

Name.....

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School.....

Date .....

Candidate's Signature.....



**SERIES 35 EXAMS**

233/3

**CHEMISTRY**

Paper 3

**INSTRUCTIONS TO CANDIDATES**

- Answer **ALL** questions in the spaces provided in this question paper.
- You are **NOT** allowed to start working with the apparatus for the first 15 minutes of the 2 ¼ 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 electronic calculators may be used.

**FOR EXAMINER'S USE ONLY**

<b>QUESTION</b>	<b>MAXIMUM MARKS</b>	<b>CANDIDATE'S SCORE</b>
1	12	
2	13	
3	15	
<b>Total score</b>	<b>40</b>	

*This paper consists of 8 printed pages.  
Candidates should check the question paper to ensure that all pages are printed as indicated and no questions are missing*

1. **You are provided with :-**

- Solid A which is 3.0g sodium ethanedioate.
- Solution B which is 0.02M potassium manganate (VII)
- Solution C which is 1.0M sulphuric (VI) acid

You are required to determine the solubility of solid A at room temperature

**PROCEDURE**

- a) Place 3.0g of the solid A into a dry 250cm<sup>3</sup> conical flask and add 50.0cm<sup>3</sup> of distilled water from a burette. Stir the mixture with a thermometer for a while and record the steady temperature reached.

**Steady temperature reached** \_\_\_\_\_ °C

- b) Warm the mixture to about 60°C while swirling the flask (NOTE : Not all the solid A may dissolve ).Cool the flask using water until the temperature reaches the initial steady temperature. Label this as solution A.
- c) Using the filter paper and funnel filler the mixture into a clean conical flask.
- d) Measure 25.0cm<sup>3</sup> of the filtrate into a 250cm<sup>3</sup> volumetric flask. Add distilled water up to the mark. Label this as solution D.
- e) Pipette 25.0cm<sup>3</sup> of solution D into a clean conical flask.To this solution add 20.cm<sup>3</sup> of 1.0M sulphuric (VI) acid solution C using a measuring cylinder
- f) Heat the mixture to about 70°C and titrate with solution B while the solution is still hot.The end point is marked by appearance of pink colouration of mixture.

Record your readings in the table below.

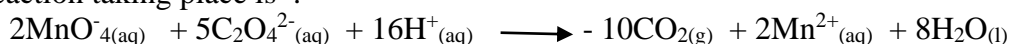
- g) Repeat ( e) to (f) and fill the table

**Table 1**

	I	II	III
<b>Final burette reading ( cm<sup>3</sup>)</b>			
<b>Initial burette reading ( cm<sup>3</sup>)</b>			
<b>Volume of solution B used (cm<sup>3</sup>)</b>			

- a) Determine average volume of solution B used. (1mk)

- b) The reaction taking place is :-



- i) Calculate the number of moles of the ethanedioate ions that reacted with the manganate (VII) ions in the 25cm<sup>3</sup> of solution D. (2mks)
- ii) Calculate the number of moles of ethanoate ions in 25cm<sup>3</sup> of the filtrate (2mks)
- iii) Calculate the solubility of sodium ethanedioate Na<sub>2</sub>C<sub>2</sub>O<sub>4</sub> in g/100g water (Na = 23.0; O = 16.0 ; C = 12.0) (2mks)

2. **You are provided with :**

Solution E which is 2M HCl

Solution F which is 0.15M sodium thiosulphate

In this experiment you are required to determine the effect of concentration on the rate of reaction between sodium the thiosulphate and dilute hydrochloric acid.

**Procedure**

Place solution E into a clean burette using of a measuring cylinder pour 50cm<sup>3</sup> of solution F into a 100cm<sup>3</sup> beaker. Mark a cross (X) into a filter paper using a pencil. On the filter paper, place the beaker containing the 50cm<sup>3</sup> of 0.15M sodium thiosulphate.

From the burette; measure 5cm<sup>3</sup> of solution E into the 50cm<sup>3</sup> of solution F in the beaker.

Swirl the mixture and start the stop watch immediately. Look through the solution in the beaker at the cross ( x) and note the time taken for the cross to become invisible

Record this time as shown in the table below.

Repeat the procedure using diluted solution F with the respective volumes adjusted with labelled water as shown in the table and complete table II

