**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: 2018**

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**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 given:

**U1**: Sodium carbonate, 2.12 g in 250 $cm^3$ solution

**U2**: Hydrochloric acid (unknown concentration)

Methyl orange indicator

(a) The colour change observed is **yellow to pinkish-orange**, indicating that all carbonate has reacted with the acid.

(b)

Balanced chemical equation:

$Na_2CO_3$ (aq) + 2HCl (aq) → 2NaCl (aq) + $H_2O$ (l) + $CO_2$ (g)

Ionic equation:

$CO_3^{2-}$ (aq) + $2H^+$ (aq) → $H_2O$ (l) + $CO_2$ (g)

(c)

Molar mass of $Na_2CO_3$ = 23×2 + 12 + 16×3 = 106 g/mol

Moles in 2.12 g = 2.12 ÷ 106 = **0.02 mol**

Volume of solution = 250 $cm^3$ = 0.25 $dm^3$

Concentration = 0.02 ÷ 0.25 = **0.08 mol/$dm^3$**

(d) Moles of $Na_2CO_3$ in 25.0 $cm^3$ = 0.08 × 25 ÷ 1000 = 0.002 mol

From the equation, 1 mol $Na_2CO_3$ reacts with 2 mol HCl

So moles of HCl = 0.002 × 2 = **0.004 mol**

(e) Volume of HCl used = 25.0 $cm^3$ = 0.025 $dm^3$

Concentration = 0.004 ÷ 0.025 = **0.16 mol/$dm^3$**

(f) Concentration in g/$dm^3$ = 0.16 × 36.5 = **5.84 g/$dm^3$**

**2.** You are given:

- V1: potassium iodide
- V2: hydrogen peroxide
- V3: sulfuric acid
- Starch indicator

(a) The blue-black colour appears because **iodine ($I_2$)** is formed during the reaction. Iodine reacts with starch to form the blue-black complex.

(b) Completed table:

| Temp (°C) | Temp (K) | Time (s) |
|---|---|---|
| 30 | 303 | 68 |
| 40 | 313 | 48 |
| 50 | 323 | 32 |

| | | |
|---|---|---|
| 60 | 333 | 21 |
| 70 | 343 | 13 |

(c)

Net ionic equation:

$H_2O_2$ (aq) + $2I^-$ (aq) + $2H^+$ (aq) → $I_2$ (aq) + $2H_2O$ (l)

(d) As temperature increases, **reaction time decreases**, meaning the **reaction rate increases**. This is due to greater particle energy and more frequent effective collisions.

(e) Precaution:

- Start timing **immediately** after mixing all reactants
- Maintain **consistent volumes and concentrations**
- Use the **same observer** to judge colour change for consistency

**3.** You are given salt **Z**, suspected to be ammonium chloride.

(i) Table of observations and inferences:

| **Test** | **Observation** | **Inference** |
|---|---|---|
| Appearance | White crystalline solid | Ammonium salt possible |
| Heating dry salt | Gas evolved turns red litmus blue | Ammonia gas present → $NH_4^+$ confirmed |
| NaOH + warm | Pungent gas evolved turns red litmus blue | $NH_4^+$ confirmed |
| $AgNO_3$ + $HNO_3$ | White precipitate forms | $Cl^-$ present |

(ii) Cation = **$NH_4^+$**, Anion = **$Cl^-$**

Therefore, salt Z = **ammonium chloride ($NH_4Cl$)**

(iii)

Reaction with NaOH (on warming):

$NH_4Cl$ (aq) + NaOH (aq) → $NH_3$ (g) + $H_2O$ (l) + NaCl (aq)

Reaction with $AgNO_3$:

$NH_4Cl$ (aq) + $AgNO_3$ (aq) → AgCl (s) + $NH_4NO_3$ (aq)

(iv) Two physical properties:

- **Sharp pungent smell** of ammonia when heated
- **Soluble white crystals** that dissolve easily in water