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 $Na_2S_2O_3.XH_2O$ 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, $MnO_4^- + I^- \rightarrow Mn^{2+} + I_2$ .....(i).

The liberated iodine, I_2 is titrated against sodium thiosulphate, $Na_2S_2O_3$ and the reaction taking place during this titration is represented as $2S_2O_3^{2-} + I_2 \rightarrow S_4O_6^{2-} + 2I^-$ .....(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 $Na_2S_2O_3$.

(iv) concentration of $Na_2S_2O_3$ in g/dm^3.

(e) Find the value of X in the formula $Na_2S_2O_3.XH_2O$.

2. You are provided with the following:
C1: A solution of 0.1 M $Na_2S_2O_3$;
C2: A solution of 0.1 M HCl;
Stop watch/clock;
Thermometer;
White plain sheet of paper marked **X**.

Procedure

(i) 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.

(ii) 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.

(iii) Measure 10 cm^3 of **C1** and 10 cm^3 of **C2** and put into separate boiling test tubes.

(iv) Take the test tubes containing **C1** and **C2** and put into the water bath; allow the contents to warm to 35 °C.

(v) 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.

(vi) 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

(a) (i) Write a balanced reaction equation for the experiment.

(ii) Explain what makes letter **X** to disappear.

(b) Using different axes, plot a graph of;
(i) time, t (s) used against temperature, T (°C).
(ii) 1/time (s^{-1}) against temperature, T (°C).

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(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).