ Calculate average volume of FA2 = (3 marks)

Questions:

(b) Calculate the number of moles of

(i) Thiosulphate ions, $S_2O_3^{2-}$ in FA2 that reacted.

(2 marks)

(ii) Dichromate(VI) ions, $Cr_2O_7^{2-}$ in 1dm³ of FA1

(2 marks)

(c) Determine the mass and hence the percentage purity of $K_2Cr_2O_7$ in FA1.
 (K=39, Cr=52, O=16)

2. You are provided with substance Y which contains two cations and two anions. You are required to identify the cations and anions in Y. Carry out the following tests on Y and record your observations and deductions in the table below. Where a gas (es) is (are) evolved, it must be identified. (34 marks)

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Heat two spatula endfuls of Y in a dry test tube first gently and then strongly until there is no further change.		
(b) To two spatula endfuls of Y in a boiling tube, add dilute nitric acid dropwise until there is no further change. Decant off the solution		
(c) To the decanted solution in (b), add <u>dilute sodium hydroxide</u> dropwise until in excess. Shake and filter, keep both the filtrate and residue.		
(d) To the filtrate from (c), add dilute nitric acid dropwise until the solution is <u>just acidic</u> . Divide the acidified filtrate into four parts		
(i) To the first part of the acidified filtrate, add dilute sodium hydroxide dropwise until in excess.		

(ii) To the second part of the acidified filtrate, add dilute ammonia solution dropwise until in excess		
(iii) To the third part of the acidified filtrate, add 4-5 drops of sodium sulphate solution		
(iv) Use the fourth part of the acidified filtrate to carry out a test of your own choice to confirm one of the cations in Y. Record test and observations Test:		
(e) Dissolve the residue from (c) in dilute nitric acid. Then divide the acidic solution into four parts.		
(i) To the first part of the acidic solution add dilute sodium hydroxide solution dropwise until in excess.		
(ii) To the second part of the acidic solution, add dilute ammonia solution dropwise until in excess and leave to stand for 1 minute.		
(iii) To the third part of the acidic solution, add 3-4		

drops of dilute sodium sulphate solution		
(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 Y. Record test and observations Test:		
(f) To two spatula endfuls of Y in a boiling tube, add about 4 cm ³ of water, shake vigorously and filter. Keep both the filtrate and residue. Divide the filtrate into three portions		
(i) To the first portion of the filtrate, add 3-4 drops of Barium nitrate solution		
(ii) To the second portion of the filtrate, add an equal volume of silver nitrate solution. Divide the resultant mixture into two parts.		
To the first part of the mixture in f(ii), add dilute ammonia solution dropwise until in excess.		

To the second part of the mixture in f(ii), add dilute nitric acid dropwise until in excess.		
(iii) To the third portion of the filtrate, add 3-4 drops of acidified potassium manganate(vii) solution and heat gently		

(g) Identify the

- (i) cations in Y: and
- (ii) anions in Y: and

3. You are provided with substance H which is an organic compound. You are required to determine the nature of H. Carryout the following tests on H and record four observations and deductions in the table below. (16 marks)

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Burn a small amount of H on spatula end or in a porcelain dish.		
(b) Shake 1 cm ³ of H with about 4cm ³ of water. Test the solution with litmus paper and divide into three parts.		
(i) To the first part of the solution, add 2-3 drops of iron(iii) chloride solution.		
(ii) To the second part of the solution, add 5 drops of acidified potassium dichromate (VI) solution and heat gently		
(c) To the third part of the solution, add 2,4 dinitrophenyl hydrazine solution dropwise until in excess.		
(d) Dissolve 0.5cm ³ of H in about 1cm ³ of methanol. To the solution add 4cm ³ of iodine solution followed by sodium hydroxide dropwise until the solution becomes pale yellow.		

Heat the mixture and allow it to stand.		
(e) To 1 cm ³ of H, add an equal volume of Fehlings solution and heat the mixture.		
(f) To 3 cm ³ of silver nitrate solution, add 2 drops of dilute sodium hydroxide. Then add ammonia solution dropwise until the precipitate just dissolves. Add 1cm ³ of H and warm		

Comment on the nature of H.

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P525/3/Inst. Sc.

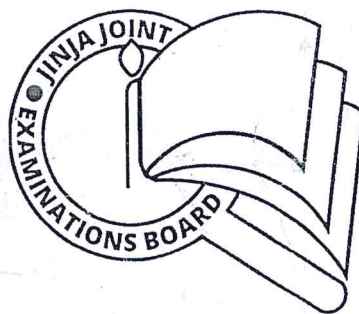
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CONFIDENTIAL:

GREAT CARE SHOULD BE TAKEN THAT THE INFORMATION GIVEN BELOW DOES NOT REACH THE CANDIDATES EITHER DIRECTLY OR INDIRECTLY.

1. *The description of the reagents and chemicals specified below does not necessarily correspond with the description in the question paper. Candidates must **NOT** be informed of the difference.*
2. *Candidates are not allowed to use reference books (i.e. textbooks, booklets on qualitative analysis etc) during the examination.*
3. *In addition to the ordinarily fittings and apparatus contained in a Chemistry laboratory, each candidates will require:*

Each candidate should be provided with the following;

- 1 Burette (50cm^3)
- 1 pipette (10cm^3)
- 2 conical flasks
- 1 volume flask (250cm^3)
- 1 Measuring Cylinder (100cm^3)
- 1 Beaker (100cm^3)
- 1 stop clock
- 40cm^3 of FA1
- 120cm^3 of FA2
- 60cm^3 of FA 3 which is 10% potassium iodide solution
- 3g of W, which is potassium iodate(V)
- 2 filter papers
- 3g of Y
- 4cm^3 of H
- FA1 is a solution made by dissolving 35.28g of substance J in 1dm^3 of water.
- FA2 is a solution made by dissolving 78.4g of substance K in 1dm^3 of water.
- Substances H, J, K and Y will be provided by JJEB