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

732/2A   **CHEMISTRY 2A**

(ACTUAL PRACTICAL A)

Time: 3 Hours   **ANSWERS**   **Thursday, 17th May 2018 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).

1. You are provided with a solution of 2.5 g anhydrous sodium carbonate in 2 litres, labelled BB and another solution of sulphuric acid of unknown concentration, labelled AA. You are also given methyl orange (MO) is also given.

(a) Perform titrations procedure to determine the volume of sulphuric acid used for neutralisation. Record your results in a suitable table of titration results.

Answer

| Burette Readings	Pilot	Titration 1	Titration 2	Titration 3
Final volume (cm³)	23.10	23.00	23.20	23.10
Initial volume (cm³)	0.00	0.00	0.00	0.00
Volume used (cm³)	23.10	23.00	23.20	23.10

(b) Comment on the colour change.

Answer

The solution changes from yellow to orange at the end point as methyl orange shifts in acidic conditions.

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

Answer

$Na_2CO_3 + H_2SO_4 -----> Na_2SO_4 + CO_2 + H_2O$
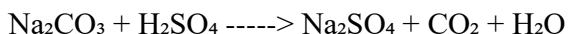
(d) State the mole ratio.

Answer

$Na_2CO_3 : H_2SO_4 = 1 : 1$

(e) Molarity of BB.

Answer

Molar mass of $Na_2CO_3 = (23×2) + 12 + (16×3) = 106$ g/mol
Mass in 2 litres = 2.5 g
Moles = 2.5 / 106 = 0.02358 mol
Molarity = 0.02358 / 2 = 0.01179 M

(f) What mass in grams of sulphuric acid present in one litre of the acid solution.

Answer

Using $M_1V_1 = M_2V_2$

$(0.01179 × 25) = M_2 × 23.10$
$M_2 = (0.2948) / 23.10$
$= 0.01276$ M

Molar mass H_2SO_4 = 98 g/mol
Mass in 1 litre = 0.01276×98 = 1.251 g

(g) If the concentration of Na_2CO_3 is doubled, what volume of sulphuric acid will be required to complete neutralization.

Answer

New concentration = 0.01179×2 = 0.02358 M

Using $M_1V_1 = M_2V_2$

$(0.02358 \times 25) = 0.01276 \times V$
V = 0.5895 / 0.01276
V = 46.2 cm³

2. You are provided with solutions AA (0.22M $Na_2S_2O_3$) and BB (0.1M HCl). You are also given distilled water, stop watch/clock and a sheet of white A4 paper marked 'X'.

Table 1: Experimental data

Expt	$S_2O_3^{2-}$ (cm³)	H_2O (cm³)	HCl (cm³)	Time, t (s)	1/t (s⁻¹)
A	2	8	10	140	0.00714
B	4	6	10	70	0.01429
C	6	4	10	47	0.02128
D	8	2	10	35	0.02857

(a) Complete the Table 1 with appropriate data.

Answer

Done above.

(b) If the rate expression is
$R = k[S_2O_3^{2-}]^a [H^+]^b$
calculate the value of 'c'. Take volume of solution as its concentration.

Answer

Let's use Expt A and B

$R_1/R_2 = (C_1/C_2)^a$
$(0.00714/0.01429) = (2/4)^a$
$0.5 = 0.5^a$
a = 1

Therefore, c = 1

(c) Given the value of a = 2, find the value of K.

Answer

If a = 2

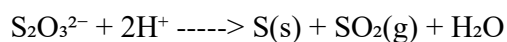Use Expt A:
R = k × (2/20)^2 × (10/20)^b

0.00714 = k × (0.1)^2 × (0.5)^b

Assume b = 1
0.00714 = k × 0.01 × 0.5
k = 0.00714 / 0.005
k = 1.428 s^{-1}

(d) Write the ionic equation for the reaction taking place in this experiment.

Answer

$S_2O_3^{2-} + 2H^+ \longrightarrow S(s) + SO_2(g) + H_2O$

(e) Plot a graph of AA (vertical axis) against the volume of sodium thiosulphate (horizontal axis).

