**Term 2 - 2022**

**CHEMISTRY (233/3)**

**PAPER 3**

**FORM FOUR (4)**

**Time: 2**¼ **Hours**

**Name**: …………………………………………………………. **Adm** **No**: ……………….

**School**: ……………………………………………………….. **Class**: …………………..

**Signature**: …………………………………………………….. **Date**: …………………...

Instruction to Candidates:

1. *Write your name and class in the spaces provided on this page above*
2. *Sign and write the date of examination in the spaces on this page above.*
3. *Answer ALL the questions in the spaces provided after EACH question in the question-paper.*
4. *You are NOT allowed to start working with the apparatus for the first 15minutes of the 2*¼ *hours allowed for this paper. This time is to enable you read the question-paper and make sure you have ALL the chemicals and apparatus that you may need.*
5. *Mathematical tables and silent electronic calculator may be used.*
6. *ALL working MUST be clearly shown where necessary.*
7. *This paper consists of 9 printed pages.*
8. *Candidates should check the question-paper to ascertain that ALL the pages are printed as indicated and that no questions are missing.*

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| --- | --- | --- |
| Questions | Maximum Score | Candidate’s Score |
| 1 | 25 |  |
| 2 | 15 |  |
| Total Score | 40 |  |

QUESTION 1.

You are provided with:

* Sulphuric acid solution A
* 0.5M sodium hydroxide solution B
* Magnessium ribbon labelled C

You are required to:-

* Investigate the rate of reaction between solution A and metal C
* Determine the concentration of sulphuric acid in moles per litre

Procedure I

(i) Using a ruler, make 6 marks at 2cm length interval on the Magnesium ribbon provided. Cut the magnesium ribbon into 2 cm long pieces.

(ii) Transfer 50cm3 of acid solution using a measuring cylinder into a clean dry 100ml beaker.

Place 2cm length piece of magnesium ribbon into the beaker with the acid and immediately

start the stop watch/clock. Shake gently and note the time taken for the piece of

magnesium ribbon to react completely.

(iii) Record in table I below. Place another piece of magnesium ribbon (2cm) to the same

solution and again note the time taken.

(iv) Repeat the procedure until all six pieces of magnesium ribbon have reacted with

the same solution initially placed in the beaker

(v) Complete the table I below:

Note: Keep the solution obtained in this experiment for use in procedure II

(a) Table I

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Piece of magnesium added | 1 | 2 | 3 | 4 | 5 | 6 |
| Length of magnesium added (cm) | 2 | 4 | 6 | 8 | 10 | 12 |
| Time taken t(second) |  |  |  |  |  |  |
| Reciprocal of time  1/t(s-1) |  |  |  |  |  |  |

(4 marks)

(b) (i) On the grid provided, plot a graph of total length of magnesium ribbon added against reciprocal of time (1/t) for the reaction to go to completion. (3 marks)

(ii) From your graph, determine the time taken when 4.5cm length of magnesium ribbon

to react completely. (1 mark)

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(iii) Write a chemical equation for the reaction between magnesium and sulphuric acid.

(1 mark)

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(iv) Given that the mass of solid V, which reacted was 0.12g and that atomic mass of

magnesium is 24.0g, determine the number of moles of sulphuric (VI) acid that were used

up during the reaction. (1 mark)

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(v) From your graph, state and explain the relationship between the length of magnesium

ribbon and the reciprocal of time (1/t) (1 mark)

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Procedure II

Place all the solution obtained in procedure I in a clean 100ml measuring cylinder.

Add distilled water to make 100cm3 of solution. Transfer all the solution into a beaker

and shake well. Label it solution D. Fill the burette with solution B. Pipette 25.0cm3

of solution D into a conical flask. Add 2-3drops of phenolphthalein indicator and titrate

with solution. Record your results in the table II below. Repeat the titration two more times

Table II

|  |  |  |  |
| --- | --- | --- | --- |
| Titration | I | II | III |
| Final burette reading (cm3) |  |  |  |
| Initial burette reading (cm3) |  |  |  |
| Volume of solution B (cm3) used |  |  |  |

(4 marks)

(c) (i) Determine the average volume of solution B used . (1 mark)

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(ii) Calculate the number of moles of sodium hydroxide solution B used. (1 mark)

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(d) Calculate:

(i) The number of moles of sulphuric acid in 25.0cm3 of solution D. (1 mark)

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(ii) The number of moles of sulphuric acid in 100cm3 of solution D. (1 mark)

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(e) Determine the total number of moles of sulphuric acid in 50cm3of solution A. (1 mark)

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(f) Calculate the concentration of the original sulphuric acid solution A in moles per litre.

(1 mark)

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**QUESTION 2.**

You are provided with solid E. Carry out the following tests and write your observations and

inferences in the table below:

(a) Place all the solid E in a boiling tube. Add about 15cm3 of distilled water and shake

vigorously for about 2 minutes.

|  |  |
| --- | --- |
| Observations | Inferences |
| ½ mark | 1 mark |

b) Divide the solution into five equal portions in five different clean test tubes.

1. To the first portion, add 2M ammonia solution drop wise until in excess.

|  |  |
| --- | --- |
| Observations | Inferences |
| 1 mark | ½ mark |

ii) To the second portion add 2M Sodium hydroxide solution drop wise until in excess.

|  |  |
| --- | --- |
| Observations | Inferences |
| 1 mark | 1 mark |

iii) To the third portion add 4 drops of 2M Lead (II) nitrate solution.

|  |  |
| --- | --- |
| Observations | Inferences |
| 1 mark | 1 mark |

iv) To the fourth portion, add 4 drops of 0.2M silver nitrate solution.

|  |  |
| --- | --- |
| Observations | Inferences |
| 1 mark | 1 mark |

(v) Clean one end of the glass rod provided. Dip the clean end of the glass rod in the fifth

portion. Remove the end and heat it in the non-luminous part of a Bunsen burner flame. Note the colour of the flame and record below.

|  |  |
| --- | --- |
| Observations | Inferences |
| 1 mark | 1 mark |

**QUESTION 3.**

You are provided with solid F. Carry out the tests below. Write your observations and inferences

in the spaces provided

1. Place about a half of solid F on a metallic spatula and burn it using a Bunsen burner flame.

|  |  |
| --- | --- |
| Observations | Inferences |
| ½ mark | ½ mark |

(b) Place the remaining of solid F in a boiling tube. Add about 10cm3of distilled water and shake the mixture well.

|  |  |
| --- | --- |
| Observations | Inferences |
| 1 mark | 1 mark |

(c) Divide the mixture obtained into three portions.

(i) To the first portion, add a small amount of solid sodium hydrogen carbonate.

|  |  |
| --- | --- |
| Observations | Inferences |
| 1 mark | 1 mark |

(ii) To the second portion, add about 1cm3 of acidified potassium dichromate (VI)

and warm.

|  |  |
| --- | --- |
| Observations | Inferences |
| 1 mark | 1 mark |

(iii) To the third portion, add two drops of acidified potassium magnate (VII)

|  |  |
| --- | --- |
| Observations | Inferences |
| 1 mark | 1 mark |