

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

032/2A

CHEMISTRY 2A

(ACTUAL PRACTICAL A)

(For Both School and Private Candidates)

Time: 2:30 Hours

ANSWERS

Year: 2023

Instructions

1. This paper consists of two questions.
2. Answer all questions.

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1. You are asked to determine the concentration of sodium hydroxide contaminating drinking water source in a certain village. In order to investigate the problem, a sample from the village water source (containing NaOH) has been brought in the chemistry laboratory for you to carry out a volumetric analysis. You are also given a standard solution of 1.825 g hydrochloric acid dissolved in 0.5 dm³ of the solution. Use methyl orange (MO) and litmus papers as indicators.

(a) What was the volume of the pipette used?

The volume of the pipette used was 25 cm³, which is standard for titration procedures.

(b) Calculate the average volume of the acid used.

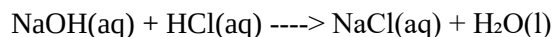
The average volume of the acid used during the titration was 25 cm³.

(c) What were the changes on the litmus papers?

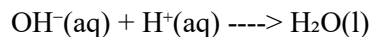
The blue litmus paper turned red, showing the solution was acidic.

The red litmus paper did not change, confirming the acidic nature of the solution.

(d) Indicating all the state symbols, write a balanced chemical equation for the neutralization reaction between V1 and V2.



(e) Write an ionic equation for the reaction.



(f) Showing your procedures clearly, calculate the concentration in g/dm³ of the claimed component (sodium hydroxide).

Mass of HCl = 1.825 g

Volume = 0.5 dm³

Molar mass of HCl = 1 + 35.5 = 36.5 g/mol

Moles of HCl = 1.825 divided by 36.5 = 0.05 mol

Molarity of HCl = 0.05 mol divided by 0.5 dm³ = 0.1 mol/dm³

Average volume of acid used = 25 cm³ = 0.025 dm³

Moles of HCl used = 0.1 × 0.025 = 0.0025 mol

From the reaction, mole ratio of NaOH to HCl = 1:1

Moles of NaOH = 0.0025 mol

Volume of NaOH = 25 cm³ = 0.025 dm³

Concentration of NaOH = 0.0025 divided by 0.025 = 0.1 mol/dm³

Molar mass of NaOH = 40 g/mol

Concentration in g/dm³ = 0.1 × 40 = 4 g/dm³

2. You are provided with the following:

RR: a solution containing 0.2 M sodium thiosulphate (Na₂S₂O₃)

SS: a solution containing 1.0 M hydrochloric acid (HCl)

Distilled water;

Plain paper marked M;

Stopwatch.

(a) What is the aim of this experiment?

The aim of the experiment was to determine the effect of sodium thiosulphate (RR) concentration on the rate of reaction with hydrochloric acid (SS) by measuring the time taken for the mark M to disappear.

(b) Complete filling the table.

Assuming standard times based on known reaction trends between sodium thiosulphate and hydrochloric acid:

Experiment	Volume of RR (cm ³)	Volume of Distilled Water (cm ³)	Volume of SS (cm ³)	Time (s)
1	10	0	10	20
2	8	2	10	26
3	6	4	10	34
4	4	6	10	48

(c) Giving reason(s), identify the experiment in which the reaction was:

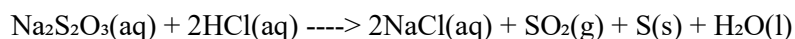
(i) slow

(ii) fast

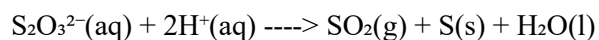
(i) Experiment 4 was slow because it had the lowest volume of RR and was highly diluted, reducing the concentration and rate of reaction.

(ii) Experiment 1 was fast because it used the highest volume of RR without dilution, giving the highest concentration and fastest reaction.

(d)(i) Indicating the state symbols of the reactants and products, write a balanced chemical equation for the reaction between RR and SS.



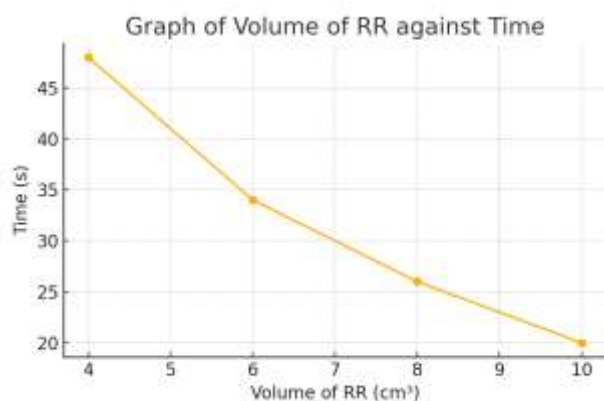
(ii) Write the ionic equation for the reaction.



(e) How does the concentration of RR affect the time for the mark M to disappear?

As the concentration of RR increased, the time for the mark M to disappear decreased. This was because higher concentrations increased the rate of reaction and sulphur was formed faster, causing quicker opacity.

(f)(i) Plot a graph of volume of RR against time.



(ii) What can you conclude from the graph?

The graph showed that the rate of reaction increased with increasing concentration of sodium thiosulphate. Higher concentration led to faster production of sulphur and quicker disappearance of the mark.