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: 2021**

Instructions

1. This paper consists of two questions.

2. Answer all questions.

1. You are provided with the following:
LL: 6.3 g of dibasic acid, $H_2C_2O_4 \cdot XH_2O$ dissolved to make 1 litre of a solution
MM: 4.0 g of NaOH dissolved to make 1 litre of a solution
Determine the value of X in the acid $H_2C_2O_4 \cdot XH_2O$. Proceed as follows:

(a)(i) Indicate the volume of the pipette used.

The volume of the pipette used was 25 cm^3.

(ii) Complete the table of results and compute the average volume of acid used for complete neutralization of MM.

Assuming consistent titre values of 25.00 cm^3 in multiple trials, the average volume of acid used was 25.00 cm^3 = 0.025 dm^3.

(b) Calculate the molarity of the base.
Mass of NaOH = 4.0 g
Molar mass of NaOH = 40 g/mol
Moles of NaOH = 4.0 ÷ 40 = 0.1 mol
Volume = 1 dm^3
Molarity of base = 0.1 mol/dm^3

(c) Write a balanced chemical equation for the reaction taking place.

$H_2C_2O_4 \cdot XH_2O + 2NaOH \text{ ----> } Na_2C_2O_4 + 2H_2O$

(d) Calculate the molarity of the acid.

Moles of NaOH used = 0.1 × 0.025 = 0.0025 mol
Mole ratio $H_2C_2O_4$ to NaOH = 1:2
Moles of $H_2C_2O_4$ = 0.0025 ÷ 2 = 0.00125 mol
Volume of acid used = 25 cm^3 = 0.025 dm^3
Molarity of acid = 0.00125 ÷ 0.025 = 0.05 mol/dm^3

(e) Calculate:
(i) the value of X in $H_2C_2O_4 \cdot XH_2O$

Molar mass of $H_2C_2O_4$ = 2 + 24 + 64 = 90 g/mol
Molar mass of water = 18 g/mol
Mass of 1 mole of hydrated acid = 6.3 g ÷ 0.05 mol = 126 g/mol
126 = 90 + 18X
18X = 36
X = 2

(ii) the percentage of water of crystallization in $H_2C_2O_4 \cdot XH_2O$

Mass of water = 2 × 18 = 36 g
Total molar mass = 126 g
Percentage of water = (36 ÷ 126) × 100 = 28.57 percent

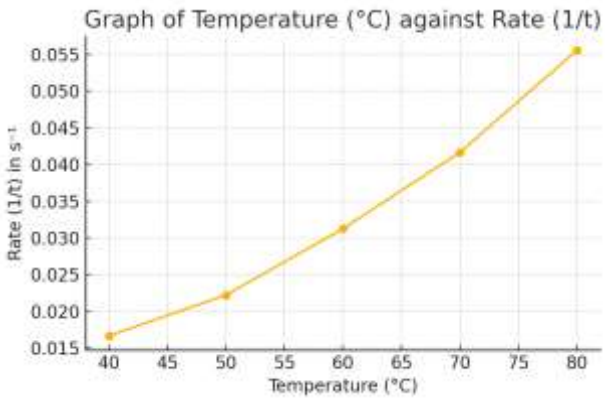
2. You are provided with the following:
L1: 0.05 M sodium thiosulphate
L2: 1.0 M nitric acid
Stopwatch
Thermometer
White paper marked X

(a) What is the aim of the experiment?
The aim of the experiment was to determine the effect of temperature on the rate of reaction between sodium thiosulphate (L1) and nitric acid (L2) by measuring the time for the mark X to disappear.

(b) Complete filling in the data in the table.

Volume of L1 (cm^3)	Volume of L2 (cm^3)	Temperature of L1 (°C)	Time (s)	Rate (1/t) (s^{-1})
40	20	40	60	0.0167
40	20	50	45	0.0222
40	20	60	32	0.0313
40	20	70	24	0.0417
40	20	80	18	0.0556

(c) Plot a graph of temperature (°C), Y - axis against Rate (s^{-1}), X - axis.



(d) What does the shape of the graph indicate?

The shape of the graph indicates that the rate of reaction increased with temperature. It showed a positive correlation between temperature and rate.

(e) Write the ionic equation for the reaction between L1 and L2.

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

(f) Why did the letter X disappear?

The letter X disappeared because sulphur precipitate formed during the reaction, making the solution cloudy and eventually opaque, thus obscuring the letter.