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: 2010**

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 the following:

Solution coded **H1**, which is a solution of sodium hydroxide of unknown concentration

Solution **H2**, a standard hydrochloric acid solution containing 3.65 g of HCl per dm^3

Phenolphthalein indicator

(i) The colour change observed is **pink to colourless**. Phenolphthalein is pink in basic solution (NaOH), and turns colourless when the solution becomes neutral or acidic after HCl is added.

(ii) The pipette used in this titration is **25.0 cm^3**, which is standard for most acid-base titrations.

(iii) Assuming accurate titres were around 25.0 cm^3, the average volume of solution H2 used to neutralize H1 is **25.0 cm^3**.

(iv) Balanced chemical equation:

$NaOH\ (aq) + HCl\ (aq) \rightarrow NaCl\ (aq) + H_2O\ (l)$

(v) Ionic equation:

$OH^-\ (aq) + H^+\ (aq) \rightarrow H_2O\ (l)$

(vi) Molar mass of HCl = 1 + 35.5 = 36.5 g/mol

Concentration of H2 = 3.65 g/dm^3 ÷ 36.5 g/mol = 0.1 mol/dm^3

Moles of HCl in 25.0 cm^3 = 0.1 × 25.0 ÷ 1000 = 0.0025 mol

From the equation, 1 mol of NaOH reacts with 1 mol of HCl

So, moles of NaOH in 25.0 cm^3 = 0.0025 mol

Therefore, concentration of NaOH (H1) = 0.0025 mol ÷ 25.0 cm^3 × 1000 = **0.1 mol/dm^3**

2. You are provided with:

- 0.1 M potassium iodide solution labeled **M1**
- 0.1 M hydrogen peroxide solution labeled **M2**
- Dilute sulfuric acid labeled **M3**
- A starch indicator solution

(i) Room temperature is approximately **298 K**.

(ii) The blue-black colour appeared due to the formation of iodine (I_2) from the reaction between iodide ions and hydrogen peroxide. Iodine then reacts with starch to give a blue-black complex.

(iii) Example of completed table:

Experiment	Temperature (°C)	Temperature (K)	Time (s)
1	30	303	65
2	40	313	45
3	50	323	28
4	60	333	18
5	70	343	12

(iv) Balanced chemical equation:

H_2O_2 (aq) + 2KI (aq) + H_2SO_4 (aq) → I_2 (aq) + K_2SO_4 (aq) + $2H_2O$ (l)

(v) Ionic equation:

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

(vi) The graph of temperature (K) against time (s) will show a downward curve, as temperature increases, reaction time decreases.

(vii) Conclusion: The rate of reaction increases with increase in temperature due to greater kinetic energy of particles leading to faster collisions and quicker product formation.

3. You are given a salt coded **R**.

(i) Sample table:

Test	Observation	Inference
Appearance	White crystalline solid	Ionic compound
Action of heat	Gas with pungent smell evolved	Possible nitrate/nitrite
Solubility in water	Soluble	Soluble ionic salt
NaOH (few drops)	Light blue precipitate forms	May contain Cu^{2+}
NaOH (excess)	Precipitate remains insoluble	Confirms Cu^{2+}
Aqueous ammonia (few drops)	Blue precipitate forms	Cu^{2+} likely
Aqueous ammonia (excess)	Deep blue solution forms	Confirms Cu^{2+}
$BaCl_2$ + HNO_3	No precipitate	No SO_4^{2-} or CO_3^{2-}
$AgNO_3$ + HNO_3	White precipitate	Presence of Cl^-

(ii) Balanced chemical equation:

Cu^{2+} (aq) + 2NaOH (aq) → $Cu(OH)_2$ (s) + $2Na^+$ (aq)

(iii) The cation is **Cu^{2+}** and the anion is **Cl^-**. So salt **R** is **copper(II) chloride ($CuCl_2$)**.

(iv) Reaction with sodium carbonate:

$CuCl_2$ (aq) + Na_2CO_3 (aq) → $CuCO_3$ (s) + 2NaCl (aq)