

THE ROYAL EXAM SERIES

Kenya Certificate of Secondary Education

233/3 — CHEMISTRY — Paper 3

PRACTICAL

FORM 4

TERM 2



DECEMBER 2021- 2 1/4 HOURS

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

School.....

Candidate's Signature..... Date.....

Instructions to candidates

- Write your name, class, admission number, index number, signature and date 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 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.
- All working MUST be clearly shown where necessary.
- Mathematical tables and silent electronic calculators may be used.
- This paper contains 8 printed pages.

For Examiner's Use Only

Question	Maximum Score	Candidate's Score
1	23	
2	10	
3	07	
Total Score	40	

1. You are provided with:-

- Solution **T**, 2M Hydrochloric acid.
- Solution **P**, 0.15M Sodium thiosulphate
- Solution **S**, Sodium carbonate

Procedure 1

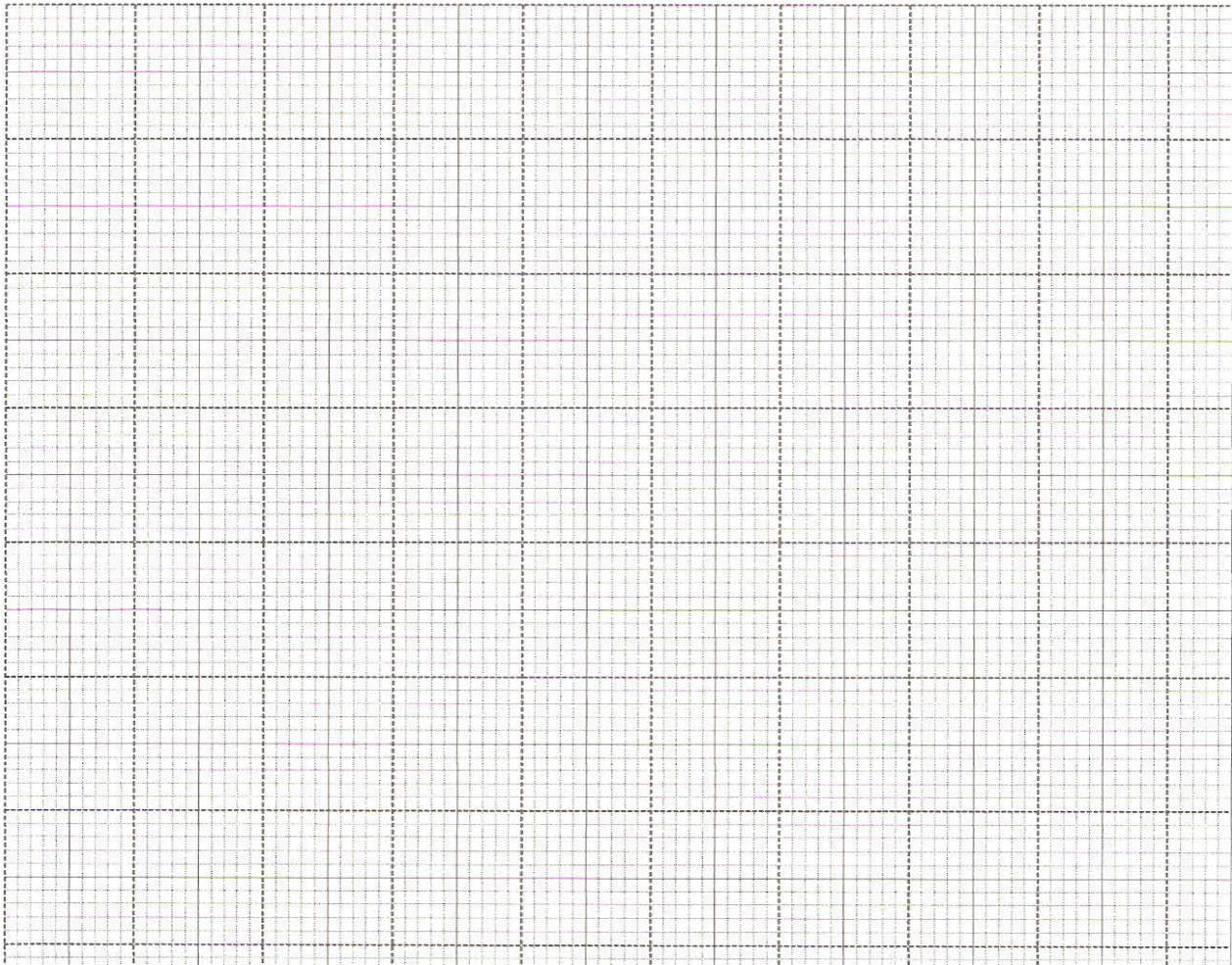
Measure 20cm³ of 0.15M Sodium thiosulphate (solution **P**) into a 250cm³ a conical flask. Place the beaker on a white piece of paper with **ink mark 'X'** on it. Measure 20cm³ of 2M hydrochloric acid solution **T** using a 50cm³ measuring cylinder. Put the acid into the conical flask containing Sodium thiosulphate and immediately start off the stop watch. Determine the time taken for the **mark 'X'** to become invisible /obscured when viewed from above. Repeat the procedure by measuring different volumes of the acid and adding the volumes of the distilled water to complete Table I below.

