THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

ADVANCED CERTIFICATE OF SECONDARY EDUCATION

EXAMINATION

132/3C   **CHEMISTRY 3C**

(ACTUAL PRACTICAL C)

(For Both School and Private candidates)

Time: 3:20 Hours   **Year: 2022**

Instructions

1. This paper consists of **three (3)** questions**,** Answer **all** questions.

2. Question **one (1)** carries **20** marks, and the other **two(2)** carry **15** marks each.

3. Qualitative Analysis Guide (QAG) authorized by NECTA may be used.

4. Mathematical tables and non-programmable calculators may be used.

5. All writing must be in **blue** or **black** ink **except** drawing which must be in pencil

6. Cellular phones and any unauthorized materials are **not** allowed in the examination room.

7. Write your **Examination Number** on every page of your answer booklet (s).

   The folowing information may be useful:

   H=1, C=12, 0=16, S=32, Na=23, K=39, Mn=55

1. You are provided with the following:

   K: A solution of 7.45 g of an impure hydrated sodium carbonate in a 500 cm^3 of an aqueous solution;

   L: 1.825 g of hydrochloric acid in a 500 cm^3 of an aqueous solution.

   POP: Phenolphthalein indicator;

   MO: Methyl orange indicator.

   Procedure

   (i)   Pipette 20 or 25 cm^3 of a solution **K** and put it in a clean conical flask.

   (ii)   Add two drops of **POP**.

   (iii)   Put solution **L** into the burette.

   (iv)   Titrate solution **L** against **K** using **POP** until the colour change is observed.

   (v)   Add two drops of **MO** and continue to titrate until further colour change is observed.

   (vi)   Repeat the procedures (i) - (v) three times and record the results in a tabular form.

   Questions

   (a) Calculate the average titre value when:

           (i)   **POP** was used.

           (ii)   **MO** was used.

   (b) Write a balanced chemical equation when;

           (i)   **POP** was used.

           (ii)   **MO** was used

   (c) Calculate the total overall average volume of the solution **L** used for complete reaction with the solution **K**.

   (d) Write the overall reaction equation of the **L** and **K**.

(e) Calculate the percentage purity of the hydrated sodium carbonate.

2. You are provided with the following:

M: A solution of 0.05 M sodium thiosulphate;

N: A solution of 0.1 M nitric acid;

Stop watch;

Thermometer.

Theory

Dilute nitric acid reacts with sodium thiosulphate to form a white precipitate of sulphur according to the following equation:

$S_2O_3^{2-}{}_{(aq)} + 2H_3O^+{}_{(l)} \rightarrow 3H_2O_{(l)} + SO_{2(g)} + S^-{}_{(s)}$. The precipitate of sulphur causes the solution to become opaque. From this phenomenon, the rate of formation of sulphur precipitate can be measured

Procedure

(i)   Draw a letter **X** on a sheet of white paper and place a 100 cm^3 beaker on top of the letter.

(ii)   Pour about 200 cm^3 of a clean water into a 250 or 300 cm^3 beaker and heat gently. Use this as your water bath.

(iii) Measure exactly 10 cm^3 of **M** and 10 cm^3 of **N** into separate two boiling tubes. Put the two tubes in the water bath and warm the contents to about 50 °C.

(iv)   (iv) Immediately, pour the hot solutions **M** and **N** into a 100 cm^3 beaker in (i) and simultaneously start the stop watch.

(v)   Swirl the mixture in (iv) and record the time taken for the letter X to disappear completely.

(vi)   Repeat the steps (i) - (v) using temperature 60°C, 70°C and 80°C.

(vii) Record your results in a tabular form.

Questions

(a) Plot a graph of $\log \frac{1}{t}(Sec^{-1})$ against $\frac{1}{T}(K^{-1})$..

(b) Determine the slope of the graph.

(c) Using Arrhenius equation, determine the activation energy of the reaction.

3. Substance **H** contains two cations and one anion. Use the information given in the experiments column of the experimental Table to complete the observations and inferences columns. Hence, identify the two cations and an anion.

S/n	Experiments	Observations	Inferences
(a)	Appearance of the sample.		
(b)	Heat a small portion of the sample in a dry test tube.		
(c)	Perform a flame test.		
(d)	Add concentrated sulphuric acid to the dry sample.		
(e)	To the small portion of the prepared solution, add dilute HCl followed by barium chloride solution.		
(f)	To the small portion of the prepared solution, add excess ammonia solution and then add ammonia sulphide solution or pass hydrogen sulphide slowly for one minute.		
(g)	Perform confirmatory test for cations present in the sample.		

Questions

(i)   Write the molecular formula for the sample.

(ii)   What are the cations and anion in the sample?