**TERM 2 - 2023**

**CHEMISTRY – PAPER THREE (233/3)**

**FORM THREE (3)**

**Time - 2¼ Hours**

**Name …………………………………………….……… Admission Number …………….**

**Candidate’s Signature ………………….…...………... Class ……………………………**

**Instructions to candidates**

(a)Write your name and index number in the spaces provided above.

(b) Sign and write the date of examination in the spaces provided above.

(c) Answer **ALL** the questions in the spaces provided in the question paper.

1. KNEC Mathematical tables and silent electronic calculators may be used for calculations.
2. All working **MUST** be clearly shown where necessary.
3. **This paper consists of 6 printed pages.**
4. **Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing**
5. **Candidates should answer the questions in English**

**For examiners’ use only.**

**FOR EXAMINERS USE ONLY**

|  |  |  |
| --- | --- | --- |
| **Question** | **Maximum score** | **Candidates score** |
| 1 | 24 |  |
| 2 | 10 |  |
| 3 | 06 |  |
| Total | 40 |  |

* + - 1. You are provided with:

* **Solution R** – a solution containing 15.75g of M(OH)2.8H2O per litre.
* **Solution Q** – Sodium carbonate solution containing 1.325 g in 250 cm3 of solution.
* **Solution J** – a monobasic acid **HA**
* Methyl orange indicator.

You are required to:

1. Standardise **solution J.**
2. Determine the relative atomic mass of element M in M(OH)2.8H2O

**Procedure 1**

1. Fill the burette with solution J.
2. Pipette 25cm3 of solution Q into a clean 250ml conical flask and add 2 drops of methyl orange indicator.
3. Titrate solution Q with solution J and record your results in **Table 1** below.
4. Repeat the procedure and complete the **table 1**.

**N/B: Retain the solution J in the burette for use in procedure II.**

(4 marks)

|  |  |  |  |
| --- | --- | --- | --- |
| **Table 1** | **I** | **II** | **II** |
| Final burette reading (cm3) |  |  |  |
| Initial burette reading (cm3) |  |  |  |
| The volume of solution J (cm3) used. |  |  |  |

Determine the:

1. Average volume of solution J used. (1 mark)
2. Number of moles of solution Q in moles per litre. (Na = 23, C = 12, O = 16)

(1 mark)

1. Number of moles of solution Q used. (1 mark)
2. Write the equation for the reaction between solution J and solution Q (1 mark)
3. Number of moles of solution J used. (1 mark)
4. The molarity of solution J. (1 mark)

**Procedure 2**

1. Using a 25cm3 measuring cylinder, transfer 25cm3 of solution R into a clean 250 ml conical flask.
2. Using a 100ml measuring cylinder, transfer 75cm3 of solution Q into the conical flask with solution R.
3. Boil the mixture for about 5 minutes. After cooling, filter the mixture into a conical flask and transfer the filtrate into a clean 100 ml measuring cylinder. Add distilled water to make exactly 100cm3 of solution. Label this solution S.
4. Pipette 25cm3 of solution S into a clean conical flask and titrate with solution J using two drops of methyl orange indicator. Record your results in **table 2** below.
5. Repeat procedure IV two more times and complete **table 2**.

**Table 2**

|  |  |  |  |
| --- | --- | --- | --- |
| **Table 2** | **I** | **II** | **II** |
| Final burette reading (cm3) |  |  |  |
| Initial burette reading (cm3) |  |  |  |
| The volume of solution J (cm3) used. |  |  |  |

(4 marks)

1. Calculate the average volume of solution J used. (1 mark)
2. Determine the number of moles of:
3. The monobasic acid, HA, in the average volume. (1 mark)
4. Sodium carbonate in 25cm3 of solution S. (1 mark)
5. Sodium carbonate in 75cm3 of solution S (1 mark)
6. Sodium carbonate in the original 75cm3 of solution Q. (1 mark)
7. Sodium carbonate that reacted with solution R. (1 mark)
8. M(OH)2.8H2O in 25cm3 of solution R. (1 mark)

(1 mole of M(OH)2.8H2O reacts with 1 mole of sodium carbonate.)

1. Determine:
   * 1. Concentration of solution R in moles per litre. (1 mark)
     2. Relative formula mass of M(OH)2.8H2O. (1 mark)
     3. The relative atomic mass of M. (O = 16, H = 1) (1 mark)
        1. You are provided with solid G. Carry out the following tests and write your observations and inferences in the spaces provided.
2. Place all solid G in a boiling tube. Add 10 cm3 of distilled water and shake. Divide the resulting solution into four equal portions.

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

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

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

1. To the second portion, dip a clean glass rod in the solution and burn it directly in a non-luminous flame.

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

1. To the third portion, add three drops of barium nitrate solution.

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

1. To the mixture in (d) above, add 3 cm3 of 2M nitric (V) acid and shake.

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

* + - 1. You are provided with **solid F.**

Carry out the tests below and write your observations and inferences in the spaces provided

* + - * 1. Place about half of solid P in a metallic spatula and burn it in a non-luminous flame.

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

* 1. Place the remaining solid F in a boiling tube, add about 6 cm3 of distilled water, and shake the boiling tube. Divide the solution into two portions of 2 cm3 each. To the first portion, add 2 drops of bromine water.

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

* 1. To the second portion, Test for the pH using universal indicator.

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

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