THE KENYA NATIONAL EXAMINATIONS COUNCIL

Kenya Certificate of Secondary Education

233/3

CHEMISTRY (Practical)

Paper 3

Nov. 2023 - 2¼ hours

Serial No.
18371252

Name: ..... **Index Number:** .....

Candidate's signature: ..... **Date:** .....

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 2¼ 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	19	
2	13	
3	08	
Total Score	40	

1 You are provided with:

- **Solution A** - mixture containing sodium thiosulphate and starch
- **Solution B** - aqueous potassium iodide
- **Solution C** - aqueous hydrogen peroxide
- **Solution D** - 0.01M potassium manganate(VII)

You are required to determine the:

- Concentration in moles per litre of hydrogen peroxide in **solution C**.
- Rate of reaction between hydrogen peroxide and potassium iodide.

PROCEDURE I

Using a pipette and pipette filler, pipette 25.0 cm^3 of solution C into a 250 ml volumetric flask. Add distilled water to the mark and label this as **solution E**.

Fill the burette with **solution D**.
Using a clean pipette and pipette filler, place 25.0 cm^3 of **solution E** into a 250 ml conical flask. Titrate with **solution D** until a permanent pink colour persists. Record the results in **table 1**. Repeat the titration two more times and complete **table 1**.

(a) **Table 1**

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

(4 marks)

(b) Determine the:

(i) average volume of solution D used. (1 mark)

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(ii) number of moles of potassium manganate(VII) that reacted. (1 mark)

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(iii) number of moles of hydrogen peroxide in 25.0 cm^3 of solution E (5 moles of hydrogen peroxide react with 2 moles of potassium manganate(VII)). (1 mark)

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(iv) concentration in moles per litre of hydrogen peroxide in solution E. (1 mark)

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(v) concentration in moles per litre of hydrogen peroxide in solution C. (1 mark)

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PROCEDURE II

(i) Rinse the burette with solution E and then with distilled water.
Fill the burette with solution C.
Place 5 test tubes on a test tube rack and label them 1, 2, 3, 4 and 5.
To each test tube place 10 cm^3 of solution C from the burette.

(ii) Clean the burette and fill it with solution B.
Place 25.0 cm^3 of solution B into a 100 ml beaker from the burette.

(iii) Using a 100 ml measuring cylinder, add 20 cm^3 of solution A to the beaker containing solution B.

(iv) Pour the contents of test tube 1 to the mixture in the beaker and immediately start the stop watch. Swirl the contents of the beaker and allow to stand. Record in **table 2** the time, in seconds, taken for a blue colour to **just** appear. Measure the temperature of the final mixture and record in the space provided. Wash the beaker and proceed to step (v).

(c) Record the temperature of the final mixture .....(1 mark)

(d) **Table 2**

Experiment	Volume (cm^3) of: Solution A	Solution B	Distilled water	Solution C	Time (Seconds)	Rate $= \frac{1000}{\text{time}} s^{-1}$
1	20	25	0	10		
2	20	20	5	10		
3	20	15	10	10		
4	20	10	15	10		
5	20	5	20	10		

