NAME…….. INDEX NO…….....

233/3 **CANDIDATE'S SIGN……..……..**
CHEMISTRY
PAPER 3 **DATE……..……**
(PRACTICAL)
TIME: 2¼ HOURS

INSTRUCTIONS TO CANDIDATES:

- Answer **ALL** questions in the spaces provided for each question.
- You are **NOT** allowed to start working with the apparatus for the first 15 minutes of 2¼ hours. This time enables you to read the questions and ensure 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 consists of **6** printed pages. Ensure that the question paper has all the pages and no questions are missing.

FOR EXAMINER'S USE ONLY:

QUESTION	MAXIMUM SCORE	CANDIDATES SCORE
1	19	
2	12	
3	09	
TOTAL SCORE	40	

1. You are provided with
   - **Solution A**, a saturated solution of sodium ethanedioate, $Na_2C_2O_4$ (sodium oxalate).
   - **Solution B**, aqueous potassium manganate (VII).
   - **Solution C**, 0.1M ammonium iron (II) sulphate.
   - 1M sulphuric (VI) acid.

   You are required to:
   (a) Standardize **solution B** using **solution C**.
   (b) Determine the **solubility of A** at room temperature.

   Procedure I
   Fill the burette with **solution B**.
   Pipette 25cm³ of **solution C** into a conical flask and add 5cm³ of 1M sulphuric (VI) acid using a measuring cylinder.
   Titrate **solution C** using **solution B** until a **permanent pale pink** colour **just** appears.
   Repeat the procedure and complete **table A** below.

Table A	I	II	III	
Final burette reading (cm³)				
Initial burette reading (cm³)				
Volume of B used (cm³)				(4mks)

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

(b) The reaction between manganate (VI) and iron (II) ions is shown by the ionic equation.

$$MnO_{4(aq)}^{-} + 5Fe_{(aq)}^{2+} + 8H_{(aq)}^{+} \rightarrow Mn_{(aq)}^{2+} + 5Fe_{(aq)}^{3+} + 3H_2O_{(l)}$$

(i) Calculate the number of moles of C used. (1mk)

(ii) Calculate the number of moles of B used. (1mk)

(iii) Calculate the number of moles of B per litre. (1mk)

Procedure II

Measure the temperature of **solution A** and record it in the space provided below.
Using a measuring cylinder, measure **2cm³ of solution A** into a conical flask and **dilute** it by adding 75cm³ of distilled water. **Label this solution D**.
Fill the burette with **solution B**. Using pipette filler pipette 25cm³ of solution D into a conical flask and add 5cm³ of **1M sulphuric acid** using a measuring cylinder.
Heat the solution to about 60°C and titrate while still hot with B until a **permanent pink colour just** appears. Record your results in the **table B** below. **Repeat** this procedure to complete the table.

Temperature of solution A _____ °C.

Table B	I	II	III	
Final burette reading (cm³)				
Initial burette reading (cm³)				
Volume of B used (cm³)				(4mks)

(c) (i) Calculate the average volume of B used. (1mk)

The reaction between manganate (VII) ions and ethanedioate ions is given by the ionic equation below.

$$2MnO_{4(aq)}^{-} + 5C_2O_{4(aq)}^{2-} + 16H_{(aq)}^{+} \rightarrow 2Mn_{(aq)}^{2+} + 10CO_{2(g)} + 8H_2O_{(l)}$$

(ii) Calculate the number of moles of manganate (VII) ions in average volume of B used. (1mk)

(iii) Calculate the number of moles of ethandioate ions in 25cm³ of solution D. (1mk)

(iv) Calculate the number of moles of ethandioate ions in 100cm³ of solution D. (1mk)

(v) How many moles of ethandioate ions are in 25cm³ of solution A used? (1mk)

(vi) Given that the molecular formula of sodium ethandioate is $Na_2C_2O_4$, calculate its solubility in grams per 100g of water at room temperature (Na = 23, C = 12, O = 16). (Assume the density of solution is 1g/cm³). (2mks)

2. You are provided with **solid G**. Carry out the tests below. Write your observations and inferences in the spaces provided.

(a) Place about **half** of solid G in a clean dry test tube and heat it strongly.

Observation	Inference
(1mk)	(1mk)

(b) Place the **remaining** solid G in a boiling tube. Add **10cm³** of distilled water. Shake the mixture for 1 minute. **Filter** the mixture.

Observation	Inference
(1mk)	(1mk)

(i) **Dip** blue and red litmus papers into the filtrate.

Observation	Inference
(1mk)	(1mk)

(ii) To about 2cm³ of **filtrate**, add 3 drops of **dilute hydrochloric acid**.

Observation	Inference
(1mk)	(1mk)

(iii) To about 2cm³ of **filtrate**, add drops of 2M sulphuric (VI) acid.

Observation	Inference
(1mk)	(1mk)

(iv) To about 1cm³ of filtrate, add 5cm³ of dilute sodium hydroxide **(excess)**.

Observation	Inference

(1mk)	(1mk)

3. You are provided with **liquid F**. Carry out the tests below and write your observations and Inferences in the spaces provided.

(a) Place **one drop** of liquid F on a metallic spatula and **burn** it using a Bunsen burner.

Observation	Inference
(1mk)	(1mk)

(b) Place about 2cm³ of the **remaining** liquid F in a test tube. Add 3cm³ of distilled water and shake the mixture well.

Observation	Inference
(½mk)	(½mk)

(c) (i) To about 2cm³ of the remaining liquid F, add **a small amount** of sodium hydrogen carbonate.

Observation	Inference
(1mk)	(1mk)

(ii) To about 1cm³ of liquid F, add 1cm³ of **acidified potassium dichromate (VI)**.

Observation	Inference
(1mk)	(1mk)

(iii) To about 2cm³ of the mixture, add two drops of **bromine water**.

Observation	Inference
(1mk)	(1mk)