Table I

Volume of acid (cm ³)	Volume of water (cm ³)	Volume of sodium thiosulphate (cm ³)	Time taken for mark 'X' to be invisible/obscured (seconds)	Reciprocal of time (sec ⁻¹) $\frac{1}{t}$
20	0	20		
18	2	20		
16	4	20		
14	6	20		
12	8	20		
10	10	20		

a) Complete the table above (6 marks)

b) Plot a graph of 1/t (rate) against volume of acid used. (3 marks)



c) Explain the shape of your graph (1 mark)

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d) From the graph determine

(i) Time taken for the cross to be obscured/invisible when the volume of the acid is:

I) 15cm^3 (1 mark)

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II) 8cm^3 (1 mark)

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(ii) The volume of the acid used if the time taken for the cross to be obscured/invisible is:

I) 40 seconds (1 mark)

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.....
II) 43 seconds (1 mark)
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Procedure 2

Using a 10 cm³ measuring cylinder, place 10 cm³ of solution T into a 250 ml volumetric flask. Add about 200 cm³ of distilled water. Shake well. Add more distilled water to top up to the mark. Label this solution U. Fill the burette with solution U. Using a pipette and pipette filler, pipette 25 cm³ of solution S into a conical flask. Add 3 drops of Phenolphthalein indicator and titrate with solution U.

- Record your results in the table.
- Repeat the titration two more times and complete the table.

Table 2

	I	II	III
Final burette reading (cm ³)			
Initial burette reading (cm ³)			
Volume of solution U (cm ³) added			

(4 marks)

a) Determine the:-

(I) Average volume of solution U used. (1 mark)

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(II) Moles of the acid in the average volume of solution U used. (2 marks)

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(IV) Concentration of solution S in moles per litre.

(2 marks)

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2. (a) Put a spatula end-full of solid Q into a boiling tube and add about 10cm³ of distilled water. Shake the mixture well. Divide the resultant solution into 4 equal portions.

Observations	Inferences
(½ mark)	(1 mark)

- (b) (i) The solution is suspected to contain **ammonium ions**. Using **calcium hydroxide solid** and **red litmus paper** provided, describe how you would confirm presence of the **ammonium ions**.

Description	Expected observations
(1 mark)	(½ mark)

- (ii) Carry out the actual test as described in (b) (i) above.

Observations	Inferences
(1 mark)	(½ mark)

(c) To the second portion, add 4 drops of hydrogen peroxide solution. Test the gas produced using a glowing splint.

Observations	Inferences
(1 mark)	(1 mark)

(d) (i) The solution is also suspected to contain **sulphite ions**. Using **Barium nitrate solution** and **dilute hydrochloric acid** solution, describe how you would confirm presence of the **sulphite ions**.

Description	Expected observations
(1 mark)	(1 mark)

(ii) Carry out the actual test as described in (d) (i) above.

Observations	Inferences
(1 mark)	(½ mark)

3. You are provided with solid R. Carry out the tests below and record your observations and inferences in the spaces provided.

(i) Place one third of solid R on a metallic spatula. Burn it in a non-luminous flame of the Bunsen burner.

Observation	Inference
(1 mark)	(1 mark)

(ii) Place the remaining solid in a test-tube. Add about 6cm^3 of distilled water and shake the mixture well. Retain the solution for the next procedure.

Observation	Inference
(1/2 mark)	(1/2 mark)

(I) To about 2cm^3 of the solution, add 2 drops of acidified potassium manganate (VII).

Observation	Inference
(1 mark)	(1 mark)

(II) To about 1cm^3 of the solution, add 3 drops of acidified potassium dichromate (VI) and warm.

Observation	Inference
(1/2 mark)	(1/2 mark)

(III) To about 2cm^3 of the solution, add 1g of sodium hydrogen carbonate.

Observation	Inference
(1/2 mark)	(1/2 mark)