THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

132/3B **CHEMISTRY 3B**

ACTUAL PRACTICAL B

(For Both School and Private Candidates)

Duration: 3:20 Hours **Year: 2025**

Instructions

1. This paper consists of **three (3)** questions.
2. Answer **all** questions.
3. Question **one (1)** carries 20 marks and the other **two (2)**, carry 15 marks each.
4. Qualitative Analysis Guide (QAG) sheet authorised by NECTA may be used
5. Mathematical tables and non programmable calculators may be used.
6. Communication devices and any unauthorised materials are **not** allowed in the examination room.
7. Write your **Examination Number** on every page of your answer booklet(s).
8. You may use the following constants:
   - Atomic masses: H = 1, C = 12, O = 16, S = 32, Na = 23, Cl = 35.5, K = 39, Mn = 55
   - Density of water = 1 g/cm^3
   - Specific heat capacity of water = 4.18 $Jg^{-1}K^{-1}$

1. A solution which contains iodine is commonly used to clean wounds. During this process, medical attendants may unpredictably smear iodine on their clothes. Cleanliness of these clothes requires the use of specific amount of thiosulphate solution. Perform titration technique and calculate the amount of sodium thiosulphate required for the laundry using the following reagents and the given apparatuses.

Q1: A solution of 0.04 M $KMnO_4$;

Q2: A solution of $Na_2 S_2 O_3$;

Q3: A solution of 10% KI;

Q4: A starch solution;

Q5: A solution of 1 M sulphuric acid.

Theory

A quantitative reaction between potassium permanganate and potassium iodide in acidic medium involves production of iodine. Iodine reacts with sodium thiosulphate during titration process.

Procedure

(i) Fill the burette with **Q2**.

(ii) Measure 10 cm^3 of **Q1** into a conical flask. Add 10 cm^3 of distilled water. Swirl the mixture gently, then add 10 cm^3 of solution **Q3** followed by 10 cm^3 of **Q5** into the mixture.

(iii) Titrate **Q2** against the mixture in the conical flask until a pale yellow colour is observed. Add 2 cm^3 of **Q4** into the conical flask and continue to titrate until the dark blue colour turn to colourless.

(iv) Record the first titre value.

(v) Repeat steps (i) to (iv) three times and record the titre values.

Questions

(a) Tabulate your results.

(b) Write the balanced chemical equation for the whole experiment.

(c) Calculate the final molarity of potassium permanganate.

(d) Determine the concentration of sodium thiosulphate in g/dm^3.

(e) Suggest another suitable mineral acid apart from sulphuric acid that can be used in this experiment.

2. Chemists should control rate of chemical reactions in order to avoid explosion for the reactions whose rate is vigorous. This task is done by determining the rate constant of reaction. Determine the rate constant of the reaction using the following reagents:

F1: 0.1 M hydrochloric acid;

F2: 0.15 M sodium thiosulphate;

Distilled water.

Theory

The rate of reaction is expressed as: Rate $= \frac{-d[S_2O_3^{2-}]}{dt} = k[S_2O_3^{2-}][H^+]^y$

Where **x** is the order of reaction with respect to $S_2O_3^{2-}$, **y** is the order of reaction with respect to H+ and **k** is the rate constant.

Procedure

(i) Place a small beaker of 100 cm3 on top of the "**X**" mark on the white paper.

(ii) Measure 25 cm^3 of **F2** using measuring cylinder and pour into the beaker placed on the marked paper.

(iii) Measure 25 cm3 of **F1**, then add into the beaker containing **F2** and immediately start the stopwatch.

(iv) Record the time taken for the mark on white paper to be obscured.

(v) Repeat steps (i) to (iv) using the set of mixtures in Table 1.

Table 1: Experimental Table.

Exp	Volume of **F2** (cm^3)	Volume of distilled water (cm^3)	volume of **F1**(cm^3)
1	25.00	0.00	25.00
2	20.00	5.00	25.00
3	15.00	10.00	25.00
4	10.00	15.00	25.00

Questions

(a) Write the ionic equation for the reaction taking place in this experiment.

(b) Calculate the order of reaction with respect to **F2**, given that the volumes are directly proportional to their concentrations.

(c) If the value of **y = 1**, calculate the rate constant.

3. Sample **RK** contains one cation and one anion. Analyse the sample using systematic qualitative analysis procedures. Carefully, record your experiments, observations and inferences as shown in Table 2. Finally, identify the anion and cation present in sample **RK**.

Table 2: Experiment Data.

S/N	Experiments	Observations	Inferences

Questions

(a) What are the cation and anion in the sample?

(b) Write the molecular formula for the sample.