THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL OF TANZANIA
DIPLOMA IN SECONDARY EDUCATION EXAMINATION

732/2A **CHEMISTRY 2A**

(ACTUAL PRACTICAL A)

Time: 3 Hours **ANSWERS** **Tuesday, 18th May 2010 a.m**

Instructions.

1. This paper consists of **three (3)** questions.
2. Answer **all** questions
3. Question number 1 carries 20 marks and the rest carry 30 marks.
4. Cellular phones are **note** allowed in the examination room.
5. Write your **examination Number** on every page of your answer booklet(s).

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1. You are provided with the following requirements:
T1: A solution containing 4 g of $Na_2S_2O_3 \cdot 5H_2O$ per dm^3.
T2: A solution of dilute HCl
T3: Distilled water
A stop watch.

Procedure:

(a) Using blue or black pen write a clear letter 'x' on a piece of white paper and place a small beaker on top of the letter 'x' such that the letter 'x' is visible through the solution.

(b) Put 10 cm^3 of T1 into the beaker followed by 5 cm^3 of T2 and start the stop watch. Stir gently and record the time taken for the letter 'x' to disappear in the solution.

(c) Repeat the above procedures by using various amounts of T1 and distilled water T3 as indicated in the table below.

Table of Results:

Volume of T1 (cm^3)	**Volume of T2 (cm^3)**	**$S_2O_3^{2-}$ M**	**t (sec)**	**$[S_2O_3^{2-}]$**	**1/t (sec^{-1})**
10	0				
8	2				
6	4				
4	6				

(d) Complete the table above.
(e) Plot a graph of 1/t against $1/[S_2O_3^{2-}]$.
(f) Plot a graph of 1/t against $[S_2O_3^{2-}]^2$.
(g) From your graphs what is the effect of $[Na_2S_2O_3]$ on the rate of reaction?
(h) What is the order of reaction with respect to $[Na_2S_2O_3]$?

Answer:

(d) Completed table:

Volume of T1 (cm^3)	**Volume of T2 (cm^3)**	**$S_2O_3^{2-}$ M (mol/dm^3)**	**t (sec)**	**$[S_2O_3^{2-}]$ (mol/dm^3)**	**1/t (sec^{-1})**
10	0	0.20	30	0.20	0.0333
8	2	0.16	37	0.16	0.0270
6	4	0.12	50	0.12	0.0200
4	6	0.08	75	0.08	0.0133

(g) As the concentration of $Na_2S_2O_3$ increases, the rate of reaction increases. This is shown by the time for the disappearance of 'X' decreasing and the values of 1/t increasing.

(h) From the shape of the graph of 1/t against $[S_2O_3^{2-}]$, the reaction is first order with respect to sodium thiosulphate.

2. You are provided with the following:
A. A solution of 5.022 g of dibasic organic acid of anhydrous salt with molecular mass of 126 g/mol in 250 cm^3 of aqueous solution.
B. A solution of 0.1 M NaOH
C. Phenolphthalein indicator.

Procedure:

(a) Pipette 20 cm^3 or 25 cm^3 of A into a conical flask.
(b) Add to it two drops of C.
(c) Put B into the burette.
(d) Titrate B against A until the colour change is observed.

Table of results:

Titration Number	Pilot	1	2	3
Final volume (cm^3)				
Initial volume (cm^3)				
Volume used (cm^3)				

(a) The volume of pipette used was _____ cm^3.
(b) The volume of burette was _____ cm^3.
For complete neutralisation, _____ cm^3 of A required _____ cm^3 of solution B.

(c) Write a balanced equation for the reaction taking place between A and B.
(d) Calculate the:
(i) molarity of A.
(ii) concentration of A in g/dm^3.
(iii) number of moles of water of crystallisation per mole of hydrated dibasic organic acid.

Answer:

Titration Number	Pilot	1	2	3
Final volume (cm^3)	22.5	22.3	22.4	22.3
Initial volume (cm^3)	0.0	0.0	0.0	0.0
Volume used (cm^3)	22.5	22.3	22.4	22.3

(a) The volume of pipette used was 25 cm^3.
(b) The volume of burette was 50 cm^3.
For complete neutralisation, 25 cm^3 of A required 22.3 cm^3 of solution B.

(c) Balanced equation:
$H_2A + 2NaOH$ -----> $Na_2A + 2H_2O$

(d) Calculations:

(i) Moles of NaOH used:
0.1 mol/dm³ × 22.3 cm³ / 1000 = 0.00223 mol

From the equation, 2 mol NaOH neutralise 1 mol acid
Moles of acid = 0.00223 / 2 = 0.001115 mol

Molarity of A:
= 0.001115 mol / 0.025 dm³ = 0.0446 mol/dm³

(ii) Concentration of A in g/dm³:
= 0.0446 mol/dm³ × 126 g/mol = 5.6196 g/dm³

(iii) Number of moles of water of crystallisation

Mass of salt in 250 cm³ = 5.022 g
In 1 dm³ = (5.022 × 1000) / 250 = 20.088 g

Mass of anhydrous acid per mol = 126 g
Moles of anhydrous acid in 1 dm³ = 20.088 / 126 = 0.1595 mol

Moles from titration = 0.0446 mol

Mass of water = 20.088 g - (126 × 0.1595) = 0 g

3. Sample W is a compound containing one anion and one cation. Using qualitative analysis techniques, identify the two ions and hence deduce the name of the compound.

Answer:

(a) Experiment table

S/N	Experiment	Observation	Inference
(a)	Appearance	White crystalline solid	Possible chloride, carbonate or sulfate
(b)	Solubility	Dissolves completely in water	Soluble salt
(c)	Add conc. H_2SO_4	Effervescence, gas turns limewater milky	CO_3^{2-} present
(d)	Add $FeSO_4$ + conc. H_2SO_4	No brown ring formed	Nitrate absent

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(e)	Add dilute NaOH dropwise then excess	White ppt soluble in excess	Zn^{2+} present
(f)	Add dilute NH_4OH dropwise then excess	White ppt soluble in excess	Confirms Zn^{2+}

(b) Cation in W: Zinc ion (Zn^{2+})

(c) Name and formula of W: Zinc carbonate ($ZnCO_3$)

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