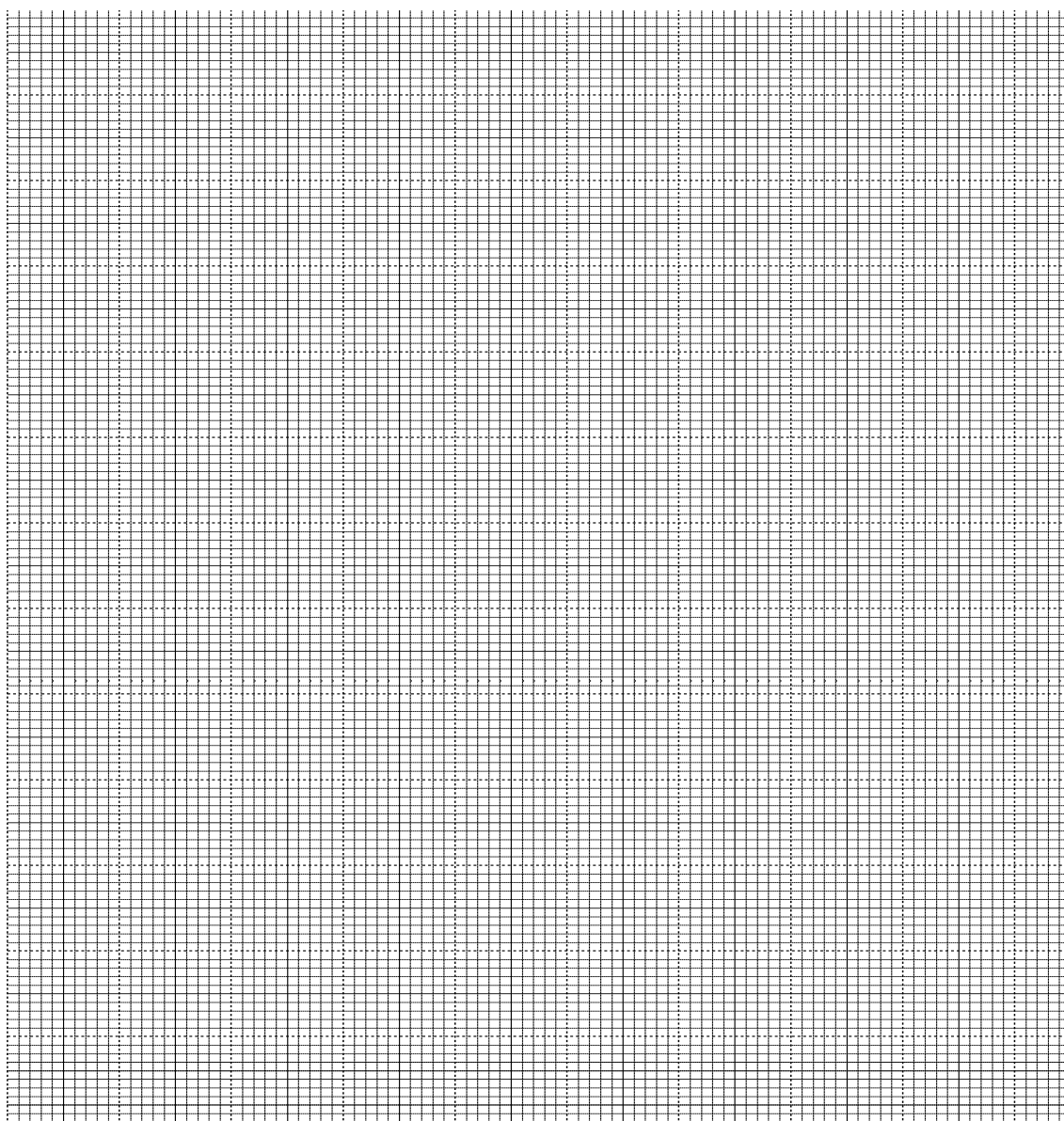
Equation for the reaction



**TABLE II**

Volume of thiosulphate of F cm <sup>3</sup>	Volume of water (cm <sup>3</sup> )	Volume of Hydrochloric acid E (cm <sup>3</sup> )	Time t(s)	Reciprocal of time <sup>1</sup> / <sub>t</sub>
50	0	5		
40	10	5		
30	20	5		
20	30	5		
10	40	5		

- b) i) Plot a graph of thiosulphat ions S<sub>2</sub>O<sub>3</sub><sup>2-</sup> against <sup>1</sup>/<sub>t</sub>. (4mks)  
(3mks)



- ii) From your graph determine the rate of reaction at volume V = 30cm<sup>3</sup> (2mks)

- iii) Explain how the concentration of the thiosulphate ions F affects its rate of reaction with dilute hydrochloric acid. (2mks)

**PART I**

3. You are provided with solid G. Carry out the test below. Write your observations and inferences in the spaces provided.

- a) Place about one third of solid G in a clean dry test – tube and heat it strongly

Observation	Inferences
(1mk)	(1mk)

- b) Place the remaining solid G in a boiling tube. Add about 10cm<sup>3</sup> of distilled water. Shake the mixture thoroughly for about one minute. Filter and divide the filtrate into four portions.

Observation	Inferences
(1mk)	(1mk)

- i) To the first portion, add 2 drops of phenolphthalein indicator

Observation	Inferences
(1mk)	(1mk)

- ii) To the second portion, add 2cm<sup>3</sup> of dilute hydrochloric acid (solution E)

Observation	Inferences

(1mk)	(1mk)
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iii) To the third portion, add 5cm<sup>3</sup> of aqueous sodium sulphate

Observation	Inferences
(1mk)	(2mks)

iv) To the fourth portion, add dilute sodium hydroxide dropwise until in excess.

Observation	Inferences
(1mk)	(1mk)

**PART II**

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

a) i) Scoop a little of solid H with a clean spatula and ignite using a bunsen burner

Observation	Inferences
(1mk)	(1mk)

ii) Put the remaining solid into a boiling tube, add about 10cm<sup>3</sup> water, retain the contents.

Observation	Inferences

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(½ mk)

(½ mk)

- b) Take two portions of about 2cm<sup>3</sup> of the contents in a(ii)  
i) To the first portion the solid sodium carbonate

Observation	Inferences
(½ mk)	(½ mk)

- ii) To the second portion add 2 – 3 drops of acidified potassium manganate VII.

Observation	Inferences
(½ mk)	(½ mk)