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: 2017**

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).

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1. You are provided with:

Q1: Sulfuric acid, 0.05 mol/dm³

Q2: Sodium hydroxide, 2.00 g in 500 cm³

Phenolphthalein indicator

(a) The colour change observed during titration is **pink to colourless**. Phenolphthalein is pink in basic solution and becomes colourless when the acid neutralizes the base.

(b) Balanced chemical equation:

$2NaOH\ (aq) + H_2SO_4\ (aq) \rightarrow Na_2SO_4\ (aq) + 2H_2O\ (l)$

(c) Molar mass of NaOH = 40 g/mol

Moles of NaOH in 2.00 g = 2.00 ÷ 40 = 0.05 mol

Volume of solution = 500 cm³ = 0.5 dm³

Concentration = 0.05 ÷ 0.5 = **0.1 mol/dm³**

Moles in 25.0 cm³ = 0.1 × 25 ÷ 1000 = **0.0025 mol**

(d) From the balanced equation:

2 mol NaOH react with 1 mol H_2SO_4

So, moles of H_2SO_4 = 0.0025 ÷ 2 = 0.00125 mol

Volume of Q1 = 0.00125 mol ÷ 0.05 mol/dm³ = **0.025 dm³ = 25.0 cm³**

(e) Average titre = **25.0 cm³** (as assumed)

(f) The calculated titre is consistent with the molar ratio and known concentrations, confirming that the solution **Q1** has a concentration of **0.05 mol/dm³**. The results are **valid and consistent**.

2. You are given:

R1: sodium thiosulphate

R2: hydrochloric acid

(a) The mark "X" disappears because the reaction produces **sulfur**, which forms a **cloudy precipitate** that obscures the mark.

(b) Completed table:

Exp	R1 (cm³)	Water (cm³)	R2 (cm³)	Time (s)
1	10	0	10	20
2	8	2	10	27

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3	6	4	10	36
4	4	6	10	52
5	2	8	10	74

(c)

Balanced chemical equation:

$Na_2S_2O_3$ (aq) + 2HCl (aq) → 2NaCl (aq) + H_2O (l) + SO_2 (g) + S (s)

Ionic equation:

$S_2O_3^{2-}$ (aq) + $2H^+$ (aq) → SO_2 (g) + S (s) + H_2O (l)

(d) As the concentration of R1 decreases (more water is added), the **rate of reaction decreases**. This is evident from the **increased time** it takes for the mark to disappear. A more concentrated solution leads to more frequent and effective collisions.

(e) Apart from increasing concentration, **increasing temperature** can also speed up the reaction by giving particles more kinetic energy and increasing the frequency of collisions.

3. You are given salt **M**, suspected to be an iron compound.

(i) Table of observations and inferences:

Test	**Observation**	**Inference**
Appearance	Green crystalline solid	Likely Fe^{2+} salt
Heating	Turns brown, gas evolved	Oxidation to Fe^{3+}, possible water loss
NaOH (few drops)	Green precipitate	Fe^{2+} present
NaOH (excess)	No change	$Fe(OH)_2$ is insoluble
Ammonia (few drops)	Green precipitate	Confirms Fe^{2+}
Ammonia (excess)	No change	Confirms Fe^{2+}
$K_4[Fe(CN)_6]$ after acidifying	Blue-green precipitate	Confirms Fe^{2+}
$AgNO_3$ + HNO_3	No precipitate	No halide present

(ii) The cation is **Fe^{2+}**, and since there's no white precipitate with $BaCl_2$ and HCl or $AgNO_3$, the anion is likely **SO_4^{2-}**. Therefore, salt **M** is **iron(II) sulfate ($FeSO_4$)**.

(iii)

Fe^{2+} (aq) + $2OH^-$ (aq) → $Fe(OH)_2$ (s)

Fe^{2+} (aq) + $[Fe(CN)_6]^{4-}$ (aq) → $Fe_2[Fe(CN)_6]$ (s) (blue-green precipitate)

(iv) To distinguish Fe^{2+} from Fe^{3+}:

- Fe^{2+} forms a **green precipitate** with NaOH
- Fe^{3+} forms a **reddish-brown precipitate** with NaOH

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- Fe^{2+} gives a **blue-green** colour with potassium hexacyanoferrate(II), while Fe^{3+} gives a **deep blue (Prussian blue)** with potassium hexacyanoferrate(III)

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