

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

032/2C

CHEMISTRY 2C

(ACTUAL PRACTICAL C)

(For Both School and Private Candidates)

Time : 2:3 Hours

ANSWERS

Year : 2021

Instructions

1. This paper consists of **two (2)** questions. Answer all questions.
2. Each question carries **twenty five (25)** marks.
3. Communication devices and any unauthorised materials are **not** allowed in the examination room.
4. Write your **Examination Number** on every page of your answer booklet(s).

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1. Determine water of crystallization in sodium carbonate...

(a) What was the volume of pipette used?

The volume of pipette used was 25 cm³.

(b) What was the colour change at the end point of titration?

The colour changed from yellow to orange-red when using methyl orange indicator.

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

Suppose the titres were 24.6 cm³, 24.4 cm³ and 24.5 cm³.

Average = $(24.6 + 24.4 + 24.5) \div 3 = 24.5 \text{ cm}^3$.

(d) Showing your procedure clearly, determine the value of X (the number of molecules of water of crystallization) in the formula Na₂CO₃·XH₂O.

Step 1: Calculate concentration of acid.

Mass of HCl = 1.825 g in 0.5 dm³.

In 1 dm³ = 3.65 g.

Molar mass HCl = 36.5 g/mol.

Moles = $3.65 \div 36.5 = 0.1 \text{ M}$.

Step 2: Moles of HCl used.

Moles = $C \times V = 0.1 \times 24.5 \div 1000 = 0.00245 \text{ mol}$.

Step 3: Equation of reaction.

$\text{Na}_2\text{CO}_3 \cdot \text{XH}_2\text{O} + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2 + \text{XH}_2\text{O}$.

1 mol Na₂CO₃ reacts with 2 mol HCl.

So moles Na₂CO₃ = $0.00245 \div 2 = 0.001225 \text{ mol}$.

Step 4: Concentration of Na₂CO₃.

In 25 cm³ pipetted solution, moles = 0.001225 mol.

In 1 dm³, moles = $0.001225 \times (1000 \div 25) = 0.049 \text{ mol/dm}^3$.

Step 5: Find molar mass of hydrated salt.

Given 3.575 g in 0.25 dm³ = 14.3 g/dm³.

Molar mass = $14.3 \div 0.049 = 292 \text{ g/mol}$.

Step 6: Calculate X.

Na_2CO_3 molar mass = 106 g/mol.

$$292 - 106 = 186.$$

$$186 \div 18 = 10.3 \approx 10.$$

Therefore, X = 10.

Formula is $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$.

2. Determine the effect of concentration on the rate of chemical reaction...

(a) Complete the table by filling the empty column.

Experiment	Volume of W (cm ³)	Volume of V (cm ³)	Volume of Distilled water (cm ³)	Time for letter X to disappear (s)
(i)	2	5	3	130
(ii)	3	5	2	100
(iii)	4	5	1	80
(iv)	5	5	0	60

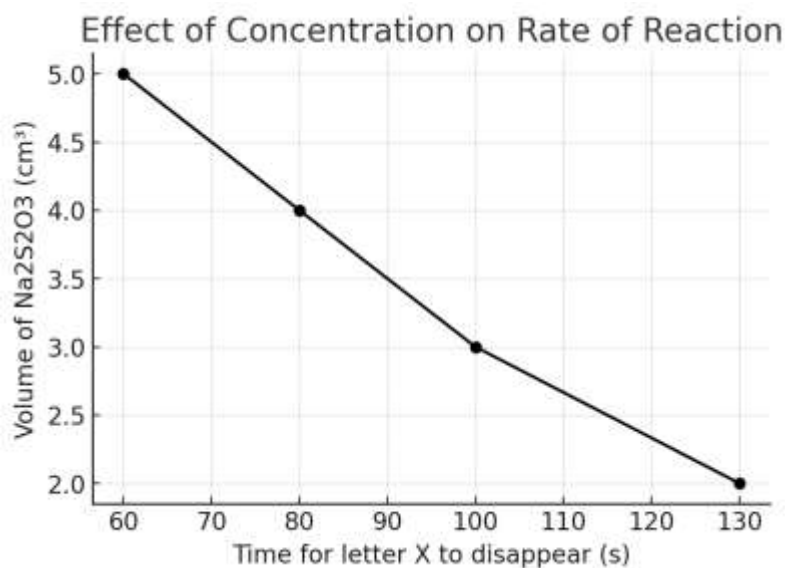
(b) Write a balanced chemical equation for the reaction between sodium thiosulphate and nitric acid.



(c) What substance caused the letter X to disappear in experiment?

The precipitate of sulphur (S) caused the solution to turn cloudy, making X invisible.

(d) Plot a graph of the volume of $\text{Na}_2\text{S}_2\text{O}_3$ (cm^3), y-axis against time (s), x-axis.



(e) What conclusion can you draw from the graph regarding the disappearance of the letter X?

As concentration (volume) of sodium thiosulphate increases, the reaction rate increases, so sulphur forms more quickly and the letter X disappears faster.

