Name…… **Index No……/…….**

School…… **Date ……..…**

Candidate's Signature……

233/3
CHEMISTRY
Paper 3
Time: 2 ¼ Hours

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

QUESTION	MAXIMUM MARKS	CANDIDATE'S SCORE
1	12	
2	13	
3	15	
Total score	**40**	

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

of

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^3 conical flask and add 50.0cm^3 of distilled water from a burette. Stir the mixture with a thermometer for a while and record the steady temperature reached.

Steady temperature reached **ºC**

b) Warm the mixture to about 60ºC 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^3 of the filtrate into a 250cm^3 volumetric flask. Add distilled water up to the mark. Label this as solution D.

e) Pipette 25.0Cm3 of solution D into a clean conical flask.To this solution add 20.cm^3 of 1.0M sulphuric (VI) acid solution C using a measuring cylinder

f) Heat the mixture to about 70ºC 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
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of solution B used (cm^3)			

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

b) The reaction taking place is :-

$$2MnO^-_{4(aq)} + 5C_2O_4^{2-}{}_{(aq)} + 16H^+_{(aq)} \rightarrow 10CO_{2(g)} + 2Mn^{2+}_{(aq)} + 8H_2O_{(l)}$$

i) Calculate the number of moles of the ethanedioate ions that reacted with the managanate (VII) ions in the 25cm^3 of solution D. (2mks)

ii) Calculate the number of moles of ethanoate ions in 25cm^3 of the filtrate (2mks)

iii) Calculate the solubility of sodium ethanadioate $Na_2C_2O_4$ 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 thiosulpahte and dilute hydrochloric acid.

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

From the burette; measure 5cm^3 of solution E into the 50cm^3 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 inviscible

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

$S_2O_3^{2-}{}_{(aq)} + 2H^+{}_{(aq)} \quad SO_{2(g)} + H_2O_{(l)} + S_{(s)}$

TABLE II

Volume of thiosulphate of F cm^3	**Volume of water (cm^3)**	**Volume of Hydrochloric acid E (cm^3)**	**Time $t_{(s)}$**	**Reciprocal of time $^1/_t$**
50	0	5		
40	10	5		
30	20	5		
20	30	5		
10	40	5		

(4mks)

b) i) Plot a graph of thiosulphat ions $S_2O_3^{2-}$ against $^1/_t$. (3mks)

ii) From your graph determine the rate of reaction at volume V = $30cm^3$ (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 building tube. Add about $10cm^3$ 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 $2cm^3$ of dilute hydrochloric acid(solution E)

Observation	Inferences
(1mk)	(1mk)

iii) To the third portion, add $5cm^3$ 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 $10cm^3$ water, retain the contents.

Observation	Inferences
(½ mk	(½ mk

b) Take two portions of about $2cm^3$ 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

END