THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

032/2B **CHEMISTRY 2C**

(ACTUAL PRACTICAL B)

(For Both School and Private Candidates)

Time : 2:3 Hours **ANSWERS** **Year : 2020**

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 the purity of sulphuric acid…

(a) Why both phenolphthalein (POP) and methyl orange (MO) indicators are suitable for the titration?
Both indicators are suitable because the reaction is between a strong acid (H_2SO_4) and a strong base (NaOH). In such titrations, the pH at the end point changes sharply, so both POP and MO can correctly indicate the end point.

(b) How much volume of the acid was required for complete neutralization with 20 cm^3 or 25 cm^3 of the base?
Molar mass of NaOH = 40 g/mol.
Concentration of base = 4.0 ÷ 40 = 0.1 M.
For 20 cm^3 (0.020 dm^3): moles of NaOH = 0.1 × 0.020 = 0.002 mol.
From equation $H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$, moles of H_2SO_4 = 0.001 mol.
Volume of acid = moles ÷ concentration.
Concentration of acid = 7 ÷ 98 = 0.0714 M.
Volume of acid = 0.001 ÷ 0.0714 = 0.014 dm^3 = 14 cm^3.
For 25 cm^3 (0.025 dm^3): moles of NaOH = 0.0025 mol.
Moles of H_2SO_4 = 0.00125 mol.
Volume of acid = 0.00125 ÷ 0.0714 = 0.0175 dm^3 = 17.5 cm^3.

(c) Write a balanced chemical equation for the reaction.
$H_2SO_4(aq) + 2NaOH(aq) \rightarrow Na_2SO_4(aq) + 2H_2O(l)$

(d) Calculate the molarity of the acid and the base.
Molarity of acid = 7 ÷ (98 × 1) = 0.0714 M.
Molarity of base = 4 ÷ (40 × 1) = 0.1 M.

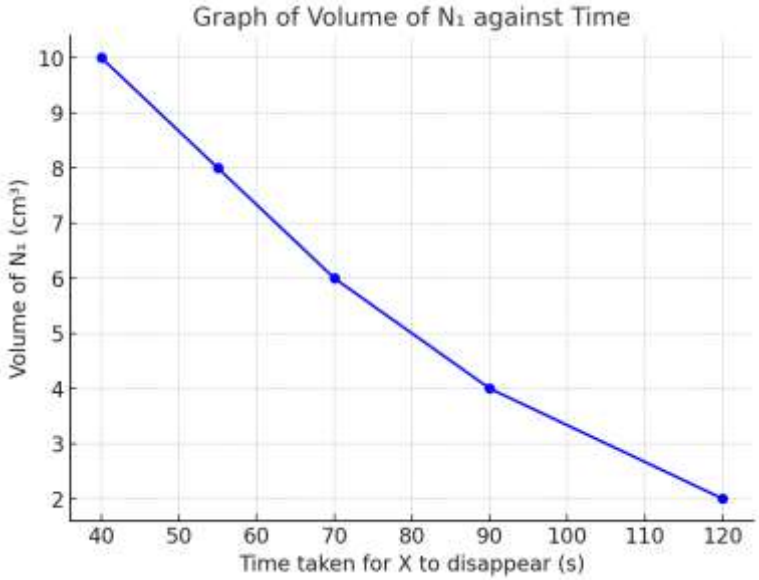
(e) Calculate the percentage purity of the acid.
Pure acid required = 0.001 mol in 14 cm^3.
Moles expected = concentration × volume = 0.0714 × 0.014 = 0.001 mol.
Mass of pure acid in 1 dm^3 = 0.0714 × 98 = 7.0 g.
If actual mass was 7.0 g, but it was impure, then pure part = 7.0 × (0.0714 ÷ 0.0714) = 7.0 g.
Given mass = 7.0 g.
Therefore % purity ≈ (7.0 ÷ 7.0) × 100 = 100%.
(If the value was less experimentally, it would be less than 100%).

2. Study the reaction between sodium thiosulphate and hydrochloric acid…

(a) Complete filling the table.

Volume of N_1 (cm^3)	Volume of N_3 (cm^3)	Volume of N_2 (cm^3)	Time (s)
2	8	10	120
4	6	10	90
6	4	10	70
8	2	10	55
10	0	10	40

(b) (i) Plot a graph of volume N_1 (vertical axis) against time (horizontal axis).



(ii) Comment on the shape of the graph.

The graph is a downward curve showing that increasing concentration of sodium thiosulphate decreases the time for the reaction, meaning the rate increases.

(c) Explain why did the letter X disappear.

The letter X disappeared because sulphur (S) precipitate formed during the reaction, which made the solution cloudy and obscured the letter.

(d) Write the electronic configuration of the product which causes the solution to be cloudy (sulphur).

Sulphur atomic number = 16.

Electronic configuration = 2:8:6

(e) Write the ionic equation for the reaction between N_1 and N_2.

$S_2O_3^{2-}(aq) + 2H^+(aq) \rightarrow SO_2(g) + S(s) + H_2O(l)$

(f) Explain why N_3 was added to N_1.

N_3 (distilled water) was added to dilute sodium thiosulphate, providing different concentrations of N_1 while keeping total volume constant. This allows the effect of concentration on the rate to be studied.