

Name Centre / Index No/.....
School Signature

P525/3
CHEMISTRY
(PRACTICAL)
Paper 3
July/August 2024
3¼ hours



WAKISSHA JOINT MOCK EXAMINATIONS
Uganda Advanced Certificate of Education

CHEMISTRY
PRACTICAL

Paper 3

3 hours 15 minutes

Instructions to Candidates:

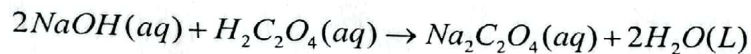
- Answer **all** questions.
- Record your answers on this question paper in the spaces provided.
- Mathematical tables and silent non-programmable calculators may be used.
- Reference books (i.e, textbooks, books on qualitative analysis etc.) should **not** be used.
- Candidates are **not** allowed to start working with the apparatus for the first 15 minutes.
This time is to enable candidates to read the question paper and make sure they have all apparatus and chemicals that they may need.
- Where necessary use (H = 1, O = 16, C = 12, Na = 23)

For Examiners' Use Only			
Q.1	Q.2	Q.3	Total

1. You are provided with the following:
- GA₁** which is a solution of sodium hydroxide of unknown concentration
- GA₂** which is 2M solution of an acid HyT
- Solid **W** which is an oxalic acid $H_2C_2O_4 \cdot 2H_2O$
- You are required to determine the;
- concentration of sodium hydroxide in **GA₁** in moles per litre.
 - Value of *y* in the acid HyT
 - Molar enthalpy of neutralization of acid HyT by sodium hydroxide.

Theory

Sodium hydroxide reacts with acid and with acid HyT according to the equations.



Part I

Procedure

Weigh accurately 1.6 g of solid W into a clean beaker. Add 100 cm³ of distilled water and stir to dissolve. Transfer the solution into a 250 cm³ volumetric flask and make up to the mark with distilled water. Label solution **GA₃**.

Measure 6 cm³ of **GA₁** into a clean beaker. Add 100 cm³ of distilled water and stir to mix. Transfer the solution into 250 cm³ volumetric flask and make up to the mark with distilled water. Label the solution **GA₄**.

Pipette 20 or 25 cm³ of **GA₄** into a clean conical flask. Add 2 to 3 drops of phenolphthalein indicator and titrate with **GA₃** from the burette until the end point is reached. Repeat the titrations until you obtain consistent results. Record your results in the table below.

Volume of pipette used _____ cm³ (½ mark)

Table I

Experiment Number	1	2	3
Final burette reading (cm ³)			
Initial burette reading (cm ³)			
Volume of GA₃ used (cm ³)			

Values used to calculate average volume of **GA₃** (4 ½ marks)
(½ mark)

Average volume of **GA₃** used (2½ marks)

Questions

(a) Calculate the number of moles of;

(i) oxalic acid in GA_3 that reacted with sodium hydroxide in GA_4 .

(H = 1, C = 12, O = 16)

(2½ marks)

(ii) Sodium hydroxide in 250 cm³ of GA_4 .

(2 marks)

(b) Determine the concentration of sodium hydroxide in GA_1 in moles per litre. (1 mark)

