THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

032/2B **CHEMISTRY 2B**

(ACTUAL PRACTICAL B)

(For Both School and Private Candidates)

Time: 2:30 Hours **ANSWERS** **Year: 2015**

Instructions

1. This paper consists of two questions.

2. Answer all questions.

1. You are provided with the following solutions:
R_1: Containing 5.6 g of TOH in 1 dm^3 of solution;
R_2: Containing 4.9 g of sulphuric acid dissolved in 1 dm^3 of solution;
Methyl orange indicator.

Questions

(a) Titrate the acid (in burette) against the base (in a conical flask) using two drops of your indicator and obtain three titre values.
Assume average titre volume of R_2 used was 24.80 cm^3 against 25.00 cm^3 of R_1.

(b) (i) ___ cm^3 of R_2 required ___ cm^3 of R_1 for complete reaction.
24.80 cm^3 of R_2 required 25.00 cm^3 of R_1 for complete reaction.

(b) (ii) Write a balanced chemical equation for the reaction in this experiment.
$H_2SO_4(aq) + 2TOH(aq) \text{----> } T_2SO_4(aq) + 2H_2O(l)$

(b) (iii) Showing your procedures clearly, identify element T in the TOH compound.
Volume of H_2SO_4 used = 24.80 cm^3 = 0.0248 dm^3
Mass = 4.9 g, molar mass of H_2SO_4 = 98 g/mol
Moles of acid = 4.9 ÷ 98 = 0.05 mol in 1 dm^3
Moles used = 0.05 × 0.0248 = 0.00124 mol
Mole ratio = 1:2 → moles of TOH = 0.00124 × 2 = 0.00248 mol
Mass of TOH in 25 cm^3 = 5.6 ÷ 1000 × 25 = 0.14 g
Molar mass = 0.14 ÷ 0.00248 = 56.45 g/mol
T is potassium (K), since molar mass of KOH is 39 + 16 + 1 = 56 g/mol

2. You are provided with the following:
Solution M: 0.2 M sodium thiosulphate;
Solution N: 2 M hydrochloric acid;
A piece of white paper marked X;
Stop-watch;
Distilled water.

Procedure
(i) Using a measuring cylinder, measure 50 cm^3 of solution M and pour into a 100 cm^3 beaker.
(ii) Measure 10 cm^3 of solution N and put into a 100 cm^3 beaker containing solution M and immediately start the stop-watch.
(iii) Swirl the contents and place the 100 cm^3 beaker on top of mark X on a piece of paper.
(iv) Switch off the stop-watch when the mark X disappears.
(v) Record the time taken for the mark X to disappear.
(vi) Repeat the experiment as shown in Table 1.

Questions

(a) Complete Table 1 by filling the last two columns.

Volume of M	Volume of water	Volume of N	Conc. of M (mol/dm³)	Time (s)	Rate (1/t) (s^{-1})
50 cm³	0 cm³	10 cm³	0.127	15	0.0667
40 cm³	10 cm³	10 cm³	0.104	22	0.0455
30 cm³	20 cm³	10 cm³	0.078	29	0.0345
20 cm³	30 cm³	10 cm³	0.052	40	0.0250
10 cm³	40 cm³	10 cm³	0.026	60	0.0167

(b) Write down a balanced chemical equation for the reaction between sodium thiosulphate and hydrochloric acid.
$Na_2S_2O_3(aq) + 2HCl(aq) \longrightarrow 2NaCl(aq) + SO_2(g) + S(s) + H_2O(l)$

(c) What substance was produced during the reaction which obscured the cross?
Sulphur (S) was produced as a precipitate, making the solution cloudy.

(d) Use the data in the Table 1 to draw a concentration-time graph, time on the X-axis and concentration on the Y-axis.
(Instruction acknowledged. Graph not drawn as per your direction.)

(e) What conclusion can you draw from the graph of the experiment?
As the concentration of sodium thiosulphate decreases, the time taken for the reaction to complete increases, meaning the rate of reaction decreases with decreasing concentration.

3. Sample L is a simple salt. Carry out the experiments described below. Record your observations and make appropriate inferences and hence identify the anion and cation present in sample L.

S/n	Experiment	Observation	Inference
a	Appearance	White crystalline solid	Ionic compound
b	Heat a little sample L in a dry test tube	No change	No water of crystallization
c(i)	Dissolve and add NaOH till excess	White ppt, soluble in excess	Zn^{2+} present
c(ii)	Add dilute HCl, then heat	Effervescence	CO_3^{2-} present
c(iii)	Add $FeSO_4$ + conc. H_2SO_4 slowly	No brown ring	No NO_3^- present
c(iv)	Add NH_3 solution till excess	White ppt, soluble in excess	Confirms Zn^{2+}
c(v)	Add $AgNO_3$ + NH_3 solution	White ppt, soluble in excess	Confirms Cl^-

Conclusion
(i) The cation in L was Zn^{2+}

(ii) The anion in L was Cl^-
(iii) The chemical formula of sample L was $ZnCl_2$