**THE UNITED REPUBLIC OF TANZANIA**

**NATIONAL EXAMINATIONS COUNCIL OF TANZANIA**

**CERTIFICATE OF SECONDARY EDUCATION EXAMINATION**

**032/2C** **CHEMISTRY 2C**

**(ACTUAL PRACTICAL C)**

(For Both School and Private candidates)

**Time: 2:30 Hours** **Year: 2020**

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## Instructions

1. This paper consists of **two (2)** questions**.**
2. Answer **all** questions**.**
3. Each question carries twenty **five (25)** marks**.**
4. All writing must be in **blue** or **black** ink **except** drawing which must be in pencil.
5. Cellular phones, and any unauthorized materials are **not** allowed in the examination room.
6. Write your **Examination Number** on every page of your answer booklet (s)

Atomic masses: H=1, C=12, 0=16, Na=23.

$1litre = 1dm^3 = 1000cm^3$

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1. Determine an unknown univalent element in a carbonate. You are Provided with the following solutions:

   (i) **P**: containing 2.65 g of the univalent element carbonate ($\mathbf{X_2CO_3}$) dissolved in a 250 $cm^3$ of an aqueous solution.

   (ii) **H:** containing 12.6 g of nitric acid dissolved in a litre of an aqueous solution.

   **Procedure**:

   Titrate nitric acid from the burette against carbonate solution using two drops of methyl orange indicator and record the end point. Repeat the procedure to obtain three burette readings and tabulate the results.

   (a) Calculate the average titre volume.

   (b) Find the volume of the acid which was required to complete neutralization.

   (c) Write balanced chemical equation for the reaction.

   (d) Calculate the molarities of the acid and base.

   (e) Determine the molar mass of the univalent element carbonate and name of the univalent element.

   (f) Write the chemical formula of the univalent element carbonate.

2. Study the reaction between sodium thiosulphate and hydrochloric acid at different temperatures. The chemicals provided are labelled as $\mathbf{A_1}$ for 0.05 M sodium thiosulphate and $\mathbf{A_2}$ for 1.0 M hydrochloric. Also, you are provided with a piece of white paper marked X on which a 100 $cm^3$ beaker containing the reaction mixture to be placed during the experiment. Measure 30$cm^3$ of $\mathbf{A_2}$ and put it into the 100 $cm^3$ beaker place on top of the X marked on the piece of paper. Then, measure 30 $cm^3$ of $\mathbf{A_1}$, put it into boiling tube, insert a thermometer into it and heat on water bath until it reaches a temperature of 40$^oC$. The next step, transfer the heated solution $\mathbf{A_1}$ into the beaker containing solution $\mathbf{A_2}$ and immediately starting the stop watch. This step is

followed by swirling the mixture, (while observing from above) and recording the time taken for letter X to disappear completely. Repeat the procedure by varying the temperature as shown in the table.

**Table: Experimental Data**

| Volume of $A_1$ ($cm^3$) | Volume of A2 ($cm^3$) | Temperature of A1 ($^oC$) | Time (s) |
|---|---|---|---|
| 30 | 30 | 40 | |
| 30 | 30 | 50 | |
| 30 | 30 | 60 | |
| 30 | 30 | 70 | |
| 30 | 30 | 80 | |

**Questions**

(a) Complete filling the table.

(b) (i) Plot a graph of volume $\mathbf{N_1}$ (vertical axis) against time (horizontal axis) taken for the letter X to disappear completely.

(ii) State what does the shape of the graph indicate.

(c) Give reason why did the letter X disappear.

(d) Write the electronic configuration of the product which causes the solution to be cloudy (milky).

(e) Write the ionic equation for the reaction between $\mathbf{N_1}$ and $\mathbf{N_2}$.

(f) Plot a graph of volume of $\mathbf{A_1}$ against the rate of the reaction.

(g) State why $\mathbf{N_3}$ was added to $\mathbf{N_1}$.