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233/3
CHEMISTRY
Paper 3
(PRACTICAL)
Oct./Nov. 2014
2 1/4 hours

Candidate's Signature

Date



THE KENYA NATIONAL EXAMINATIONS COUNCIL
Kenya Certificate of Secondary Education
CHEMISTRY
Paper 3
(PRACTICAL)
2 1/4 hours

Instructions to Candidates

- (a) Write your name and index number in the spaces provided above.
- (b) Sign and write the date of examination in the spaces provided above.
- (c) Answer **ALL** the questions in the spaces provided in the question paper.
- (d) You are **NOT** allowed to start working with the apparatus for the first 15 minutes of the 2 1/4 hours allowed for this paper. This time is to enable you to read the question paper and make sure you have all the chemicals and apparatus that you may need.
- (e) All working **MUST** be clearly shown where necessary.
- (f) KNEC mathematical tables and silent electronic calculators may be used.
- (g) **This paper consists of 8 printed pages.**
- (h) **Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.**
- (i) **Candidates should answer the questions in English.**

For Examiner's use only

Question	Maximum score	Candidate's Score
1	21	
2	13	
3	6	
Total Score	40	

1 You are provided with:

- solution **J** containing copper (II) ions.
- solution **K**, 0.1 M sodium thiosulphate.
- aqueous potassium iodide, solution **L**.
- solution **N**, sodium hydroxide.
- starch indicator, solution **M**.

You are required to determine the:

- concentration of copper (II) ions in solution **J**;
- enthalpy change of reaction between copper (II) ions and hydroxide ions.

PROCEDURE I

- (a) Using a pipette and **pipette filler**, place 25.0 cm³ of solution **J** in a 250 ml volumetric flask. Add distilled water to make upto the mark. Label this as solution **J₂**. Retain solution **J** for use in **procedure II**.
- (b) Place solution **K** in a burette. Using a clean pipette and **pipette filler**, place 25.0 cm³ of solution **J₂** in a 250 ml conical flask. Add 10 cm³ of potassium iodide, solution **L**. Shake well, then add 2 cm³ of starch indicator, solution **M**. Titrate until a blue-black colour appears and continue titrating until the blue-black colour just disappears. Record your readings in **Table 1** below.
- (c) Repeat step (b) two more times and complete **Table 1**.

	I	II	III
Final burette reading			
Initial burette reading			
Volume of solution K (cm ³) used			

Table 1

(3 marks)

Calculate the;

- (i) average volume of solution **K** used;

(1 mark)

.....

(ii) moles of sodium thiosulphate used; (2 marks)

.....
.....
.....

(iii) concentration in moles per litre of copper (II) ions in solution J given that the number of moles of copper (II) ions in 25.0 cm³ of solution J₂ are the same as the moles of sodium thiosulphate used. (2 $\frac{1}{2}$ marks)

.....
.....
.....

