**Term 1- 2023 OPENER EXAM**

**CHEMISTRY**

**PAPER 3 (233/3)**

**FORM FOUR (4)**

**Time: 2 ¼ Hours**

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

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

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

**INSTRUCTIONS**

\* Write your **name** and the indicated details in the spaces provided on this page.

\* Answer **ALL** questions in the spaces provided in the question paper.

\* You are **NOT** allowed to start working with the apparatus for the first 15 minutes of the 2¼ 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 you may need.

\* Mathematical tables and silent electronic calculators may be used.

\* All working must be clearly shown where necessary.

**For Examiner’s Use Only**

|  |  |  |
| --- | --- | --- |
| **Question** | **Maximum score** | **Candidate's score** |
| 1 | 14 |  |
| 2 | 16 |  |
| 3 | 10 |  |
| **Total score** | **40** |  |

*This paper has 6 printed pages. Candidates should check the questions paper to ascertain that all pages are printed as indicated and that no questions are missing.*

1. **You are provided with:**

* Solution **P** containing 0.2 moles in 1.0 dm3 of HCl
* Solid **Q**, 0.5 g of metal carbonate (MCO3)
* Solution **R**, sodium hydroxide solution containing 4.0 g in one litre of solution.

***You are required to:***

1. Determine the R.A.M of metal M

***Procedure***

Using a 100 ml measuring cylinder, measure 100 cm3 of solution **P** into a clean 250 ml conical flask and add all the 0.5 g of the solid **Q**. Shake well and wait for effervescence to stop. Label this as solution **S**. Pipette 25cm3 of solution **S** into a conical flask and add 2-3 drops of phenolphthalein indicator. Fill the burette with solution **R** and titrate against the solution **S** until the end-point. Repeat the titration two more times and record your results in the table below.

***Table I***

|  |  |  |  |
| --- | --- | --- | --- |
| **Titre** | **1** | **2** | **3** |
| Final burette reading (cm3) |  |  |  |
| Initial burette reading (cm3) |  |  |  |
| Volume of solution **R** used (cm3) |  |  |  |

(4 marks)

(a) Calculate the average volume of solution **R** used. (1 mark)

(b) Calculate the number of moles of sodium hydroxide, solution **R** used. (1 mark)

(c) Calculate the number of moles of HCl in solution **S** used. (1 mark)

(d) Calculate the number of moles of HCl solution **S** in 100 cm3 of solution. (1 mark)

(e) Calculate the number of moles of HCl in the 100cm3 of the original solution **P**.

(1 mark)

(f) Calculate the number of moles of HCl solution **P** that reacted with solid **Q**. (1 mark)

(g) Calculate the number of moles of MCO3 that reacted. (2 marks)

(h) Calculate R.F.M of MCO3 and hence the R.A.M of M. (C=12, O=16). (2 marks)

1. You are provided with **solid V.** Carry out the following tests and record your observations and inferences in the spaces provided.
2. Describe the appearance of **solid V**. (1 mark)

………………………………………………………………………………………………………

1. Add all solid **V** to about 10cm3 of distilled water in a boiling tube and shake well. Place 2cm3 portions of the resulting mixture into 5 separate test tubes to be used for the following tests.

|  |  |
| --- | --- |
| **Observations** | **Inference** |
| (1 mark) | (1 mark) |

1. To the first portion add 2M sodium hydroxide solution dropwise until in excess.

|  |  |
| --- | --- |
| **Observation** | **Inference** |
| (1 mark) | (1 mark) |

1. Clean one end of the glass rod provided. Dip the clean glass rod end into the second portion and heat it in a non-luminous flame. Note the colour of the flame and record it below.

|  |  |
| --- | --- |
| **Observation** | **Inference** |
| (1 mark) | (1 mark) |

1. To the third portion, add 2 or 3 drops of lead (II) nitrate solution.

|  |  |
| --- | --- |
| **Observation** | **Inference** |
| (1 mark) | (1 mark) |

1. To the fourth portion add 2 drops of barium nitrate solution followed by 2 cm3 of nitric (V) acid provided.

|  |  |
| --- | --- |
| **Observation** | **Inference** |
| (2 marks) | (1 mark) |

1. To the fifth portion, add 3 drops of acidified potassium manganate (VII) solution.

|  |  |
| --- | --- |
| **Observation** | **Inference** |
| (1 mark) | (1 mark) |

1. Give possible identities of the cation and anion present in solid **V**. (2 marks)

**Cation** ……………………………… **Anion** ………………………………

1. You are provided solid **T**. Carry out the following test and write your observations and inferences in the spaces provided.
2. Describe the appearance of **solid T**. (1 mark)

………………………………………………………………………………………………

1. Place a spatulaful of solid **T** in a test tube. Heat it gently and record your observations.

|  |  |
| --- | --- |
| **Observations** | **Inference** |
| (1 mark) | (1 mark) |

1. Add all the remaining solid **T** to about 10cm3 of distilled water in a boiling tube and shake well. Place 2cm3 portions of the resulting mixture into 5 separate test tubes to be used for the following tests.
2. To the first portion add 2M sodium hydroxide solution dropwise until in excess.

|  |  |
| --- | --- |
| **Observations** | **Inference** |
| (1 mark) | 1. mark) |

(ii) To the second portion add ammonia solution dropwise until in excess.

|  |  |
| --- | --- |
| **Observations** | **Inference** |
| (2 marks) | (1 mark) |

(iii) Give the name and the formula of the complex ion formed in test (ii) above. (2 marks)

**Name**………………………………………. **Formula** ……………………………………….