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

732/2C

CHEMISTRY 2C

Time: 3 Hours **ANSWERS** **Year: 2021**

Instructions.

1. This paper consists of sections three questions.
2. Answer **all** questions
3. Cellular phones are **note** allowed in the examination room.
4. Write your **examination Number** on every page of your answer booklet(s).

1. You are given:

- **Solution A:** 43.99 g of impure anhydrous sodium carbonate in 1 dm^3
- **Solution B:** 7.30 g of HCl in 1 dm^3
- **Indicator:** Methyl orange

Instructions:
(i) Measure 20 cm^3 of A and dilute it to 100 cm^3. Name the resulting solution as L.
(ii) Titrate B against 25.0 cm^3 of L. Record three accurate titre values.

Questions:
(a)
(i) What was the colour change observed during this titration experiment?
(ii) What was the volume of the pipette used?
(iii) Calculate the average volume of solution B used to neutralize solution L.

(b) Write a balanced chemical equation between L and B.

(c) Calculate the **percentage purity** of A.

Answer 1:

(a) (i) **Colour change**: Yellow to orange/red (methyl orange in acid-base titration)
(ii) **Volume of pipette**: 25.00 cm^3
(iii) Assume titres: 17.40 cm^3, 17.60 cm^3, 17.50 cm^3
→ Average volume = (17.40 + 17.60 + 17.50) / 3 = **17.50 cm^3**

(b) **$Na_2CO_3(aq) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2O(l) + CO_2(g)$**

Calculate molarity of B:
Molar mass of HCl = 36.5 g/mol
Moles = 7.30 / 36.5 = **0.2 mol** → [B] = 0.2 mol/dm^3

Use formula:
MaVa/na = MbVb/nb
Let Ma = concentration of L
→ Ma = (0.2 × 17.5 × 1) / (25 × 2) = 3.5 / 50 = **0.07 mol/dm^3**

Use dilution:
MdVd = McVc
→ Mc = (0.07 × 100) / 20 = **0.35 mol/dm^3**

Convert to g/dm³:
Molar mass of Na_2CO_3 = 106 g/mol
→ 0.35 mol/dm³ × 106 g/mol = **37.1 g/dm³**

Purity = (mass of pure / mass of impure) × 100
→ Purity = (37.1 / 43.99) × 100 ≈ **84.4%**

Instructions:
Use sodium thiosulphate solution (AA) and nitric acid (BB). Add water to vary concentration of AA and record time for mark "X" to disappear.

Questions:

(a) Complete the table (done above).
(b) Why did mark X disappear?
(c)
(i) Write a balanced chemical equation (with states).
(ii) Write the ionic equation.
(d) Plot graph of AA volume vs 1/time.
(e) How does rate change if BB concentration increases but AA is constant?
(f) What does 1/time mean?

Answer 2:

(b) The mark X disappeared due to formation of **solid sulfur precipitate**, which made the solution opaque.

(c)
(i) $Na_2S_2O_3(aq) + 2HNO_3(aq) \rightarrow 2NaNO_3(aq) + S(s) + SO_2(g) + H_2O(l)$
(ii) $S_2O_3^{2-}(aq) + 2H^+(aq) \rightarrow S(s) + SO_2(g) + H_2O(l)$

(d) The graph of AA volume vs 1/time is a **straight line sloping downward**, showing that as the volume of AA decreases, rate of reaction also decreases.

(e) Increasing BB concentration **increases rate** of reaction because more H^+ ions are available to react with thiosulphate, increasing collision frequency.

(f) 1/time represents the **rate of reaction** — the faster the reaction, the smaller the time, and thus higher the value of 1/time.

2. Sample Z is a simple salt. Perform the following tests:

(a) Appearance
(b) Action of heat
(c) Action of conc. H_2SO_4
(d) Solubility
(e) NaOH solution
(f) Flame test
(g) Action of HNO_3 + $AgNO_3$

Questions:
(i) Prepare a Table showing results and inferences.
(ii) Write the reaction for test (c).
(iii) Write electronic configuration of Z cation.
(iv) How is Z prepared in the lab? Include equation.
(v) State two uses of sample Z and explain briefly.

(i) **Table of Results**

Test	Observation	Inference
(a)	White crystalline solid	Salt, likely NaCl
(b)	No visible change	Stable to heat
(c)	Colourless gas, choking smell	HCl gas formed → Cl^- present
(d)	Soluble in water	Soluble salt
(e)	No precipitate	Na^+ ion does not form ppt with NaOH
(f)	Yellow flame	Sodium ion present

(g)	White precipitate	Cl^- confirmed with $AgNO_3$

(ii) **$H_2SO_4 + 2NaCl \rightarrow Na_2SO_4 + 2HCl(g)$**

(iii) **Electronic configuration of Na^+** = $1s^2\ 2s^2\ 2p^6$ → **2:8**

(iv) **Preparation in lab:**
$NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l)$
Evaporate to crystallize NaCl

(v) **Uses of NaCl:**

- *Preserving food*: It inhibits microbial growth.
- *Manufacture of chlorine*: Used in electrolysis of brine to produce Cl_2.