

233/3

— **CHEMISTRY** —
(PRACTICAL)

Paper 3



Nov. 2019 – 2¼ hours

Name Index Number

Candidate's Signature Date

Instructions to candidates

- Write your name and index number in the spaces provided above.
- Sign and write the date of examination in the spaces provided above.
- Answer **all** the questions in the spaces provided in the question paper.
- 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.
- All working **must** be clearly shown where necessary.
- KNEC mathematical tables and silent electronic calculators may be used.
- This paper consists of 8 printed pages.**
- Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.
- Candidates should answer the questions in English.

For Examiner's Use Only

Question	Maximum Score	Candidate's Score
1	16	
2	14	
3	10	
Total Score	40	



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Turn over

1. You are provided with:

- **Solution A** : aqueous Iron(III) sulphate.
- **Solution B** : aqueous potassium iodide.
- **Solution C** : mixture of aqueous starch and sodium thiosulphate solution.

You are required to determine the rate of reaction between aqueous Iron(III) sulphate (**solution A**) and aqueous potassium iodide (**solution B**).

Procedure:

- (i) Place 5 test tubes on a test tube rack and label them **1, 2, 3, 4** and **5**. Fill a burette with **solution A**. To each test tube place 3 cm^3 of solution A from the burette.
 - (ii) Clean the burette and fill it with **solution B**. Place 8 cm^3 of solution B into a 100 ml beaker from the burette.
 - (iii) Using a 10 ml measuring cylinder, add 2 cm^3 of **solution C** to the beaker containing **solution B** followed by 7 cm^3 of distilled water measured using the same 10 ml measuring cylinder.
 - (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. Record in **table 1** the time 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).
 - (v) Place 6 cm^3 of **solution B** into 100 ml beaker from the burette. Add 2 cm^3 of solution C followed by 9 cm^3 of distilled water. Add solution A in test tube 2 to the mixture in the beaker and immediately start the stop watch. Swirl the contents of the beaker. Record in **table 1** the time taken for a blue colour to just appear. This is experiment 2.
 - (vi) Wash the beaker. Repeat step (v) with solution A in test tubes 3, 4 and 5 with corresponding volumes of solution B, solution C and distilled water as indicated in **table 1** for experiments 3, 4 and 5.
- (a) Temperature of final mixture °C (1 mark)

(b) Table 1

Experiment	Volume (cm ³) of				Time (seconds)
	Solution A	Solution B	Solution C	Distilled Water	
1	3	8	2	7	
2	3	6	2	9	
3	3	5	2	10	
4	3	4	2	11	
5	3	3	2	12	

(3 marks)

(c) Complete table 2 for each experiment by:

- (i) calculating the square of **volume of solution B, B²** and filling in the table.
(ii) calculating the rate of reaction which is given by the expression

$$\text{Rate} = \frac{1}{\text{Time}} \times 1000 \text{ s}^{-1} \text{ and filling in the table.}$$

