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: 2013**

Instructions

1. This paper consists of two questions.

2. Answer all questions.

1. You are provided with the following solutions:
JJ: Containing 3.0 g of acetic acid in 0.50 dm^3 of solution
KK: Containing 1.5 g of impure potassium hydroxide in 250 cm^3 of solution
Phenolphthalein indicator

Questions
(a) Is the use of methyl orange indicator in this experiment as suitable as phenolphthalein? Give a reason for your answer.
No, methyl orange is not suitable. It is appropriate for strong acid–strong base titrations. Acetic acid is a weak acid and potassium hydroxide is a strong base, so phenolphthalein is the better choice as it changes colour in the pH range suitable for this titration.

(b) Titrate the acid (in a burette) against the base (in a conical flask) using two drops of your indicator and obtain three titre values.
Assume 25.00 cm^3 of KK required 22.50 cm^3 of JJ for complete neutralization.

(c) (i) ___ cm^3 of JJ required ___ cm^3 of KK for complete reaction.
22.50 cm^3 of JJ required 25.00 cm^3 of KK for complete reaction.

(c) (ii) Write a balanced chemical equation for the reaction between JJ and KK.
$CH_3COOH(aq) + KOH(aq) \longrightarrow CH_3COOK(aq) + H_2O(l)$

(d) Showing your procedures clearly, calculate the percentage purity of potassium hydroxide.
Molar mass of KOH = 39 + 16 + 1 = 56 g/mol
Volume of KK = 25.00 cm^3 = 0.025 dm^3
Assume JJ = 0.1 mol/dm^3
Moles of acetic acid = 0.1 × 0.0225 = 0.00225 mol
Mole ratio is 1:1 ---> moles of KOH = 0.00225 mol
Mass = 0.00225 × 56 = 0.126 g in 25.00 cm^3
So in 250 cm^3, mass = (0.126 ÷ 25) × 250 = 1.26 g
Purity = (1.26 ÷ 1.5) × 100 = 84%

2. You are provided with the following:
L_1: 0.50 M sodium thiosulphate
L_2: 0.10 M hydrochloric acid
Distilled water
Stopwatch
Plain paper

Table 1

Volume of L_1 (cm^3)	Volume of water (cm^3)	Volume of L_2 (cm^3)	Time (s)	Rate (1/t) (s^{-1})
25	0	25	14	0.0714

20	5	25	18	0.0556
15	10	25	26	0.0385
10	15	25	34	0.0294
5	20	25	52	0.0192

Questions

(a) What is the aim of this experiment?

To determine how the concentration of sodium thiosulphate affects the rate of reaction with hydrochloric acid.

(c) Write the electronic configuration of the product which causes the solution to cloud letter X.

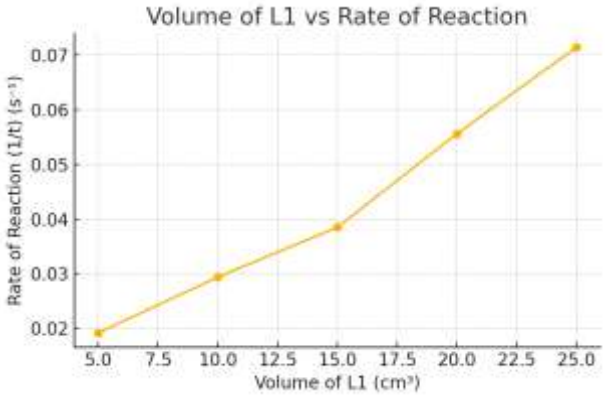
Sulphur (S) is the precipitate.

Electronic configuration of sulphur (S): 2:8:6

(d) With state symbols, write the ionic equation for the reaction between L_1 and L_2.

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

(e) Plot a graph of volume of L_1 against rate of reaction.



(f) What can you conclude from the graph?

As the volume (and concentration) of sodium thiosulphate increases, the rate of reaction increases, confirming that rate of reaction is directly proportional to concentration of reactants.