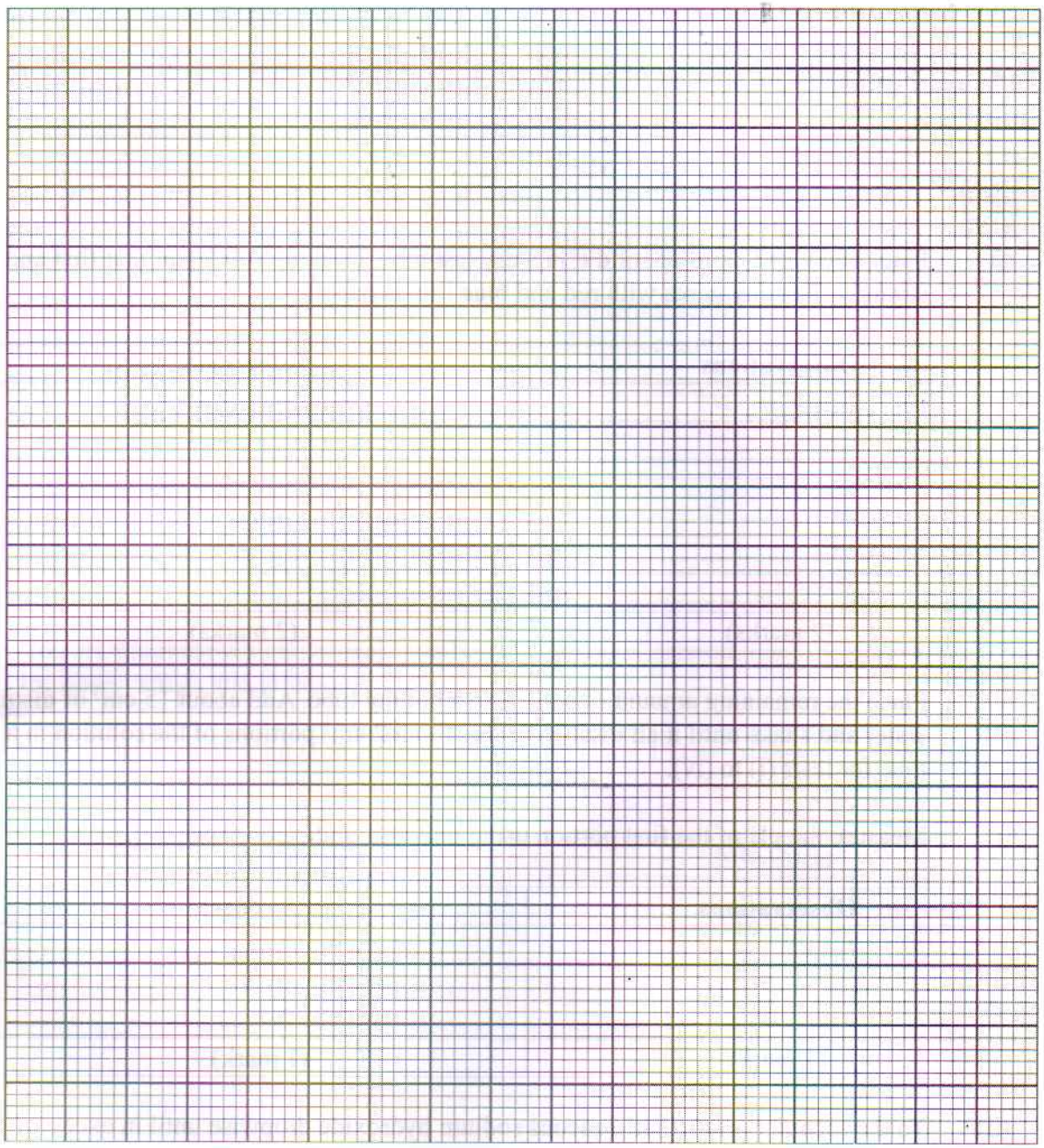
(5 marks)

(v) Place 20.0 cm^3 of **solution B** into the 100 ml beaker from the burette. Using the 100 ml measuring cylinder, add 20 cm^3 of **solution A** to the beaker followed by 5 cm^3 of distilled water measured using a 10 ml measuring cylinder. Add **solution C** in test tube 2 to the mixture in the beaker and immediately start the stop watch. Swirl the contents of the beaker and allow to stand. Record in table 2 the time taken for a blue colour to **just** appear. This is experiment 2 in **table 2**. Wash the beaker.

(vi) Repeat step (v) with **solution C** in test tubes 3, 4 and 5 with the corresponding volumes of **solution B**, **solution A** and distilled water as shown in **table 2** for experiments 3, 4 and 5.

(vii) Complete **table 2** by calculating the rate for each experiment given by:
Rate $= \frac{1000}{\text{time}} s^{-1}$ and filling in the table.

(e) Plot a graph of rate (*y-axis*) against volume of solution B. (3 marks)



(f) State why it was necessary to add distilled water to the mixture in experiments 2, 3, 4 and 5.
(1 mark)

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2 You are provided with **solid F**. Carry out the following tests and record the observations and inferences in the spaces provided.

(a) Describe the appearance of Solid F. (1 mark)

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(b) Place about one-third of solid F in a dry test tube. Heat the solid gently at first and then strongly. Test any gases with red and blue litmus papers.

Observations	Inferences
(2 marks)	(2 marks)

(c) Place the remaining amount of solid F in a boiling tube. Add about 15 cm^3 of distilled water and shake until it all dissolves. Use about 2 cm^3 portions of the solution in a test tube for tests (i) to (iv).

(i) Measure the pH of the first portion using universal indicator paper and chart.

Observations	Inferences
(1 mark)	(1 mark)

(ii) To the second portion, add aqueous sodium hydroxide dropwise until in excess.

Observations	Inferences
(1 mark)	(1 mark)

(iii) To the third portion, add three drops of aqueous barium chloride. Shake the mixture and then add about 1 cm^3 of dilute hydrochloric acid.

Observations	Inferences
(1 mark)	(1 mark)

(iv) To the fourth portion, add about 3 cm^3 of aqueous hydrogen peroxide.Shake the mixture and then add aqueous ammonia dropwise until in excess.

Observations	Inferences
(1 mark)	(1 mark)

3 You are provided with an organic compound, **solid G**. Carry out the following tests and record the observations and inferences in the spaces provided.

(a) Place all of solid G in a boiling tube. Add about 15 cm^3 of distilled water and shake the mixture. Retain the mixture for use in test (b).

Observations	Inferences
(1 mark)	(1 mark)

(b) Use about 2 cm^3 portions of the mixture, in a test tube, for each of the following tests:

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

Observations	Inferences
(1 mark)	(1 mark)

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

Observations	Inferences
(1 mark)	(1 mark)

(iii) To the third portion, add about 1 cm^3 of acidified potassium dichromate(VI), warm the mixture.

Observations	Inferences
(1 mark)	(1 mark)

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