**Name…………………………………………………. Adm.No……..................Class………**

**SCHOOL………………………………………………………Candidates Signature………**

233/3

CHEMISTRY

PAPER 3

PRACTICAL

SEPTEMBER 2021

2 ¼ HOURS



**Kenya Certificate of Secondary Education 2021**

**INSTRUCTIONS TO CANDIDATES**

* *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 2 ¼ hours allowed for this paper. This time is to enable you to read the question paper and ensure that you have all the chemicals and apparatus that you may require.*
* *Mathematical tables and electronic calculators may be used.*

**For Examiners Use Only**

|  |  |  |
| --- | --- | --- |
| **Questions** | **Maximum Score** | **Candidates Score** |
| 1 | 20 |  |
| 2 |  12 |  |
| 3 |   8 |  |
| **Total** |  40 |  |

**This paper consists of 8 printed pages. Candidates should check the question paper to ensure that all the pages are printed as indicates and no questions are missing.**

**1. You are provided with the following:**

1. Sodium hydroxide, **solution** B
2. Hydrochloric acid, **solution A**
3. Sodium carbonate, **solution Q** prepared by dissolving 31.8 grams in one litre of solution.

 You are required to:

1. Standardize Hydrochloric acid, solution A using sodium carbonate, solution Q
2. Determine the molar enthalpy of neutralization of the acid using sodium hydroxide, solution B.

**Procedure I**

Fill the burette with hydrochloric acid, solution A. Pipette 25 cm3 of sodium carbonate, solution Q and transfer into a clean conical flask. Add 3 drops of methyl orange indicator and titrate against Solution A from the burette. Repeat the procedure two more times and fill **table I** below.

|  |  |  |  |
| --- | --- | --- | --- |
| **Table 1.** | I  | II | III |
| Final burette reading (cm3) |  |  |  |
| Initial burette reading (cm3) |  |  |  |
| Volume of solution A used (cm3) |  |  |  |

 (4mks)

1. Calculate the average volume of solution A used. (1mk)
2. Calculate the concentration of sodium carbonate solution Q in moles per litre. (1mk)

 (Na=23, O=16, C=12)

1. Calculate the number of moles of sodium carbonate, solution Q in the 25 cm3 that reacted. (1mk)
2. Calculate the number of moles of Hydrochloric acid, solution A that reacted with the 25cm3 portion of solution Q. (1mk)
3. Calculate the concentration of Hydrochloric acid, solution A in moles per litre. (1mk)

 **Procedure II**

Pipette 25cm3 of sodium hydroxide, solution **B** into a clean 100ml plastic beaker.

Measure the temperature of this solution and record it in the **table II** below. Fill the burette with hydrochloric acid solution **A**. Run 5cm3 portion of the acid from the burette into the 100 ml plastic beaker containing 25 cm3 of solution B. Stir using the thermometer and record the highest temperature reached. Repeat the procedure by **running 5cm3 portions** to the solution in the beaker until the total volume of the acid added is 35cm3

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  Volume of acid added(cm3) | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 |
| Temperature (**0C**) of solution |  |  |  |  |  |  |  |  |

 (3marks)

1. Plot the graph of temperature (**Y- axis**) against volume of hydrochloric acid added

 (**X-axis**). (3mks)

b) From your graph;

 (i) Determine the highest temperature rise **∆T**  (1mk)

 ii) Determine the volume of acid used (1mk)

c) Calculate the heat change for the reaction. (1mrk)

 (Take C = 4.2kJkg-1k-1, density of solution 1g/cm3)

d) Calculate the number of moles of the acid in the volume that reacted. (1mrk)

1. Calculate the molar enthalpy of neutralization for this reaction. (1mk)

2. You are provided with **solid D.** Carry out the following tests and record your observations and inferences in the spaces provided.

1. Place a half a spatula-full of **solid D** onto a boiling tube. Heat gently and then strongly. Test the gases produced using both moist red and blue litmus papers.

|  |  |
| --- | --- |
| Observations | Inferences |
|  (2 marks) |  (2marks) |

1. Transfer the remaining solid D to a clean boiling tube. Add 8 cm3 of distilled water and divide into 4 portions.

i) To the first portion, add **sodium hydroxide** solution until in excess.

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

ii) To the second portion, add **ammonia solution** until in excess.

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

1. To the third portion, add 3 drops of **2M hydrochloric acid**.

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

1. To the last portion add 3 drops of **barium nitrate**.

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

3. You are provided with **solid P.** Carry out the following tests and record your observations and inferences in the spaces provided.

a) Place about one-third of solid P on a clean metallic spatula and **burn** it in a non-luminous Bunsen burner flame.

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

b) Place the remaining amount of solid P in a boiling tube. Add about 10 cm3 of distilled water and shake. Use the mixture for tests (i), (ii), (iii) and (iv) below.

|  |  |
| --- | --- |
| Observations | Inferences |
|    (½ mark) |  ( ½ mark) |

i) Using about 2cm3 of the mixture in a test-tube, determine the PH using **universal indicator solution** and pH chart**.**

|  |  |
| --- | --- |
| Observations | Inferences |
|    (½ mark) |  ( ½ mark) |

ii) To about 2cm3 of the solution, add 3 drops of **acidified potassium manganate (VII) solution.**

|  |  |
| --- | --- |
| Observations | Inferences |
|   ( ½ mark) |  (1 mark) |

iii) To about 2cm3 of the solution, add the **clean magnesium** ribbon provided.

|  |  |
| --- | --- |
| Observations | Inferences |
|   ( ½ mark) |  (1 mark) |

iv) To about 2cm3 of the solution, add all the **sodium carbonate** provided.

|  |  |
| --- | --- |
| Observations | Inferences |
|    ( ½ mark) |  (½ mark) |