Part II

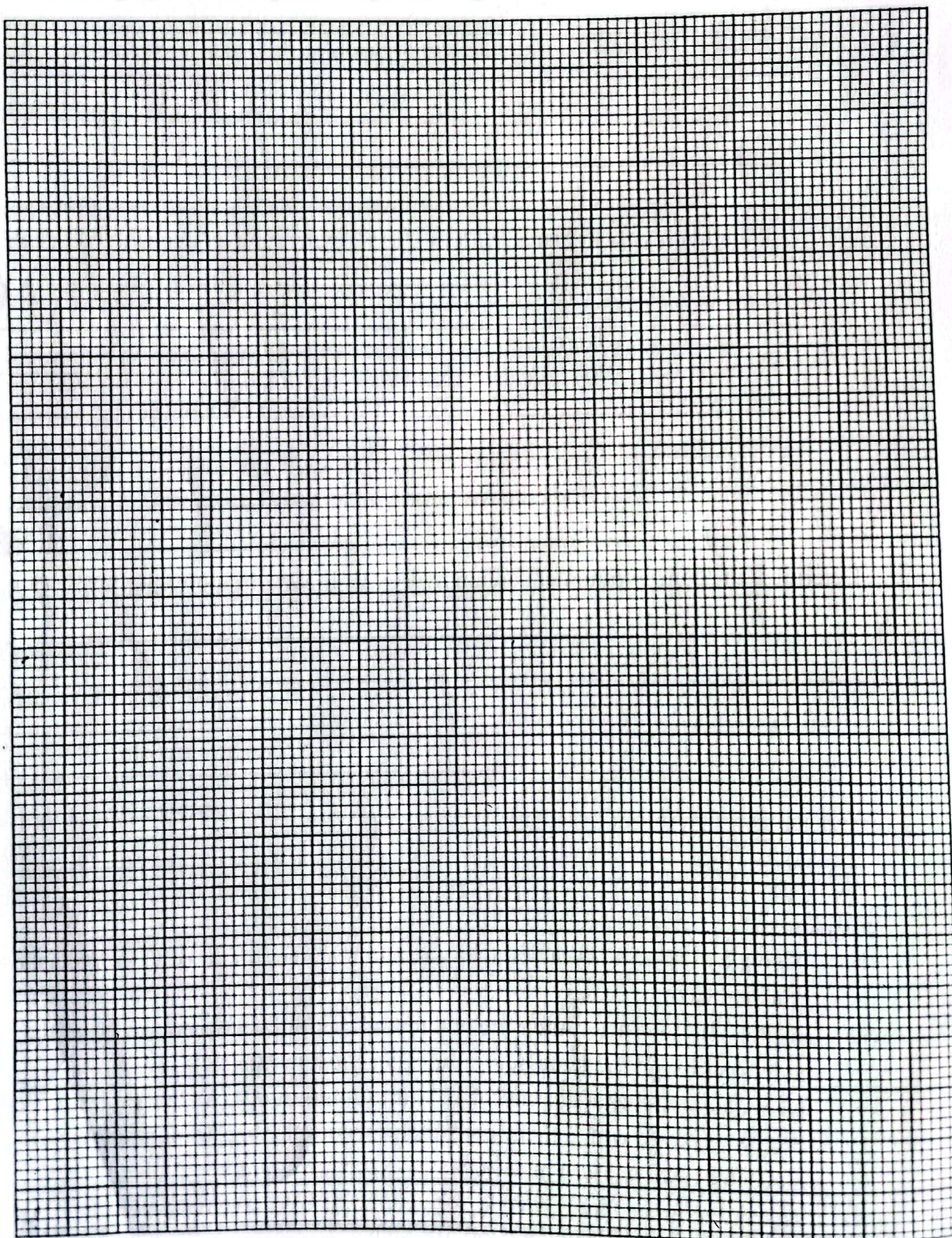
Procedure

- (i) Using a measuring cylinder, measure and transfer 24 cm³ of GA_1 into a clean plastic beaker.
- (ii) Using a thermometer, measure and record the initial temperature T, of the solution GA_1 in the table below, in experiment number 1.
- (iii) Using a burette, titrate 4 cm³ of GA_2 into solution of GA_1 in the plastic beaker. Stir the mixture with a thermometer and record the highest temperature T, reached by the mixture in the table in experiment number 2.
- (iv) Repeat the procedure (i) to (iii) for volume of GA_2 added equal to 8, 12, 16, 20 and 24 cm³ for experiment numbers, 3, 4, 5, 6 and 7
- (v) Record your results in the table.

