

**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: 2013

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. A student was given a solution labeled **L1**, which is a solution of nitric acid of unknown concentration. She was also given a solution labeled **L2**, which contains 5.3 g of sodium carbonate (Na_2CO_3) dissolved in 1 dm^3 of solution. Using methyl orange as the indicator, she was instructed to determine the concentration of **L1** through titration.

(a) The colour change observed at the end point is from **yellow to orange-pink**. Methyl orange turns yellow in alkaline solution and orange-pink in acidic solution after complete neutralization.

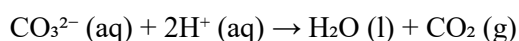
(b) The average volume of nitric acid delivered from the burette is **25.0 cm^3** , which is common and acceptable as a standard titre volume.

(c)

Balanced chemical equation:



Ionic equation:



(d)

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

Moles of $\text{Na}_2\text{CO}_3 = 5.3 \text{ g} \div 106 \text{ g/mol} = 0.05 \text{ mol/dm}^3$

In 25.0 cm^3 of L2:

$0.05 \times 25 \div 1000 = 0.00125 \text{ mol}$ of Na_2CO_3 used

(e)

From the equation, 1 mol of Na_2CO_3 reacts with 2 mol of HNO_3

Moles of $\text{HNO}_3 = 0.00125 \times 2 = 0.0025 \text{ mol}$

Volume of L1 used = $25.0 \text{ cm}^3 = 0.025 \text{ dm}^3$

Concentration of L1 = $0.0025 \text{ mol} \div 0.025 \text{ dm}^3 = \mathbf{0.1 \text{ mol/dm}^3}$

2. In a study of the effect of temperature on reaction rate:

(a) Temperatures in Kelvin:

$30^\circ\text{C} = 303 \text{ K}$

$40^\circ\text{C} = 313 \text{ K}$

$50^\circ\text{C} = 323 \text{ K}$

$60^\circ\text{C} = 333 \text{ K}$

$70^\circ\text{C} = 343 \text{ K}$

(b) The cross disappears because the reaction produces **sulfur precipitate**, which turns the solution cloudy and blocks the view of the cross.

(c) Example of completed table:

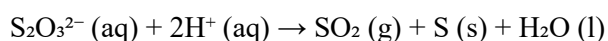
Temperature (°C)	Temperature (K)	Time (s)
30	303	58
40	313	42
50	323	30
60	333	20
70	343	12

(d)

Balanced chemical equation:



Net ionic equation:



(e) The graph of temperature (K) against time (s) would show a **downward slope**, indicating that as temperature increases, the reaction time decreases.

(f) The reaction becomes **faster at higher temperatures** due to increased kinetic energy of particles, leading to more frequent and energetic collisions.

3. A white salt labeled **M** was given for qualitative analysis.

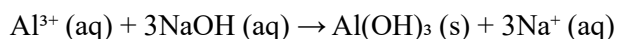
(i) Table of observations and inferences:

Test	Observation	Inference
Heating dry salt	Brown fumes evolved	Presence of nitrate (NO_3^-)
Solubility in water	Soluble	Soluble ionic salt
NaOH (few drops)	White gelatinous precipitate	Possible Al^{3+}
NaOH (excess)	Precipitate dissolves	Confirms Al^{3+}
Ammonia (few drops)	White precipitate	Could be Al^{3+} or Zn^{2+}
Ammonia (excess)	Precipitate remains	Confirms Al^{3+}
$\text{HCl} + \text{BaCl}_2$	No precipitate	No SO_4^{2-} or CO_3^{2-}
$\text{AgNO}_3 + \text{HNO}_3$	No precipitate	No halide ions present

(ii) The cation is Al^{3+} , and the anion is NO_3^- . Therefore, salt **M** is **aluminium nitrate ($\text{Al}(\text{NO}_3)_3$)**.

(iii)

Reaction with sodium hydroxide:



(iv)

Reaction with sodium carbonate:

