THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL OF TANZANIA
ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

132/3B **CHEMISTRY 3B**
(PRACTICAL B)
(For Both School and Private Candidates)

Time: 3:20 Hours **Year: 2020**

Instructions

1. This paper consists of **three (3)** questions. Answer **all** the questions.
2. Question number **one (1)** carries 20 marks and the other **two (2)** carry 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, O = 16, S = 32, K = 39, Mn = 55, Fe = 56.

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1. You are provided with the following:

K: A solution made by dissolving 0.79 g of $KMnO_4$ in a distilled water to make a 0.25 dm^3 of an aqueous solution;

L: A solution made by dissolving 13.90 g of $FeSO_4.XH_2O$ in a distilled water to make a 0.5 dm^3 of an aqueous solution;

M: Dilute sulphuric acid.

Procedure

(i) Fill the burette with solution **K**.

(ii) Pipette 20 or 25 cm^3 of **L** into a conical flask. Add the same volume of **M** using a measuring cylinder.

(iii) Titrate the mixture solution at (ii) against **K** until a permanent colour change is observed.

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

Summary

(i) The volume of the pipette used was _____.

(ii) _____cm^3 of **L** required _____cm^3 of **K** for complete reaction.

Questions

(a) (i) Write half reaction equations involved in this reaction.

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

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

(b) Why an indicator is not used in this experiment?

(c) Why sulphuric acid is used in this experiment instead of hydrochloric acid or nitric acid?

(d) Calculate the;

(i) concentration of **L** in g dm^{-3}.

(ii) concentration of **K** in g dm^{-3}.

(iii) molarity of **K**.

(iv) molarity of $FeSO_4$.

(v) concentration of $FeSO_4$ in g dm^{-3}.

(e) Find the value of X in the formula $FeSO_4.XH_2O$.

2. You are provided with the following:

H1: solution of 0.05 M of sodium thiosulphate;

H2: solution of 0.1 M nitric acid;

A stop watch or clock;

A plain paper marked **X**;

A thermometer (0˚C - 100˚C).

Theo

A white precipitate of amorphous sulphur can be obtained by the action of dilute acid on sodium thiosulphate according to the equation; $S_2O_3^{2-} + 2H_3O^+ \rightarrow 3H_2O + S\downarrow + SO_2\uparrow$. 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.

Procedure

(i) Place a 50 cm^3 beaker on top of the letter **X** in such a way that, the mark is clearly seen through the bottom of the beaker.

(ii) Pour about 200 cm^3 of a tap water into a 250 cm^3 or 300 cm^3 beaker (Use this as your water bath).

(iii) Measure 10 cm^3 of **H2** and 10 cm^3 of **H1** into separate boiling test tubes.

(iv) Put the two boiling test tubes containing **H2** and **H1** into the water bath in step (ii) and warm the contents to 50 °C.

(v) Immediately pour the hot solutions **H2** and **H1** in a 50 cm^3 beaker in step (i) and simultaneously start the stopwatch/stopclock.

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

(vii) Repeat procedures (iii) to (vi) using temperatures of 60 °C, 70 °C and 80 °C and record your results as shown in Table 1.

Table 1: Experimental Table

Temperature T(°C)	Temperature T(K)	Time of reaction t (sec.)	1/T (K^{-1})	$Log_{10}{}^1/_t$ (sec^{-1})
50				
60				
70				
80				

Questions

(a) Plot a graph of $\log_{10}\frac{1}{t}(sec^{-1})$ against $\frac{1}{T}(K^{-1})$.

(b) Determine the slope of the graph plotted in (a) above.

(c) Using the equation $K = Ae^{-E/RT}$ which gives the relationship describing the dependence of the rate constant on temperature; determine the values of A and E.

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3. You are provided with a sample **P** containing **two cations** and **one anion**. Carry out the experiments described in Table 2. Record carefully your observations and make appropriate inferences. Finally, identify the cations and anion present in the sample **P**.

Table 2: Table of results

S/n	Experiment	Observations	Inferences
(a)	Appearance of the sample **P**.		
(b)	Heat sample **P** strongly in a dry test tube.		
(c)	Prepare a solution of **P** and divide it into four portions.		
	(i) Add dilute hydrochloric acid to the first portion followed by barium chloride solution.		
	(ii) Add lead acetate to the second portion.		
	(iii) To the third portion, add ammonia solution till in excess.		
	(iv) To the fourth portion, add sodium hydroxide solution till in excess.		
(d)	Perform confirmatory tests for the cations.		

Conclusion:

The two cations in the sample **P** are _____and _____, the anion is _____.