Candidate's Name : .....

Signature:.....

Random No.					Personal No.		

(Do not write your School / Centre Name or Number anywhere on this booklet.)

P525/3
CHEMISTRY
(Practical)
Nov./Dec. 2022
3¼ hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Advanced Certificate of Education

CHEMISTRY
(PRACTICAL)

Paper 3

3 hours 15 minutes

INSTRUCTIONS TO CANDIDATES:

Answer **all** *questions. Use* **blue** *or* **black** *ink. Any work done in pencil will* **not** *be marked* **except** *drawings.*

All your answers **must** *be written in the spaces provided.*

Mathematical tables and silent non-programmable scientific calculators may be used.

Reference books (i.e. text books, booklets on qualitative analysis etc.) should **not** *be used.*

You are **not** *allowed to start working with the apparatus for the first* **15 minutes.** *This time is to enable candidates read the question paper and make sure they have all the apparatus and chemicals that they may need.*

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

1. You are provided with the following:

FA1, which is a solution of hydrochloric acid.

Metal **X**.

Substance **Y**, which is an oxide of **X**, with a formula **XO**.

You are required to determine the enthalpy change for the reduction of the oxide of **X** and comment on your answer.

PART I

Procedure

Weigh accurately about 1.2 g of **X**.

Using a measuring cylinder, transfer 100 cm^3 of **FA1** into a plastic beaker or cup. Read and record its initial temperature, in table **1**.

Add at once the 1.2 g of **X** into **FA1** in the plastic beaker or cup and at the same time, start the stop clock or watch.

Stir gently with the thermometer and record the temperature of the mixture after every half-minute in table **1**, up to the fourth minute.

Results

Mass of weighing container + **X** = ...g *(½ mark)*

Mass of weighing container alone = ...g *(½ mark)*

Mass of **X** used = ...g *(½ mark)*

Table 1

Time (minutes)	0	½	1	1½	2	2½	3	3½	4
Temperature of solution (°C)									

(4½ marks)

PART II

Procedure

Weigh accurately about 2.0 g of **Y**.

Using a measuring cylinder, transfer 100 cm^3 of **FA1** into a plastic beaker or cup. Read and record its initial temperature, in table 2.

Add at once the 2.0 g of **Y** into **FA1** in the plastic beaker or cup and at the same time, start the stop clock or watch.

Stir gently with the thermometer and record the temperature of the solution after every half-minute in table 2, up to the fourth minute.

