

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

732/2B

**CHEMISTRY 2B
(ACTUAL PRACTICAL B)**

Time: 3 Hours

ANSWERS

Year: 2009

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 **not** 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:

Solution coded **G1** (a solution of hydrochloric acid with unknown concentration)

Solution **G2**, a standard sodium carbonate solution containing 2.65 g of Na_2CO_3 per dm^3

Methyl orange indicator

Instruction: Titrate **G2** (from the burette) against **G1** (in the titration flask) using methyl orange as the indicator. Record your results including one rough and three accurate titrations in a tabular form.

Questions

(i) The colour change observed during the titration is from yellow to orange-pink at the endpoint. This is due to the pH change near 4 when all carbonate is neutralized by the acid.

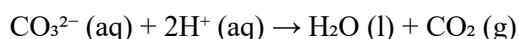
(ii) The volume of the pipette used is 25.0 cm^3 . This is a standard volume used in titrations to transfer a known amount of analyte.

(iii) If the average titre volume recorded is around 25.0 cm^3 , then the average volume of solution G2 used to neutralize G1 is **25.0 cm^3** .

(iv) The balanced chemical equation between HCl and Na_2CO_3 is:



(v) The ionic equation is:



(vi) Molar mass of $\text{Na}_2\text{CO}_3 = 23 \times 2 + 12 + 16 \times 3 = 106 \text{ g/mol}$

Concentration of G2 = $2.65 \text{ g/dm}^3 \div 106 \text{ g/mol} = 0.025 \text{ mol/dm}^3$

From the equation:

1 mol Na_2CO_3 reacts with 2 mol HCl

Moles of Na_2CO_3 in $25.0 \text{ cm}^3 = 0.025 \text{ mol/dm}^3 \times 25.0 \text{ cm}^3 \div 1000 = 0.000625 \text{ mol}$

Then moles of HCl = $0.000625 \text{ mol} \times 2 = 0.00125 \text{ mol}$

So concentration of G1 (HCl) = $0.00125 \text{ mol} \div 25.0 \text{ cm}^3 \times 1000 = \mathbf{0.05 \text{ mol/dm}^3}$

2. You are provided with:

0.1 M sodium thiosulphate labeled **TQ**

0.1 M hydrochloric acid labeled **TR**

Distilled water

A stopwatch, beaker, test tubes, thermometer, and a sheet of paper with a black letter “Z”

(i) Room temperature is approximately 25°C, which is **298 K**.

(ii) The mark “Z” disappeared because the reaction between thiosulphate and hydrochloric acid produces sulfur, which forms a cloudy precipitate that obscures the black letter on the paper.

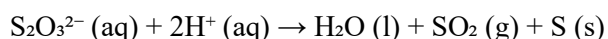
(iii) Sample data (you can adjust):

Experiment	Temperature (°C)	Temperature (K)	Time (s)
1	30	303	60
2	40	313	42
3	50	323	28
4	60	333	20
5	70	343	14

(iv) The balanced chemical equation is:



(v) The net ionic equation is:



(vi) The graph of temperature (K) vs time (s) would show a **negative correlation**. As temperature increases, time decreases, indicating that the reaction proceeds faster at higher temperatures.

(vii) Conclusion: Increasing the temperature increases the rate of reaction. This is due to higher kinetic energy of particles, leading to more frequent and energetic collisions.

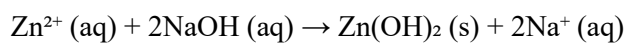
3. You are given a salt coded **Q**. It contains one cation and one anion.

(i) Sample table of observations and inferences:

Test	Observation	Inference
Appearance	White crystalline solid	Could be a metal salt
Heating	No water or colour change	No water of crystallization
Solubility in water	Soluble	Ionic compound
NaOH (few drops)	White precipitate forms	Possible Zn^{2+} , Al^{3+} or Pb^{2+}
NaOH (excess)	Precipitate dissolves	Zn^{2+} likely
Aqueous ammonia (few drops)	White precipitate	Zn^{2+} or Al^{3+}
Aqueous ammonia (excess)	Precipitate dissolves	Confirms Zn^{2+}
BaCl_2 + dilute HCl	White precipitate forms	Presence of SO_4^{2-}

AgNO ₃ + dilute HNO ₃	No precipitate	No Cl ⁻ or Br ⁻ present
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(ii) Balanced chemical equation for test with NaOH:



(iii) The cation is **Zn²⁺**, and the anion is **SO₄²⁻**, so salt **Q** is **zinc sulfate (ZnSO₄)**.

(iv) Reaction between zinc sulfate and sodium carbonate:

