**NAME: …………………………………………………………… INDEX NO: ……………....……………**

**SCHOOL ……………………………………………………… CANDIDATE’S SIGNATURE………..**

**DATE: ……………………………………..……..………….**

**233/3**

**CHEMISTRY**

**PAPER 3**

**Time: 2 Hours**

**INSTRUCTIONS TO THE CANDIDATES**

* *You are not allowed to start working with the apparatus in the first 15minutes of the 2 ¼ ours allowed for this paper. This time is to enable you ensure that you have all the apparatus and reagents required.*
* *Answer* ***ALL the*** *questions in this question paper in the spaces provided.*
* *Mathematical tables and silent non-programmable calculators may be used*

**FOR EXAMINER’S USE ONLY**

|  |  |  |
| --- | --- | --- |
| **QUESTION** | **MAXIMUM SCORE** | **CANDIDATE’S SCORE** |
| 1 | **22** |  |
| 2 | **09** |  |
| 3 | **09** |  |
| **Total Score** | **40** |  |

*This paper consists of 5 printed pages. Candidates should check to ascertain that all pages are printed as indicated and that no questions are missing.*

1. You are provided with
   * Magnesium ribbon, **solid A**
   * **0.5M** aqueous sulphuric(vi)acid, **solution B**
   * **0.3M** aqueous sodium hydroxide, **solution D**

You are required to determine the molar heat of reaction of sulphuric(vi)acid with magnesium.

**Procedure I**

Using a burette place 40cm3 of solution **B** in to a 100ml beaker.Measure the temperature of solution **B** in the 100ml beaker and record it in **table I**. Put the magnesium ribbon in the solution in the 100ml beaker and immediately start a stop watch clock. Stir the solution continuously with the thermometer making sure that the magnesium ribbon remains in the solution as it reacts. Measure the temperature after every 30 seconds and record the values in the **table I**. Keep the resulting mixture for use in procedure II

**Table I**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Time (seconds)** | **0** | **30** | **60** | **90** | **120** | **150** | **180** | **210** | **240** | **270** | **300** |
| **Temperature (OC)** |  |  |  |  |  |  |  |  |  |  |  |

**(**4mks)

**(i)** Plot the graph of temperature (vertical axis) against time (3mks)

(ii) From the graph determine the maximum change in temperature, ∆T. (1mk)

(iii) Calculate the heat change during the reaction of sulphuric (vi) acid with magnesium(Assume the specific heat capacity of the solution is 4.2Jg -1 k -1 and density of the solution is 1.0gcm -3) (2mks)

**ProcedureII**

Transfer all the mixture obtained in procedure I into a 250ml volumetric flask. Rinse the beaker and add to the volumetric flask. Add more distilled water to make the volume to the mark. Label this **solution C.**

Empty the burette and fill it with **solution C.** Using a pipette and pipette filter place 25.0cm3 of **solution D** into a 250ml conical flask. Add two drops of phenolphthalein indicator and titrate **solution D** with **solution C**. Record your results in table II. Repeat the titration two more times and complete table II

(b)

|  |  |  |  |
| --- | --- | --- | --- |
| **Table II** | **I** | **II** | **III** |
| Final burette reading |  |  |  |
| Initial burette reading |  |  |  |
| Volume of solution C used (cm3) |  |  |  |

What is the average volume of **solution C** used? (1mk)

(c) Calculate the number of moles of sulphuric (vi) acid in the

(i) Volume of solution **C** used (2mks)

(ii) 250cm3 of **solution C** (1mk)

(iii) 40cm3 of **solution B.** (1mk)

(d) Determine moles of sulphuric (vi) acid that reacted with magnesium (1mk)

(e) Determine the molar heat of reaction of sulphuric (vi) acid with magnesium (2mks)

1. You are provided with solid **E**. Carry out the test below and record your observations and inferences in the spaces provided.

a) Add about 2cm3 of 2M hydrochloric acid to all the solid **E** provided in a boiling tube. Test the gas

by bringing the glass rod dipped in calcium hydroxide solution to the mouth of the boiling tube.

|  |  |
| --- | --- |
| **OBSERVATIONS** | **INFERENCE** |
| (2mks) | (1mk) |

1. Filter the mixture obtained in (a) above into a test tube. Add about 4cm3 of distilled water into the filtrate and divide the resultant solution into three portions.
2. To the first portion add 2M aqueous sodium hydroxide dropwise till in excess.

|  |  |
| --- | --- |
| **OBSERVATIONS** | **INFERENCE** |
| (1mk) | (1mk) |

(ii) To the second portion add 2M aqueous ammonia dropwise till in excess.

|  |  |
| --- | --- |
| **OBSERVATIONS** | **INFERENCE** |
| (1mk) | (1mk) |

(iii) To the third portion add all the solid **F** provided.

|  |  |
| --- | --- |
| **OBSERVATIONS** | **INFERENCE** |
| (1mk) | (1mk) |

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

a) Place half of the solid provided in a clean metallic spatula and ignite in the non-luminous flame of Bunsen burner.

|  |  |
| --- | --- |
| **OBSERVATIONS** | **INFERENCE** |
| (1mk) | (1mk) |

1. Add about 5cm3 of distilled water to the remaining portion of solid **G** in a boiling tube and shake to dissolve. Divide the resultant solution into three portions for the tests below.

(i) To the first portion, add three drops of acidified potassium dichromate (vi) solution and warm.

|  |  |
| --- | --- |
| **OBSERVATIONS** | **INFERENCE** |
| (1mk) | (2mks) |

(ii) To the second portion, add two drops of methyl orange solution.

|  |  |
| --- | --- |
| **OBSERVATIONS** | **INFERENCE** |
| (1mk) | (1mk) |

(iii) To the third portion add a small amount of solid sodium carbonate.

|  |  |
| --- | --- |
| **OBSERVATIONS** | **INFERENCE** |
| (1mk) | (1mk) |