Answer
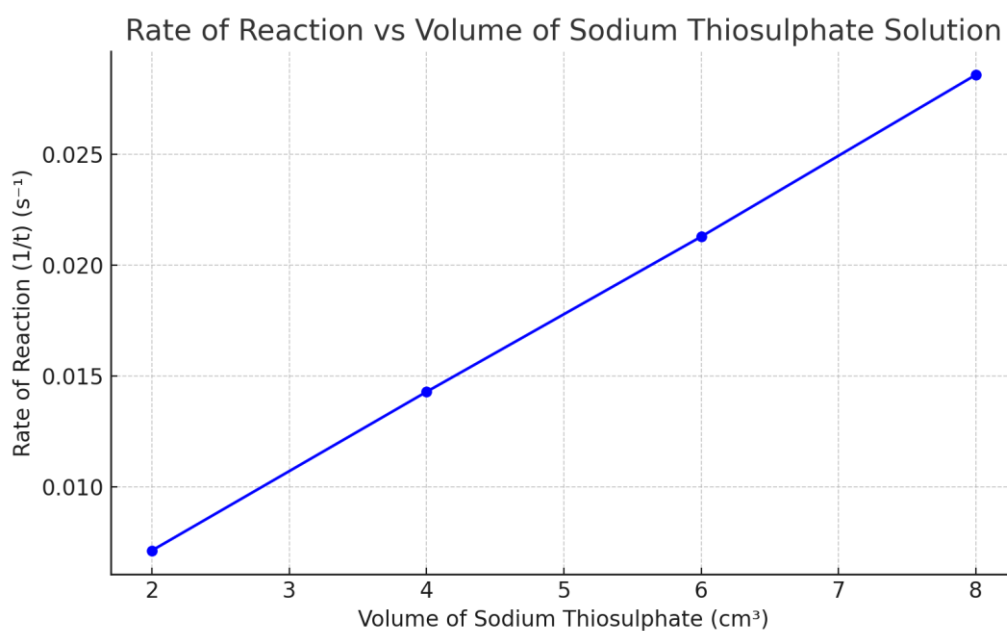
(f) Based on the nature of the graph in (e), suggest the order of reaction with respect to sodium thiosulphate.

Answer

Since the graph of rate vs $[Na_2S_2O_3]$ is linear, order of reaction with respect to $Na_2S_2O_3$ is first order.

3. You are given sample L which contains one cation and one anion. Carry out qualitative analysis to identify the cation and anion present in L based on the tests given in Table 2.

Table 2: Experimental Observation and Inferences

S/N	Experiment	Observation	Inference
(a)	Appearance of sample L.	White crystalline solid	Soluble salt
(b)	Heat the sample.	No change	Thermally stable
(c)	Dissolve in water and divide.	Clear solution	Soluble in water
(d)	Add conc. H_2SO_4	Effervescence, CO_2 gas	Presence of CO_3^{2-}
(e)	Add dilute HCl	Effervescence	Confirm CO_3^{2-}
(f)	Add dilute NaOH till excess	White ppt, soluble in excess	Presence of Zn^{2+}
(g)	Add dilute NH_4OH till excess	White ppt, soluble in excess	Confirms Zn^{2+}
(h)	Add $BaCl_2$	White ppt	Presence of SO_4^{2-}
(i)	Add $AgNO_3$	No ppt	No halides

(b) Give the name and chemical formula of the cation in sample L.

Answer

Cation: Zinc ion, Zn^{2+}

(c) Write down the chemical formula of L.

Answer

$ZnCO_3$

(d) What is the common name for the experiment (f)?

Answer

Confirmatory test for zinc using NaOH

(e) Is it the anion or cation that determined the observed dissolubility property of the salt? Give reason for your answer.

Answer

The anion determined the solubility. Carbonates are typically sparingly soluble but zinc carbonate is relatively more soluble than most carbonates, contributing to the observed solubility.