Results

Mass of weighing container + **Y** = ...g *(½ mark)*

Mass of weighing container alone = ...g *(½ mark)*

Mass of **Y** used = ...g *(½ mark)*

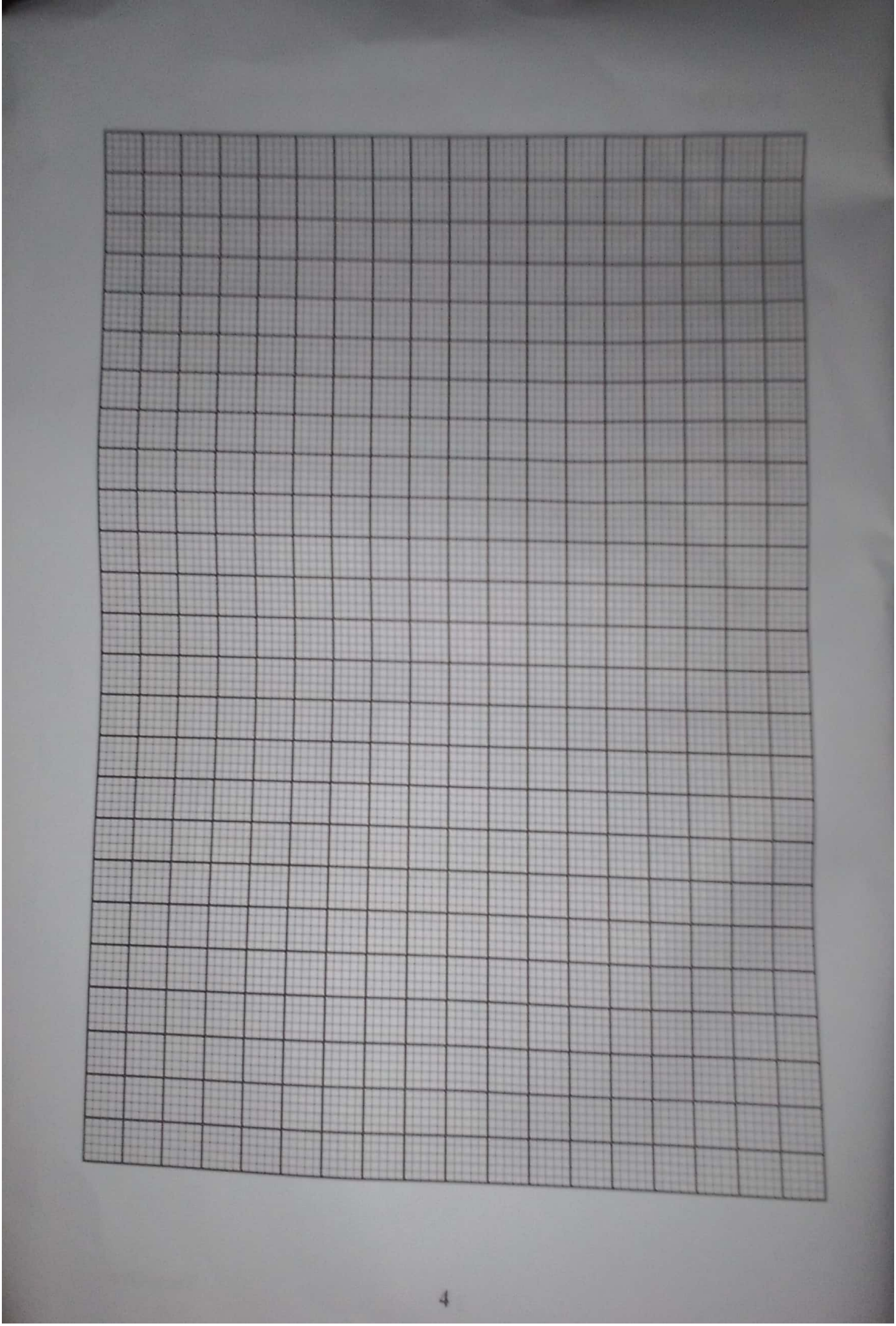
Table 2

Time (minutes)	0	½	1	1½	2	2½	3	3½	4
Temperature of solution (°C)									

(4½ marks)

(a) (i) Plot on the same axes, graphs of temperature against time for results obtained in both **Part I** and **Part II**. *(07 marks)*

(Graph paper is provided on page 4.)



(ii) From your graphs, determine the maximum temperature change for each reaction. *(03 marks)*

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(iii) Calculate the heat of reaction in **Part I** and **Part II**.

[*Specific heat capacity of the solution* = 4.2 $Jg^{-1} K^{-1}$ *and its density* = 1 g cm^{-3} *in each case, equation of the reactions of* **X** *and* **Y** *are as follows:*

$X_{(s)} + 2\,HCl_{(aq)} \longrightarrow XCl_{2\,(aq)} + H_{2\,(g)}$

$XO_{(s)} + 2\,HCl_{(aq)} \longrightarrow XCl_{2\,(aq)} + H_2O_{(l)}$]

Part I: *(01 mark)*

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Part II: *(01 mark)*

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(iv) Calculate the molar heat of reactions in **Part I** and **Part II**.
(X = 24, O = 16) *(03 marks)*

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(b) Determine the heat energy change for the reaction.

