**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 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**

1. Place 3.0g of the solid A into a dry 250cm3 conical flask and add 50.0cm3 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 25.0cm3 of the filtrate into a 250cm3 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.cm3 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 ( cm3)** |  |  |  |
| **Initial burette reading ( cm3)** |  |  |  |
| **Volume of solution B used (cm3)** |  |  |  |

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

b) The reaction taking place is :-

2MnO-4(aq) + 5C2O42-(aq) + 16H+(aq)  - 10CO2(g) + 2Mn2+(aq) + 8H2O(l)

i) Calculate the number of moles of the ethanedioate ions that reacted with the managanate (VII) ions in the 25cm3 of solution D. (2mks)

ii) Calculate the number of moles of ethanoate ions in 25cm3 of the filtrate

(2mks)

iii) Calculate the solubility of sodium ethanadioate Na2C2O4 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 50cm3 of solution F into a 100cm3 beaker. Mark a cross (X) into a filter paper using a pencil. On the filter paper, place the beaker containing the 50cm3 of 0.15M sodium thiosulphate.

From the burette; measure 5cm3 of solution E into the 50cm3 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

S2O32-(aq) + 2H+(aq) SO2(g) + H2O(l) + S(s)

**TABLE II**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Volume of thiosulphate of F cm3** | **Volume of water (cm3)** | **Volume of Hydrochloric acid E (cm3)** | **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 S2O32- against 1/t. (3mks)

![](data:application/x-msmetafile;base64,)

ii) From your graph determine the rate of reaction at volume V = 30cm3 (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.

1. 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 10cm3 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 2cm3 of dilute hydrochloric acid(solution E)

|  |  |
| --- | --- |
| **Observation** | **Inferences** |
| (1mk) | (1mk) |

iii) To the third portion, add 5cm3 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 10cm3 water, retain the

contents.

|  |  |
| --- | --- |
| **Observation** | **Inferences** |
| (½ mk | (½ mk |

b) Take two portions of about 2cm3 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***