NAME………………………………………….. INDEX NO…………………......................

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

SERIES 7 EXAMS

INSTRUCTIONS TO CANDIDATES:
1. Answer **ALL** questions in the spaces provided for each question.
2. Use the first 15 minutes to read through your paper and ensure you have all the chemicals and apparatus needed.
3. All working must be clearly shown where necessary.
4. Mathematical tables and silent electronic calculators may be used.
5. This paper consists of **8** printed pages.
6. Check the question paper to ascertain that all the pages are printed and that no questions are missing.

FOR EXAMINER'S USE ONLY:

QUESTION	MAXIMUM SCORE	CANDIDATES SCORE
1	12	
2	10	
3	18	
TOTAL SCORE	40	

1. You are provided with:-
    - 0.08M sodium hydroxide, solution A.
    - $H_2C_2O_4.\chi H_2O$ acid, solution B containing 15.75 grams in 250cm³ of solution.
    - 2.0g of solid anhydrous sodium carbonate, solid D.

    You are required to:-
    (a) Prepare a dilute solution of the acid, solution C.
    (b) Determine:-
         (i)   the concentration of solution B in moles per litre.
   (ii) the number of moles of water of crystallization, X.

    Procedure
    - Using a 25ml measuring cylinder, measure 50cm³ of the acid, solution B and place it in a 250ml beaker.
    - Add all the solid D at once to the acid in the beaker and stir with a glass rod until effervescence stops.
    - Transfer the contents of the beaker carefully into a 250ml volumetric flask.
    - Add distilled water with shaking and top up to the mark.
    - Label this solution as solution C.
    - Fill a burette with solution A.
    - Using a clean pipette and a pipette filler, place 25cm³ of solution C into a 250ml conical flask.
    - Add three drops of phenolphthalein indicator and titrate using solution A.
    - Record your results in the table below.
    - Repeat the titration two more times to obtain consistent results.

    Volume of pipette used = _____ cm³.

	1	2	3	
Final burette reading (cm³)				
Initial burette reading (cm³)				
Volume of base, solution A used (cm³)				(3mks)

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

         (ii) number of moles of sodium hydroxide, solution A in the average volume used. (1mk)

(b)   Given the equation for the reaction:

$$H_2C_2O_4.XH_2O_{(aq)} + 2NaOH_{(aq)} \rightarrow Na_2C_2O_{4(aq)} + 2H_2O_{(l0)} + XH_2O_{(l)}$$
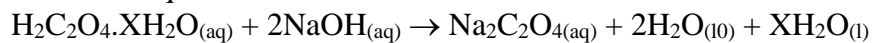
Determine the:

(i)   the number of moles of the acid, present in 25cm³ of solution C.   (1mk)

(ii)   number of moles of acid, present in 250cm³ of solution C.   (1mk)

(c)   Calculate the

(i)   number of moles of sodium carbonate that reacted.
           (Na = 23, C = 12, 0 = 16, H = 1)   (1mk)

(ii)   number of moles of acid B, that reacted with the carbonate.
           (Reacting ratio of acid: carbonate = 1:1).   (1mk)

(iii)   Concentration of the original acid, solution B.   (2mks)

    (d)   Determine the:-

        (i)   molar mass of the acid.   (1mk)

        (ii)   Value of X in the acid, $H_2C_2O_4.XH_2O$.   (1mk)

2.   You are provided with:

    (a)   Solution K (2.0M hydrochoric acid).

    (b)   Solution L (0.15M sodium thiosulphate).

You are required to:

Determine the rate of reaction between sodium thiosulphate and hydrochloric acid solution A.

Procedure I

Using a measuring cylinder measure 10cm³ of solution L into a clean 100ml glass beaker. Place it together with its content on a white piece of paper with across (X) written with a pencil. Measure the temperature of solution L. Record it as shown in the table I below. Using a clean 10ml measuring cylinder, measure 5cm³ of solution. Add this to the contents of the beaker above and immediately start the stop watch. Record the time it will take for the cross (X) to become invisible when viewed above the reaction mixture in the beaker. Wash the beaker and repeat the experiment at different temperatures indicated, warm sodium thiosulphate solution B to the stated temperature before adding hydrochloric acid solution.

