

**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 : 2021

Instructions

1. This paper consists of **three (3)** questions. Answer **all** questions.
2. Question number **one (1)** carries **twenty (20)** marks and the other **two (2)** carry **fifteen (15)** marks each.
3. Qualitative Analysis Guide (QAG) sheet authorized by NECTA may be used.
4. Mathematical tables and non-programmable calculators may be used.
5. Cellular phones and any unauthorised materials are **not** allowed in the examination room.
6. Write your **Examination Number** on every page of your answer booklet(s).
7. You may use the following atomic masses:

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



1. You are provided with the following:
- A:** A solution made by dissolving 1.58 g of KMnO_4 in a 0.5 dm^3 of a solution.
 - B:** A solution made by dissolving 5.8 g of $\text{Na}_2\text{S}_2\text{O}_3 \cdot \text{XH}_2\text{O}$ in a 0.25 dm^3 of a solution.
 - C:** A solution of 10% KI;
 - D:** A starch solution;
 - E:** A solution of dilute H_2SO_4 .

Theory

Quantitatively, potassium permanganate and potassium iodide react in an acidic medium as represented by the reaction equation, $\text{MnO}_4^- + \text{I}^- \rightarrow \text{Mn}^{2+} + \text{I}_2$ (i).

The liberated iodine, I_2 is titrated against sodium thiosulphate, $\text{Na}_2\text{S}_2\text{O}_3$ and the reaction taking place during this titration is represented as $2\text{S}_2\text{O}_3^{2-} + \text{I}_2 \rightarrow \text{S}_4\text{O}_6^{2-} + 2\text{I}^-$ (ii).

Procedure

- (i) Pipette 20 or 25 cm^3 of a solution **A** into a conical flask. Using a measuring cylinder, add an equal amount of **C** (20 or 25 cm^3) followed by 20.00 cm^3 or 25.00 cm^3 of **E** in the same flask.
- (ii) Titrate the liberated iodine with **B** until the colour change is observed. Add 2 cm^3 of **D** and continue to titrate until the permanent colour change is observed.
- (iii) Repeat the procedures (i) and (ii) three more times and record your results in a tabular form.

Summary

- (i) The volume of the pipette used was _____.
- (ii) _____ cm^3 of **A** liberated iodine that required _____ cm^3 of **B** for complete reaction.

Questions

- (a) State the role of solution **D** in this experiment.
- (b) State the main purpose of adding solution **C** into a conical flask containing acidified solution of **A**.
- (c) Why is it advisable to add solution **D** just close to the end point in this experiment?
- (d) Calculate the;
 - (i) concentration of **A** in g/dm^3 .
 - (ii) molarity of **A**.
 - (iii) molarity of $\text{Na}_2\text{S}_2\text{O}_3$.

(iv) concentration of $\text{Na}_2\text{S}_2\text{O}_3$ in g/dm^3 .

(e) Find the value of X in the formula $\text{Na}_2\text{S}_2\text{O}_3 \cdot \text{XH}_2\text{O}$.

2. You are provided with the following:

C1: A solution of 0.1 M $\text{Na}_2\text{S}_2\text{O}_3$;

C2: A solution of 0.1 M HCl;

Stop watch/clock;

Thermometer;

White plain sheet of paper marked **X**.

Procedure

- Put a 50 cm^3 beaker on top of a white sheet of paper marked **X** in such a way that, the mark is clearly seen through the bottom of the beaker.
- Put about 200 cm^3 of water into a 250 or 300 cm^3 beaker. Heat the beaker containing water. Use this as the water bath.
- Measure 10 cm^3 of **C1** and 10 cm^3 of **C2** and put into separate boiling test tubes.
- Take the test tubes containing **C1** and **C2** and put into the water bath; allow the contents to warm to 35°C.
- Pour the contents into a 50 cm^3 beaker placed on top of a mark **X** and immediately start a stop clock. Record the time taken for the mark **X** to disappear.
- Repeat procedures (iii) to (v) by varying the temperature of the contents as indicated in Table 1.

Table 1: Experimental data

Temperature (°C)	Time for reaction, t (Sec)	1/t (Sec ⁻¹)
35		
40		
45		
50		
55		
60		

Questions

- Write a balanced reaction equation for the experiment.
 - Explain what makes letter **X** to disappear.
- Using different axes, plot a graph of;
 - time, t (s) used against temperature, T (°C).
 - 1/time (s⁻¹) against temperature, T (°C).

- (c) Study the graphs in (b) and explain how the rate of reaction changes with temperature.
3. Sample **K** is a simple salt containing one cation and one anion. Carefully, carry out qualitative analysis experiment to identify the ions present in the salt based on the following tests:
- (a) Appearance of the sample.
 - (b) Action of heat on the sample.
 - (c) Solubility.
 - (d) Action of aqueous sodium hydroxide on solution of **K**.
 - (e) Action of ammonia solution on solution of **K**.
 - (f) Action of FeCl_3 solution on solution of **K** followed by dilute HCl then boil.
 - (g) Perform flame test for sample **K**.
 - (h) Perform a confirmatory test for the cation and anion.

Questions

- (i) Prepare a relevant Table showing the qualitative analysis results.
- (ii) Write the molecular formula for the sample.
- (iii) Write a balanced chemical equation of the reaction in experiment (b).