THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

DIPLOMA IN SECONDARY EDUCATION EXAMINATION

732/2B **CHEMISTRY 2B**

(ACTUAL PRACTICAL 2B)

Time: 3 Hours **Year: 2023**

Instructions

1. This paper consists of **three (3)** questions.
2. Answer **all** questions.
3. Question number **one (1)** carries **twenty (20)** marks and the rest carry **fifteen (15)** marks each.
4. Cellular phones and any unauthorized materials are not allowed in the examination room.
5. Write your **Examination Number** on every page of your answer booklet (s)

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1. Sulphuric acid is hygroscopic and is an oxidizing agent; its concentration cannot be stable for a long time. You have decided to prove this fact by conducting an experiment using sulphuric acid solution labelled **SA** and primary standard solution made by dissolving 0.840 g of anhydrous sodium hydrogen carbonate in exactly 100 mL of solution. The primary standard solution was labelled **PS**. The titration indicator is methyl orange solution. Perform the experiment in the given procedures and answer the questions that follow.

   Procedure

   (i) Pipette 20 cm^3 or 25 cm3 of the solution **PS** and transfer it into the titrating flask.

   (ii) Add 2 to 3 drops of the indicator (MO) in the titrating flask.

   (iii) Transfer **SA** solution into the burette.

   (iv) Titrate **PS** using **SA** until the end point is reached.

   (v) Repeat step (i) to (iv) three more times.

   Questions

   (a) (i) What is the volume of pipette used?

   (ii) Draw and complete appropriate table of results.

   (b) (i) Calculate the average volume of **SA** used.

   (ii) Calculate the molarity of sodium hydrogen carbonate in solution **PS**.

   (c) (i) Write the balanced chemical equation for the reaction that took place in this experiment.

   (ii) Calculate the molarity of the standardized sulphuric acid.

2. You are given a task to determine the effect of temperature on the rate of chemical reaction using sodium thiosulphate and nitric acid. During the experiment, you

observe that sodium thiosulphate reacts with an acid to form white precipitates. However, the intensity of precipitation changes with change in temperature. You are asked to replicate the same experiment by using the following materials:

B1: A solution of 0.05 M sodium thiosulphate;

B2: A solution of 0.1 M nitric acid; Stopwatch, thermometer and other relevant facilities.

Perform the experiment through the given procedures and then answer the questions that follow.

Procedures

(i) Put an empty beaker (50 cm3) on top of the mark "+" drawn on the given piece of paper. Make sure that the mark is clearly visible.

(ii) Pour about 200 cm3 of water into a 250 or 300 cm3 beaker. (Use this as your water bath).

(iii) Measure 10 cm3 of **B1** and 10 cm3 of **B2**, and pour into separate test tubes.

(iv) Put the two test tubes containing, **B1** and **B2**, into the water bath in and warm the contents to 50 °C.

(v) Pour the hot solutions of **B1** and **B2** in the beaker in (i) and immediately start the stopwatch.

(vi) Using a glass rod, stir the reaction mixture and record the time taken for the letter + to disappear completely.

(vii) Repeat the procedure (iii) to (vi) by warming to temperatures, 60 ˚C, 70 ˚C and 80 ˚C instead of warming to 50 °C in procedure (iv).

Questions

a) Complete the following Table

Table of Results

Temperature, T		$\frac{1}{T}(K^{-1})$	**Time, t (s)**	**Rate** $\left[\frac{1}{t}(S^{-1})\right]$	$\log\left(\frac{1}{t}\right)$
°C	K				
50					
60					
70					
80					

b) From the table of results, give a conclusion with respect to the relationship between the temperature and the rate of reaction.

c) Plot a graph of log (1/t) as a function of 1/T.

(i) Arrhenius equation can be presented by the relation $\log\left(\frac{1}{t}\right) = \frac{-E_a}{2.303R}\frac{1}{T} + \log A$, Where $\mathbf{E}_a$ is the activation energy and **R** is the gas constant = $8.314 Jmol^{-1}K^{-1}$. With the aid of the graph obtained in (c), calculate the activation energy, $\mathbf{E}_a$ in $Jmol^{-1}$.

3. John was complaining of stomach pains after drinking some tea. After diagnosis by the medical doctor, it was noted that the tea might have been contaminated with sample **L**. Perform the experiment to identify the cation and anion present in the tea sample based on the following tests and answer the questions that follow:

(i) Appearance of sample **L**

(ii) Action of heat on sample **L** in a test tube

(iii) Action of dilute sulphuric or hydrochloric acid to solid sample

(iv) Action of concentrated sulphuric acid on solid sample

(v) Flame test

(vi) Solubility of the sample

(vii) Confirmatory test for the anion

(viii) Confirmatory test for the cation.

Questions

(a) Prepare a relevant Table showing the qualitative analysis results.

(b) Identify the ions in sample L.

(c) What is the name of sample L?

(d) Write the reaction equation to indicate what took place in test (viii).

(e) Write the reaction equation to indicate what took place in test (iv)