

**THE UNITED REPUBLIC OF TANZANIA
PRESIDENT'S OFFICE,
REGIONAL ADMINISTRATION AND LOCAL GOVERNMENT
NJOMBE REGION**



FORM SIX PRE – NATIONAL EXAMINATION

CODE: 132/3B

CHEMISTRY 3B

(For Both School and Private Candidates)

TIME: 03: 20 HOURS

THURSDAY, 21ST March 2024 A.M

INSTRUCTIONS

1. This paper consists of three (3) questions.
2. Answer **all** questions. Question one (1) carries twenty (20) marks and the other two (2) carries 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 unauthorized materials are not allowed in the examination room.
6. Write your **Examination Number** on every page of your answer booklet(s) provided.
7. You may use the following atomic masses:
H = 1, C=12, O = 16, Cl=35.5, Fe = 56, S = 32, Mn = 55, Na = 23, K = 39.

1. You are provided with:

A: A solution made by dissolving 0.79g of KMnO_4 in 250 cm^3 of distilled water.

B: A solution made by dissolving 13.9g of $\text{FeSO}_4 \cdot \text{XH}_2\text{O}$ in 500 cm^3 of distilled water.

C: A dilute sulphuric acid

Procedure:

1. Pipette 20 cm^3 (or 25 cm^3) of **B** into a conical flask. Add 20 cm^3 of **C** to the same conical flask.
2. Titrate this solution against **A** until permanent colour change is observed.
3. Repeat the procedure two or three times and record all the results in the table below.

Burette readings:

Titration Number	PILOT	1	2	3
Final reading (cm^3)				
Initial reading (cm^3)				
Titre value (cm^3)				

Results:

The volume of the pipette used was _____ cm^3

The volume of burette used was _____ cm^3

Summary

_____ cm^3 of **B** required _____ cm^3 of **A** for complete reaction.

Questions

(a) (i) Write the half – reaction equations involved in these reactions.

(ii) Write the overall balanced ionic equation for the reaction.

(iii) Indicate which species is an oxidant and which one is reductant.

(b) Explain why an indicator is not used in this type of experiment.

(c) Explain why sulphuric acid and not hydrochloric acid or nitric acid is used in this particular experiment.

(d) Calculate the;

(i) Concentration of $\text{FeSO}_4 \cdot \text{XH}_2\text{O}$ in g dm^{-3}

(ii) Concentration of KMnO_4 in g dm^{-3} .

(iii) Molarity of KMnO_4

(iv) Molarity of FeSO_4

(v) Concentration of FeSO_4 in g dm^{-3}

(vi) Value of X in the formula $\text{FeSO}_4 \cdot \text{XH}_2\text{O}$

2. You are provided with the following:

S: 5.6g of Sodium Carbonate decahydrate ($\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$)

T: 2.12g of Sodium Carbonate anhydrous (Na_2CO_3)

Thermometer, distilled water and plastic beaker

Procedure:

- Measure 50 cm^3 of distilled water and put in a plastic beaker record the temperature of water, label it **T1**.
- Dissolve 5.6g of $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ and stir using thermometer record the temperature of solution, label it **T2**.
- Discard the contents of plastic beaker and wash the plastic beaker, then measure 50 cm^3 of distilled water and put in a plastic beaker. As usual take the initial temperature of water using a thermometer and record it as **T3**.
- Take 2.12g of anhydrous Sodium Carbonate, dissolve in plastic beaker and stir using the thermometer. Record the final temperature call it **T4**

Table of results:

Experiment (salt)	Initial temperature	Final temperature	Temperature change
S			
T			

Questions:

- Calculate the heat change in each experiment
- Calculate the molar heat change of solution in each experiment
- Calculate the molar heat of hydration of anhydrous Sodium Carbonate to decahydrate Sodium carbonate.
- Comment on the difference in the molar heat change of solution in two salts (**S** and **T**)

3. You are provided with the sample **E** which contains **TWO ANIONS** and a **COMMON CATION**. Carefully carry out qualitative analysis experiments to identify the ions present in the salt based on the following tests:

- Appearance of the sample.
- Action on heat on the sample.
- Solubility.
- Action of aqueous Sodium hydroxide on the solution sample **E**.
- Action of concentrated sulphuric acid on solution sample **E**.
- Perform a confirmatory test for the cation and the two anions.

Questions:

- Prepare a relevant table showing the qualitative analysis results.
- Write a balanced chemical equation for the reaction in experiment (f) above.
- The cation present is _____ and anions are _____ and _____