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).

1. Determine water of crystallization in sodium carbonate…

(a) What was the volume of pipette used?

The volume of pipette used was 25 cm^3.

(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 cm^3, 24.4 cm^3 and 24.5 cm^3.

Average = (24.6 + 24.4 + 24.5) ÷ 3 = 24.5 cm^3.

(d) Showing your procedure clearly, determine the value of X (the number of molecules of water of crystallization) in the formula $Na_2CO_3 \cdot XH_2O$.

Step 1: Calculate concentration of acid.

Mass of HCl = 1.825 g in 0.5 dm^3.

In 1 dm^3 = 3.65 g.

Molar mass HCl = 36.5 g/mol.

Moles = 3.65 ÷ 36.5 = 0.1 M.

Step 2: Moles of HCl used.

Moles = C × V = 0.1 × 24.5 ÷ 1000 = 0.00245 mol.

Step 3: Equation of reaction.

$Na_2CO_3 \cdot XH_2O + 2HCl \rightarrow 2NaCl + H_2O + CO_2 + XH_2O$.

1 mol Na_2CO_3 reacts with 2 mol HCl.

So moles Na_2CO_3 = 0.00245 ÷ 2 = 0.001225 mol.

Step 4: Concentration of Na_2CO_3.

In 25 cm^3 pipetted solution, moles = 0.001225 mol.

In 1 dm^3, moles = 0.001225 × (1000 ÷ 25) = 0.049 mol/dm^3.

Step 5: Find molar mass of hydrated salt.

Given 3.575 g in 0.25 dm^3 = 14.3 g/dm^3.

Molar mass = 14.3 ÷ 0.049 = 292 g/mol.

Step 6: Calculate X.

Na_2CO_3 molar mass = 106 g/mol.

292 – 106 = 186.

186 ÷ 18 = 10.3 ≈ 10.

Therefore, X = 10.

Formula is $Na_2CO_3 \cdot 10H_2O$.

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

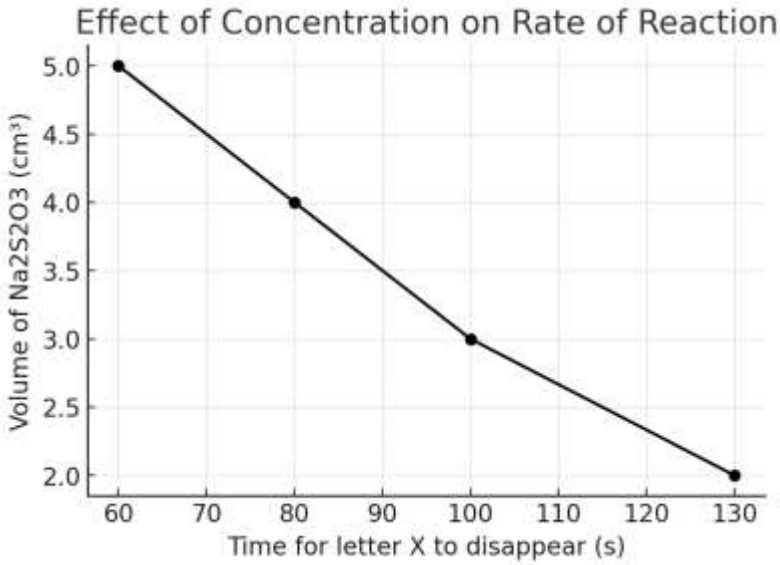
(b) Write a balanced chemical equation for the reaction between sodium thiosulphate and nitric acid.

$Na_2S_2O_3(aq) + 2HNO_3(aq) \rightarrow 2NaNO_3(aq) + H_2O(l) + SO_2(g) + S(s)$.

(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 $Na_2S_2O_3$ (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.