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: 2023**

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 provide with the following:

   B1: A solution of H_2O_2 prepared by diluting 1.00 cm^3 with distilled water to form 250 cm^3 of an aqueous solution;

   B2: A solution of $KMnO_4$ made by dissolving 0.79 g in distilled water to form a 250 cm^3 of an aqueous solution.

   B3: A dilute H_2SO_4;

   Procedure

   (i) Pipette 20 or 25 cm^3 of **B1** into a conical flask. Add 10 cm^3 of **B3**.

   (ii) Titrate the mixture from step (i) against **B2** until a pink colour is observed.

   (iii) Repeat the procedures (i) and (ii) three more times and record your results in tabular form.

   Summary

   (i) The volume of pipette used was ____ cm^3.

   (ii) _____ cm^3 of solution **B1** required _____ cm^3 of **B2** for complete reaction.

   Questions

   (a) Write the two half reaction equations for the experiment.

   (b) Write a balanced ionic equation for the whole process.

   (c) Calculate the concentration of the original solution of hydrogen peroxide in g/dm^3 .

   (d) Calculate the volume of oxygen gas produced at s.t.p when **B1** reacted with an acidified **B2**

2. You are provided with the following:

S: A solution of 0.5 M sodium thiosulphate;

T: A solution of 0.1 M nitric acid; A stop watch/clock; A white plain paper marked N; A thermometer (0 – 100°C);

Theory

A yellow precipitate of amorphous Sulphur can be obtained by the action of the dilute acid on sodium thiosulphate ($Na_2S_2O_3$) according to the equation;

$$\boldsymbol{S_2O_3^{2-}(aq) + 2H_3O^{+}(aq) \rightarrow 3H_2O(l) + S_2O(g) + S(s)}$$

The precipitated Sulphur causes the solution to become opaque. From this phenomenon, you can assess the rate of Sulphur precipitation by measuring the time taken for the solution to become totally opaque due to Sulphur.

Procedure

(i) Place a 50 cm^3 beaker on top of a white plain paper marked **N** in such a way that, the mark is clearly seen through the bottom of the beaker.

(ii) Put about $\frac{3}{4}$ full of water into a 250 or 300 cm^3 beaker and use it as your water bath.

(iii) Measure 10 cm^3 of solution S and 10 cm^3 of **T** into two separate boiling test tubes.

(iv) Put the two boiling test tubes containing S and T into the water bath and warm the contents to about 50°C.

(v) Immediately pour the hot solutions of S and T into a 50 cm^3 beaker placed on top of letter N in step (i), and immediately start a stop watch/ clock.

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

(vii) Repeat the procedures (iii) to (vi) at temperatures 60°C, 70°C and 80°C and tabulate your results as indicated in Table 1:

Table 1: Experimental Table.

Temperature of the Reaction Mixture		Time for reaction, t (sec)	$\frac{1}{T}\left(K^{-1}\right)$	$\frac{1}{t}\left(Sec^{-1}\right)$	$\log\frac{1}{t}\left(Sec^{-1}\right)$
°C	T (K)				
50					
60					
70					
80					

Questions

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

(b) Determine the slope of the graph in part (a).

(c) Using the equation, $K = AEe^{\frac{-Ea}{RT}}$, which gives the relation describing the dependence of the rate constant on temperature, determine the value of activation energy in a given equation.

3. Sample **Z** contains two cations and one anion. Perform the experiments given in the Table 2 and record the observations. Make appropriate inferences and hence, identify the two cations and anion.

Table 2: Experimental Table

S/n	Experiment	Observations	Inferences
(a)	Observe sample **Z**.		
(b)	Heat 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 HCl followed by barium chloride solution.		
(f)	To the small portion of the prepared solution, add excess ammonia solution and then pass hydrogen sulphide gas slowly for one minute.		
(g)	Perform confirmatory tests for cations present in the sample		

Questions

(i) Write the molecular formulas for the samples.

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