$XO_{(s)} + H_{2(g)} \longrightarrow X_{(s)} + H_2O_{(l)}$ *(02 marks)*

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(c) Comment on your answer in (b). *(01 mark)*

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2. You are provided with substance **D** which contains **two** cations and **two** anions.
You are required to carry out the tests in table 3 to identify the cations and anions in **D**. Identify any gas(es) evolved.
Record your observations and deductions in the table.

Table 3 *(30 marks)*

TESTS	OBSERVATIONS	DEDUCTIONS
(a) To **two** spatula end-fuls of **D** in a test tube, add dilute nitric acid until there is no further change.		
(b) To **two** spatula end-fuls of **D** in a test tube, add about 5 cm^3 of distilled water, shake well and filter. Keep both the filtrate and the residue.		
(c) Divide the filtrate into **three** parts. (i) To the **first** part, add silver nitrate solution followed by dilute nitric acid.		
(ii) To the **second** part, add aqueous iron(II) chloride solution.		

TESTS	OBSERVATIONS	DEDUCTIONS
(iii) Use the **third** part of the filtrate to carry out a test of your own choice to confirm one of the anions in **D**. **Test:**		
(d) Wash the residue twice with water. Transfer it into a test tube, add dilute nitric acid and warm. Add dilute sodium hydroxide solution drop-wise until in excess. Filter and keep both the filtrate and the residue.		
(e) To the filtrate from part (d), add dilute nitric acid drop-wise until the solution is just acidic. Divide the solution into **three** parts.		

TESTS	OBSERVATIONS	DEDUCTIONS
(i) To the **first** part of the acidified filtrate, add dilute sodium hydroxide solution drop-wise until in excess.		
(ii) To the **second** part of the acidified filtrate, add dilute ammonia solution drop-wise until in excess.		
(iii) Use the **third** part of the acidified filtrate to carry out a test of your own choice to confirm one of the cations in **D**. **Test:**		
(f) Dissolve the residue in part (d) in a minimum amount of dilute nitric acid. Divide the resultant solution into **three** parts.		

TESTS	OBSERVATIONS	DEDUCTIONS
(i) To the **first** part, add dilute sodium hydroxide solution drop-wise until in excess.		
(ii) To the **second** part, add dilute ammonia solution drop-wise until in excess.		
(iii) Use the **third** part to carry out a test of your own choice to confirm the second cation in **D**. **Test:**		

(g) (i) The cations in **D** are .....and .....

(ii) The anions in **D** are .....and .....

3. You are provided with substance **L**, which is an organic compound. You are required to carry out the tests in table 4 to determine the nature of **L**.
Record your observations and deductions in the table.

Table 4

(20 marks)

TESTS	OBSERVATIONS	DEDUCTIONS
(a) Burn a small amount of **L** on a spatula-end or in porcelain dish.		
(b) To about 1 cm^3 of **L**, add about 2 cm^3 of distilled water. Shake the mixture and test with litmus. Divide the mixture into **four** parts. (i) To the **first** part, add 2-3 drops of 2, 4 - dinitrophenyl hydrazine solution.		
(ii) To the **second** part, add a half a spatula endful of solid sodium hydrogencarbonate.		
(iii) To the **third** part, add 2-3 drops of neutral iron(III) chloride solution.		
(iv) To the **fourth** part, add 2-3 drops of acidified potassium dichromate solution and heat.		

	TESTS	OBSERVATIONS	DEDUCTIONS
(c)	To 1 cm^3 of **L** add about an equal volume of ethanoic acid, followed by about 2-3 drops of concentrated sulphuric acid and heat the mixture. Pour it into a beaker of cold water and allow to stand.		
(d)	To 1 cm^3 of **L**, add 2-3 drops of concentrated sulphuric acid and heat. Pass the vapour evolving into a test tube containing acidified potassium manganate(VII) solution.		
(e)	To 1 cm^3 of **L**, add 4 -5 drops of Lucas reagent.		

(f) Describe the nature of **L**.

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END