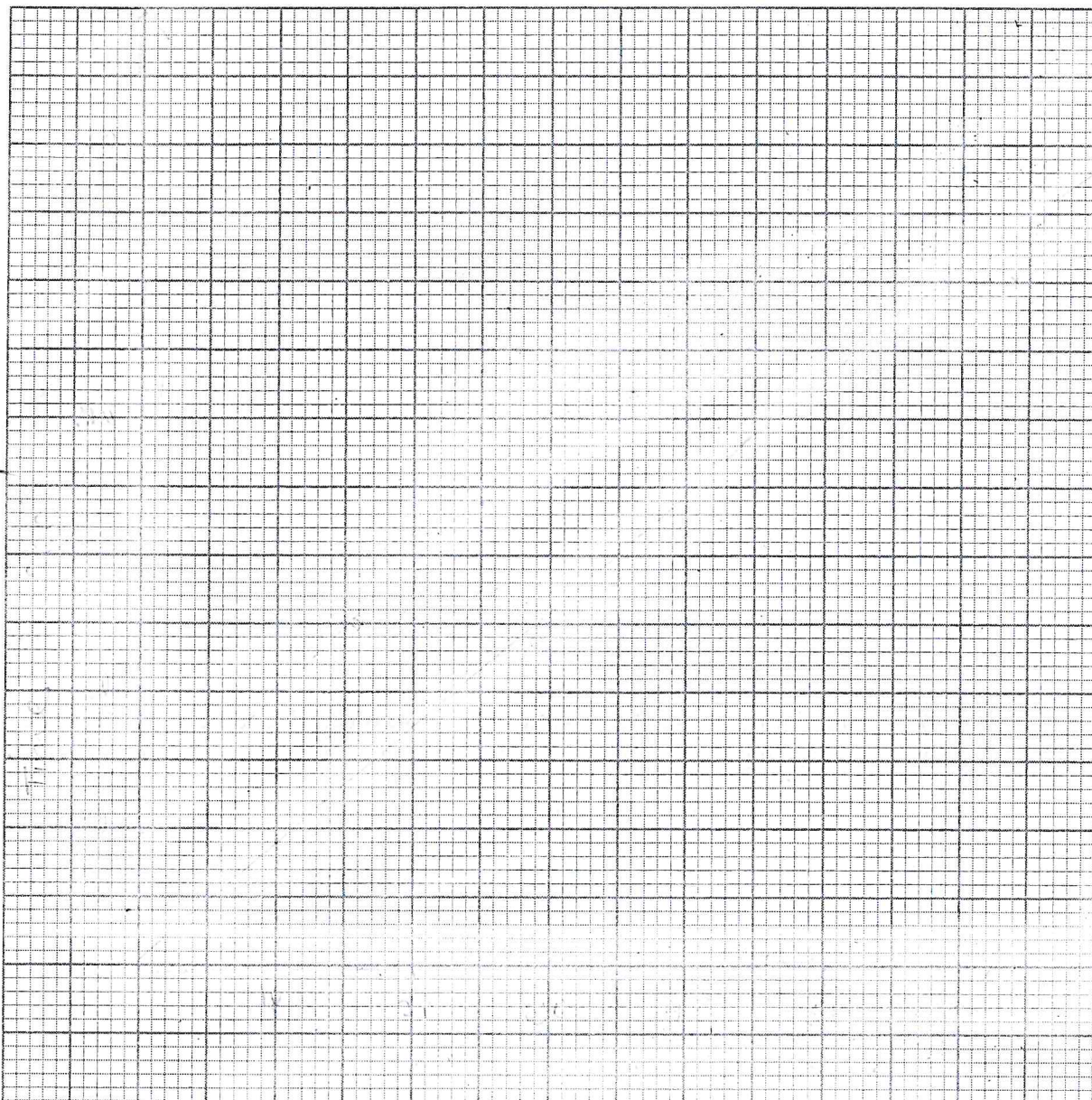
Table 2

Experiment	B ²	Rate = $\frac{1}{\text{Time}} \times 1000 \text{ s}^{-1}$
1		
2		
3		
4		
5		

(5 marks)

(d) Plot a graph of rate (y-axis) against B^2

(3 marks)



(e) Using the graph, determine the time that it will take for the blue colour to appear if the experiment is repeated using the following mixture:

Volume (cm ³) of			
Solution A	Solution B	Solution C	Distilled water
3	7	2	8

(2 marks)

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- (f) In this experiment the rate of reaction was determined with respect to potassium iodide. Describe how the rate of the reaction can be determined with respect to Iron(III) sulphate. (2 marks)

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

- (a) Place about one-third of **solid P** in a dry test tube and heat it strongly. Test any gases produced with red litmus paper.

Observations	Inferences

(2 marks)

(1 mark)



- (b) Place the remaining amount of **solid P** in a boiling tube. Add about 15 cm³ of distilled water and shake to dissolve the solid. Use about 2 cm³ portions of the solution in a test tube for each of the tests (i) to (iv).

- (i) To the first portion of the solution add aqueous sodium hydroxide.

Observations	Inferences

(1 mark)

(2 marks)

- (ii) To the second portion of the solution add 2 or 3 drops of aqueous barium nitrate.

Observations	Inferences

(1 mark)

(1 mark)

- (iii) To the third portion of the solution add 2 or 3 drops of aqueous lead(II) nitrate. Warm the mixture.

Observations	Inferences

(1 mark)

(1 mark)

- (iv) To **solid D** in the test tube add about 2 cm³ of distilled water. Shake and label this as **chlorine water**. Add all the chlorine water to the fourth portion of the solution. Shake the mixture and then add 3 drops of starch solution.

Observations	Inferences

(2 marks)

(1 mark)

- (c) Give the formulae of the ions present in **solid P**:

(i) cation

(½ mark)

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(ii) Anion

(½ mark)

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3. You are provided with **liquid Q**. Carry out the following tests and record the observations and inferences in the spaces provided.

- (a) Place 2 drops of liquid Q on a watch glass. Ignite the liquid with a Bunsen burner flame.

Observations	Inferences

(1 mark)

(1 mark)

- (b) Place about 2 cm³ of liquid Q in a test tube. Add about 2 cm³ of distilled water and shake the mixture.

Observations	Inferences

(1 mark)

(1 mark)

- (c) To about 2 cm³ of liquid Q in a test tube, add all of the solid sodium hydrogen carbonate provided.

Observations	Inferences

(1 mark)

(1 mark)

- (d) To about 2 cm³ of liquid Q in a test tube, add 2 or 3 drops of bromine water.

Observations	Inferences

(1 mark)

(1 mark)

- (e) To about 2 cm³ of liquid Q in a test tube, add 2 or 3 drops of acidified potassium dichomate(VI) and warm the mixture.

Observations	Inferences

(1 mark)

(1 mark)

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