    (a)   (i)   Table I

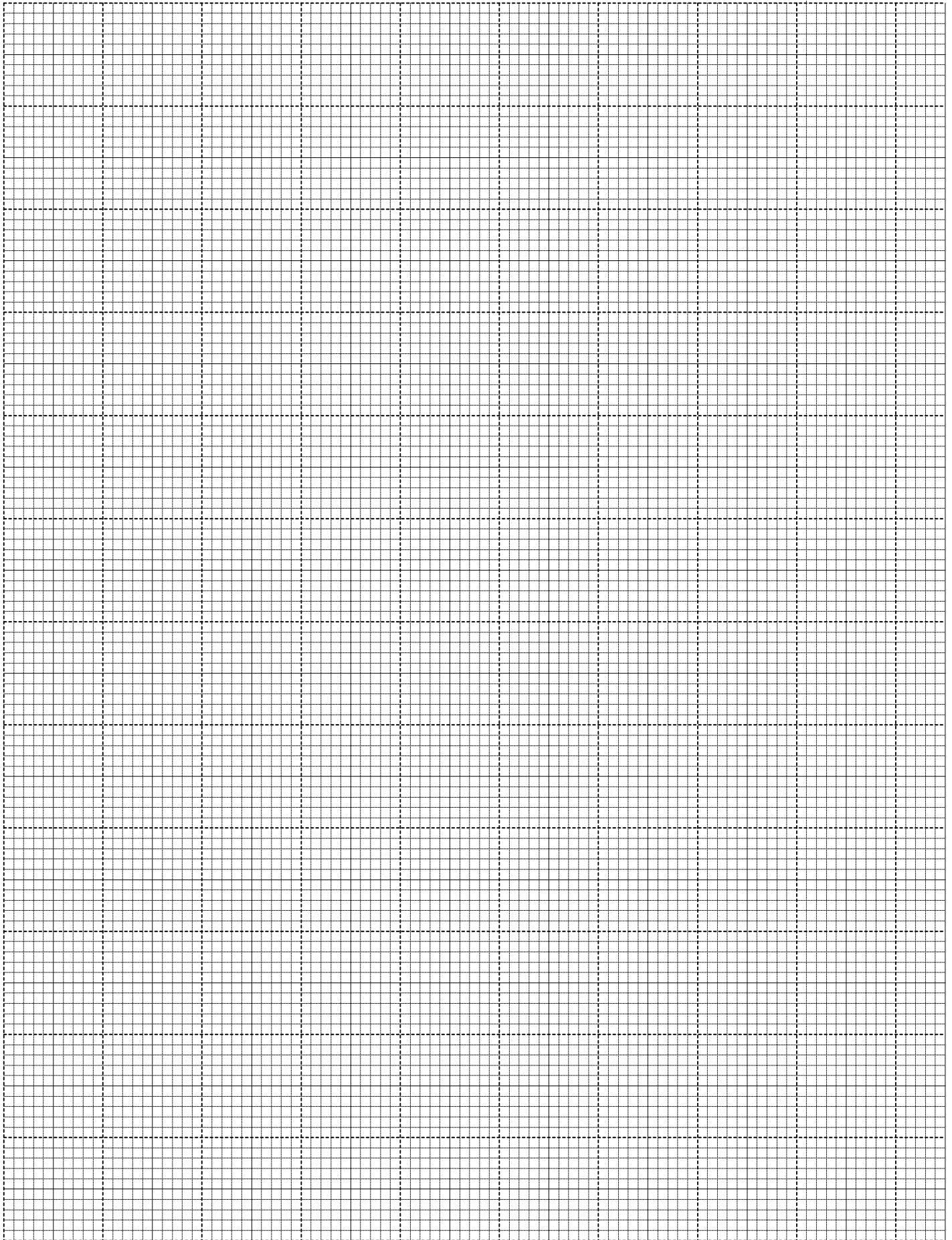| Experiment number	1	2	3	4	5	
Volume of HCl acid solution K (cm³)	5	5	5	5	5	
Volume of $Na_2S_2O_3$ solution L (cm³)	10	10	10	10	10	
Temperature °C of $Na_2S_2O_3$ solution L	Room Temp.	30	40	50	60	
Time in seconds						
Reciprocal of time $\left(\dfrac{1}{t}\sec^{-1}\right)$						(4mks)

        (ii)   On the graph paper provided; plot a graph of reciprocal of time $\dfrac{1}{t}$ against

temperature.   (3mks)

      (iii)   Comment on the effect of change of temperature on the reaction.   (1mk)

      (iv)   Use your graph to determine

              I   The time taken by the cross (X) to become invisible when the
                     temperature is 48°C.   (1mk)

              II   The temperature at which the rate of reaction is 0.05 sec^{-1}.   (1mk)

3.   I   You are provided with solid X. Carry out the tests below and record your observation and inferences in the spaces provided.

      (a)   Heat about half of solid X in a dry test tube test any gas produced.

Observation	Inference
(1mk)	(1mk)

      (b)   (i)   Add the remaining solid X in about 8cm³ of distilled water in a boiling tube and shake. Filter the mixture; keep both the filtrate and residue.
                     Divide the filtrate into four portions.

Observation	Inference
(1mk)	(1½mks)

(ii) To the first portion of filtrate, add sodium hydroxide solution drop wise until in excess.

Observation	Inference
(½mk)	(1mk)

(iii) To the second portion of the filtrate add 3 drops of lead (II) nitrate solution then warm the mixture.

Observation	Inference
(½mk)	(1mk)

(iv) To the third portion of filtrate, add 3 drops of barium chloride solution followed by dilute hydrochloric acid.

Observation	Inference
(½mk)	(1mk)

(v) To the fourth portion of the filtrate add 2 or 3 drops of acidified potassium manganate (VII) solution.

Observation	Inference
(½mk)	(½mk)

3.   II   You are provided with liquid Z. Carry out the tests below.

(a) Place about 1cm³ of liquid Z on a watch glass and light using a burning splint.

Observation	Inference

(½mk)	(½mk)

(b)   Place about 5cm³ of liquid Z into a clean boiling tube. Add 3cm³ of distilled water and swirl the mixture.

Observation	Inference
(½mk)	(½mk)

(c)   (i)   Divide the solution above into five portions to the first portion, test with litmus papers.

Observation	Inference
(1mk)	(1mk)

(ii)   To the second portion, add 2-3 drops of universal indicator.

Observation	Inference
(½mk)	(1mk)

(iii)   To the third portion, add a little sodium carbonate.

Observation	Inference
(½mk)	(½mk)

(iv)   To the fourth portion, add 2-3 drops of acidified potassium dichromate (VI) solution and then warm.

Observation	Inference
(½mk)	(1mk)