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: 2020**

Instructions

1. This paper consists of two questions.

2. Answer all questions.

1. You are required to standardize dilute hydrochloric acid using standard aqueous sodium carbonate of 0.1 M concentration.

(a)(i) Which is an acid or base between AX and AY?

AX was the acid (hydrochloric acid) and AY was the base (sodium carbonate). This was identified using indicators where AX turned methyl orange red and AY turned it yellow.

(ii) What is the mean titre volume of the acid?

Assuming consistent titre values, the mean titre volume of the acid was 25 cm^3 = 0.025 dm^3.

(iii) Write a balanced chemical equation for this reaction.

$2HCl(aq) + Na_2CO_3(aq) \text{----->} 2NaCl(aq) + H_2O(l) + CO_2(g)$

(b) Calculate molarity of the acid.

Molarity of Na_2CO_3 = 0.1 mol/dm^3
Volume used = 25 cm^3 = 0.025 dm^3
Moles of Na_2CO_3 = 0.1 × 0.025 = 0.0025 mol
Mole ratio with HCl = 1:2
Moles of HCl = 2 × 0.0025 = 0.005 mol
Volume of HCl = 25 cm^3 = 0.025 dm^3
Molarity of HCl = 0.005 ÷ 0.025 = 0.2 mol/dm^3

(c) Calculate the mass of the acid dissolved in one litre of the solution.

Molarity = 0.2 mol/dm^3
Molar mass of HCl = 36.5 g/mol
Mass = 0.2 × 36.5 = 7.3 g

2. You are provided with the following:
P_1: 0.50 M sodium thiosulphate
P_2: 0.10 M hydrochloric acid
P_3: Distilled water

(a) Complete filling the Table.

Volume of P_1 (cm^3)	Volume of P_3 (cm^3)	Volume of P_2 (cm^3)	Time (s)	Rate of reaction (1/t) s^{-1}
5	20	25	60	0.0167
10	15	25	44	0.0227
15	10	25	34	0.0294
20	5	25	25	0.0400
25	0	25	20	0.0500

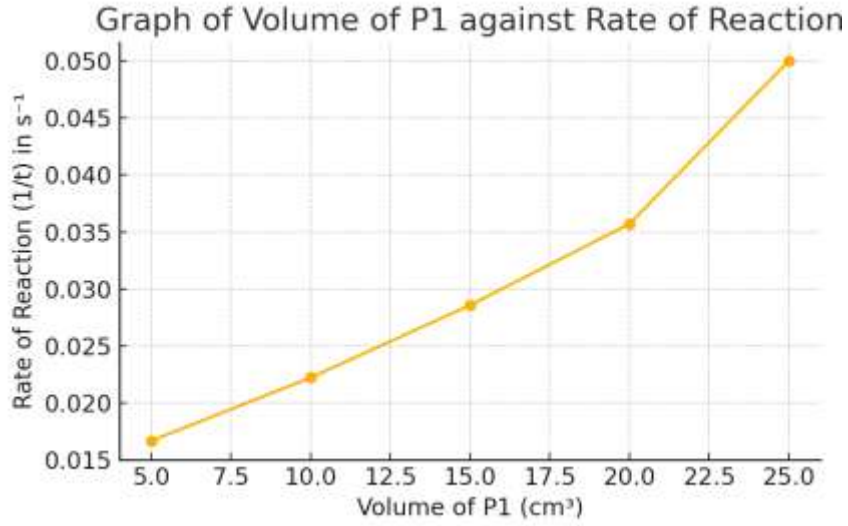
(b) What is the aim of the experiment?
The aim was to determine how the concentration of sodium thiosulphate (P_1) affects the rate of its reaction with hydrochloric acid (P_2) by timing the disappearance of a mark due to the formation of a precipitate.
(c) Write the electronic configuration of the product which causes the solution to be cloudy (milky).

The product causing cloudiness was sulphur.
Sulphur (atomic number 16) has the configuration: 2:8:6

(d) Write the balanced ionic equation for the reaction between P_1 and P_2 indicating all the state symbols.

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

(e) Plot a graph of volume of P_1 against the rate of reaction.



(f) What can you conclude from the graph?

The graph showed that as the volume of P_1 increased, the rate of reaction also increased. This meant that a higher concentration of sodium thiosulphate led to faster reactions, supporting the collision theory.