Experiment number	1	2	3	4	5	6	7
Volume of GA_2 added (cm^3)	0	4	8	12	16	20	24
Highest temperature, T of the mixture ($^\circ\text{C}$)							

(7 marks)

- (c) Plot a graph of the highest temperature against the volume of GA_2 added. (6 marks)



- (d) Use the graph to determine the;
- Highest temperature reached at the neutralization point (1 mark)

 - Temperature change at the neutralization point. (1 mark)

 - Volume of acid HyT required to neutralize sodium hydroxide solution. (1 mark)

- (e) Calculate the number of moles of;
- Sodium hydroxide in GA₁ that reacted with acid in GA₂. (1 mark)

 - Acid HyT in GA₂ that reacted with sodium hydroxide in GA₁. (1 mark)

- (f) Calculate the value of y in the acid HyT and write an actual equation for the reaction between acid HyT and sodium hydroxide. (4½ marks)

- (g) Calculate the molar enthalpy of neutralization of the acid HyT by sodium hydroxide in GA₁ (Density of solution = 1 g/cm³, specific heat capacity of solution = 4.2 Jg⁻¹ °C⁻¹) (4½ marks)

Turn Over

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 present. Identify any gases evolved. (31 marks)

Test	Observation	Deduction
(a) To two spatula end full of X in a boiling tube, add 6 drops of concentrated sulphuric acid and heat strongly.		
(b) To three spatula end full of X add 7 cm ³ of water and shake strongly. Filter and keep both the residue and the filtrate. Divide the filtrate into three parts.		
(i) To the first part, add 1 cm ³ of lead(II) nitrate solution.		
(ii) To the second part, add 1 cm ³ of dilute hydrogen peroxide solution followed by 7 drops of concentrated sulphuric acid and shake and then add starch indicator.		

<p>(iii) Use the third part to carry out a test of your own choice to confirm the anion in the filtrate.</p> <p>Test:</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p>		
<p>(c) Wash the residue with distilled water, add 5 cm³ of dilute nitric acid drop wise to the washed residue and warm. Allow to cool and decant it to obtain the clear upper solution to be used in part (d)</p>		
<p>(d) To 4 cm³ of the solution obtained in (c) above add 5 cm³ of sodium hydroxide solution drop wise and shake. Filter and keep both the residue and the filtrate.</p>		
<p>(e) To the filtrate obtained, add dilute nitric acid drop wise until it is just acidic. Divide the resultant solution into four parts.</p>		
<p>(i) To the first part, add sodium hydroxide solution drop wise until excess.</p>		

Turn Over

(ii) To the second part, add 1 cm ³ of dilute sulphuric acid.		
(iii) To the third part, add ammonium hydroxide solution drop wise until excess.		
(iv) Use the fourth part to carry out a test of your own choice to confirm the cation in the filtrate. Test: _____ _____ _____ _____		
(f) Wash residue with sodium hydroxide solution and dissolve it in dilute nitric acid. Divide the resultant solution into three parts.		
(i) To the first part add sodium hydroxide solution drop wise until excess.		

(ii) To the second part add ammonium hydroxide solution drop wise until in excess.		
(iii) Use the third part to carry out a test of your own choice to confirm the cation in the residue. Test: _____ _____ _____ _____		

- (g) Identify the
 (i) Cations in T and
 (ii) Anions in T..... and

3. You are provided with substance **M** which is an organic compound. Carry out the following tests on **M** to identify its nature and functional group. (14 marks)

Test	Observation	Deduction
(a) Burn a small amount of M on a spatula or a crucible lid.		
(b) To 4 cm ³ of M , add 2 cm ³ of distilled water and shake. Test the resultant solution with litmus paper. Divide the solution into four parts.		

(i) To the first part, add little solid sodium carbonate.		
(ii) To the second part, add 1 cm ³ of neutral iron(III) chloride solution.		
(iii) To the third part, add acidified solution of potassium manganate (VII) and heat.		
(iv) To the fourth part, add 1 cm ³ of 2,4 - dinitrophenyl hydrazine.		
(c) To 1 cm ³ of M in a test tube, add 1 cm ³ of fehling's solution and heat.		

(d) To 1 cm ³ of M, add 2 cm ³ of Iodine solution followed by sodium hydroxide solution drop by drop until the solution turns pale yellow. Warm the solution and then cool under running water.		
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(e) Comment on M

END