PROCEDURE II

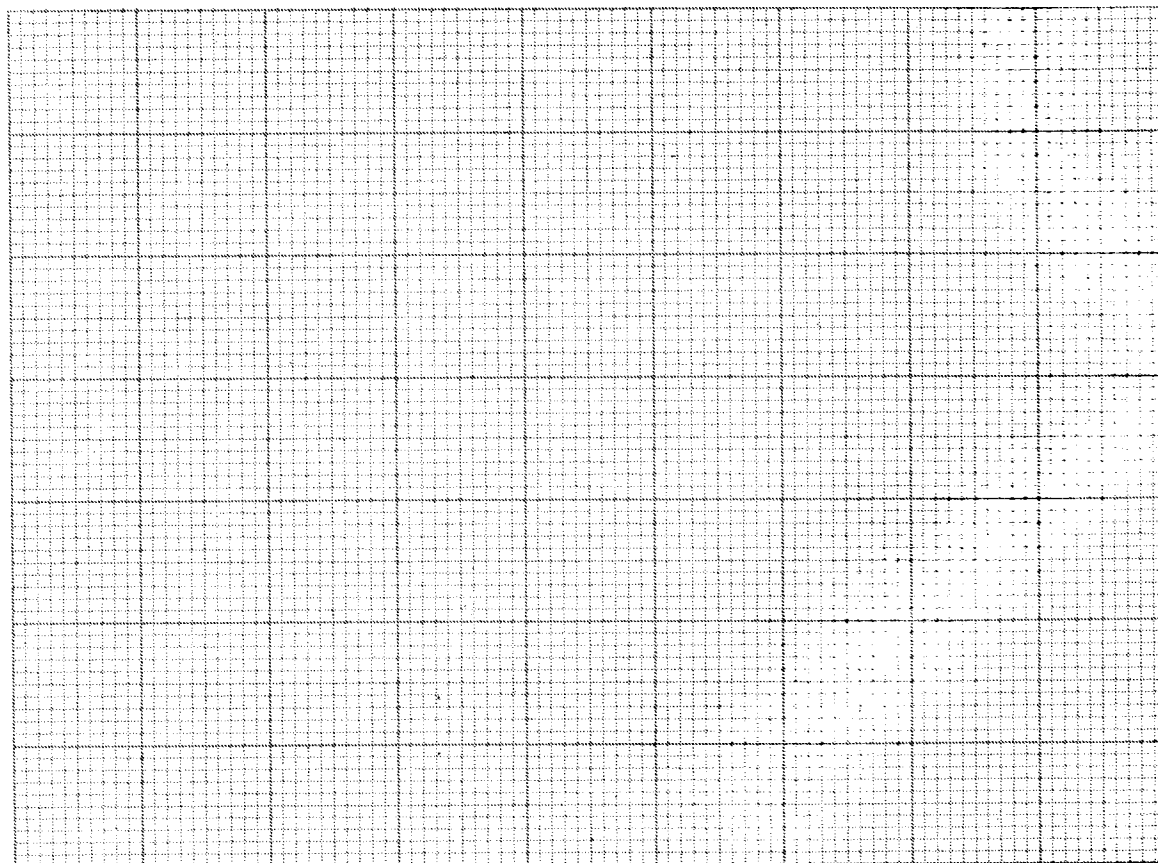
- (a) Using a clean burette, place 5.0 cm³ of solution N into each of six (6) test-tubes.
- (b) Using a 100 ml measuring cylinder, place 20 cm³ of solution J in a 100 ml plastic beaker. Measure the temperature of solution J and record it in **Table 2** below.
- (c) To solution J in the beaker, add sodium hydroxide, solution N from one of the test-tubes. Stir the mixture with the thermometer and record in **Table 2**, the maximum temperature reached. Continue with step (d) **IMMEDIATELY**.
- (d) Add the sodium hydroxide, solution N from another test-tube to the mixture obtained in (c) above, stir and record the maximum temperature reached in **Table 2**. Continue adding the sodium hydroxide, solution N from each of the other four test-tubes, stirring the mixture and recording the maximum temperature each time and complete **Table 2**.

Volume of sodium hydroxide, solution N added (cm ³)	0	5	10	15	20	25	30
Maximum temperature (°C)							

Table 2

(3½ marks)

- (i) On the grid provided, plot a graph of temperature (vertical axis) against volume of sodium hydroxide solution N added. (3 marks)



(ii) Using the graph, determine the:

I volume of sodium hydroxide, solution N that reacted completely with
20 cm³ of solution J; (2 marks)

.....

II temperature change, ΔT , for the reaction; (1 mark)

.....

(iii) enthalpy change of the reaction per mole of copper (II) ions. (3 marks)
(Heat capacity = 4.2 J g⁻¹k⁻¹, density of the mixture = 1.0 g cm⁻³).

.....

.....

.....

.....

2 You are provided with substance **P**. Carry out the tests below and write your observations and inferences in the spaces provided.

(a) Describe the appearance of substance **P**. (1 mark)

.....

(b) Place about one-third of substance **P** in a dry test-tube and heat it strongly.

Observations	Inferences
(1 mark)	(1 mark)

(c) Place the remaining amount of substance **P** in a boiling tube. Add about 10 cm³ of distilled water and shake well. **Retain** the mixture for tests in (d) below.

Observations	Inferences
(1 mark)	(1 mark)

(d) Use about 2 cm³ portions of the mixture obtained in (c) for tests (i) to (iii) below.

(i) Add two to three drops of aqueous barium nitrate to the mixture.

Observations	Inferences
(1 mark)	(2 marks)

(ii) Add five drops of dilute nitric(V) acid to the mixture.

Observations	Inferences
(1 mark)	(1 mark)

(iii) Add to the mixture, aqueous sodium hydroxide dropwise until in excess.

Observations	Inferences
(1 mark)	(1 mark)

(e) Give the formula of the cation and anion present in substance P.

Cation: ($\frac{1}{2}$ mark)

Anion: ($\frac{1}{2}$ mark)

3 You are provided with an organic substance **Q**. Carry out the following tests and record your observations and inferences in the spaces provided.

- (a) Place about one-third of substance **Q** on a **metallic spatula** and ignite it with a Bunsen burner flame.

Observations	Inferences
(1 mark)	(1 mark)

- (b) Place the remaining amount of substance **Q** in a boiling tube and add about 10 cm³ of distilled water. Heat the mixture and allow it to boil for about 30 seconds. Divide the mixture while still hot into two portions.

- (i) To the first portion, add solid sodium hydrogen carbonate provided.

Observations	Inferences
(1 mark)	(1 mark)

- (ii) To the second portion, add two or three drops of acidified potassium manganate (VII).

Observations	Inferences
(1 mark)	(1 mark)

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