THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

DIPLOMA IN SECONDARY EDUCATION EXAMINATION

732/2A **CHEMISTRY 2A**

(ACTUAL PRACTICAL A)

Time: 3 Hours **Year: 2023**

Instructions

1. This paper consists of **three (3)** questions.
2. Answer **all** questions.
3. Question number **one (1)** carries **twenty (20)** marks and the rest carry **fifteen (15)** marks each.
4. Cellular phones and any unauthorized materials are not allowed in the examination room.
5. Write your **Examination Number** on every page of your answer booklet (s)

1. Your tutor meets you and your friend in the laboratory arguing about the name and atomic mass of a certain metal present in the metal hydroxide. She then decides to give both of you an experiment to identify the metal present in the hydroxide. For the smooth running of the experiment, the tutor provides you with the following solutions:

A1: A solution containing metal hydroxide (MOH) where M is unknown metal.

B2: A solution of 3.65 g of pure hydrochloric acid in 1.00 dm^3 of aqueous solution.

Methyl orange indicator.

Perform the experiment using the procedures given and answer the questions that follow.

Procedure

(i) Pipette 20 cm^3 or 25 cm^3 of solution **A1** into a conical flask.

(ii) Add 2 to 3 drops of methyl orange indicator.

(iii) Titrate solution **B2** against solution **A1** until a colour change is observed.

(iv) Record up to four titre values.

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Questions

(a) (i) What is the volume of the pipette used?

(ii) Present your results in a tabular form.

(b) What is the colour change of the indicator?

(c) Calculate the concentration of solution **B2** in mol dm^{-3}.

(d) Calculate the concentration of **A1** in mol dm^{-3}.

(e) Calculate the atomic mass of metal **M** if the concentration of MOH is 5.6 g/dm^3.

(f) Identify the element **M** in MOH.

2. One of the factors that affect the rate of a chemical reaction is the concentration of the reactants. Investigate the effect of concentration on the rate of reaction between sodium thiosulphate ($Na_2S_2O_3.5H_2O$) and hydrochloric acid (HCl). You are given the following materials:

AA: A solution containing 0.25 M $Na_2S_2O_3.5H_2O$;

BB: A solution containing 0.5 M HCl; Distilled water, stopwatch and a white paper with a cross "+". Perform the experiment using the procedures given and answer the questions that follow.

Procedures

(i) Put an empty beaker (50 cm^3) on top of the mark "+" drawn on the given piece of paper. Make sure that the mark is clearly visible.

(ii) Using a measuring cylinder, transfer 10 cm^3 of **AA** into a beaker positioned on top of the mark "+".

(iii) Using another measuring cylinder measure 5 cm^3 of **BB**.

(iv) Hold the measuring cylinder containing 5 cm^3 of **BB** in one hand and hold the stop watch in another hand.

(v) Simultaneously, pour 5 cm^3 of **BB** into the beaker positioned on top of the mark "+" and start the stop watch.

(vi) Stir gently the contents in the beaker and record the time of disappearance of the mark "+".

(vii) Repeat the procedure (i) to (vi) by using 8 cm^3, 6 cm^3, 4 cm^3 instead of 10 cm^3 of **AA** in procedure (ii) as tabulated below:

Table of Results

Experiment	Volume of Reactants (cm3)	Time, t (s)	Rate(s□1)
AA	**Water**	**BB**	
1	10	0	5
2	8	2	5
3	6	4	5
4	4	6	5

Questions

(a) Complete the Table of Results.

(b) Write the ionic equation representing the reaction between thiosulphate ion and an acid.

(c) Plot a graph of rate (1/t) of reaction as a function of a volume of sodium thiosulphate.

(d) With the aid of the graph obtained in (c), comment on the relationship between concentration of sodium thiosulphate and the rate of reaction.

(e) Use the data in (a) to find the value of a rate constant, k, given that rate of chemical reaction is expressed by $Rate = k\left[S_2O_3^{2-}\right]^2\left[H^+\right]$

3. Sample **K** is a simple salt in the laboratory, which contains one cation and one anion. Perform a systematic qualitative analysis experiment to identify the cation and the anion present in the sample based on the following tests and answer the questions that follow.

i) Appearance of sample **K**

ii) Action of heat on sample **K** in a test tube

iii) Action of dilute sulphuric or hydrochloric acid on the solid sample

iv) Action of concentrated sulphuric acid on the solid sample

v) Flame test

vi) Solubility of the sample

vii) Confirmatory test for the anion

viii) Confirmatory test for the cation

Questions:

(a) Prepare a relevant Table showing the qualitative analysis results.

(b) What are the cation and anion present in the unknown sample?

(c) Write the reaction equation to indicate what took place in test (vii)