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: 2019**

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:

V1: Nitric acid (unknown concentration)

V2: Sodium carbonate, 5.3 g in 500 cm^3

Methyl orange indicator

(a) The colour change is **yellow to orange-pink**. Methyl orange changes from yellow in alkaline to orange-pink in acidic solutions.

(b)

Balanced chemical equation:

Na_2CO_3 (aq) + $2HNO_3$ (aq) → $2NaNO_3$ (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 = 106 g/mol

Moles in 5.3 g = 5.3 ÷ 106 = **0.05 mol**

Volume of solution = 500 cm^3 = 0.5 dm^3

Concentration = 0.05 ÷ 0.5 = **0.1 mol/dm^3**

(d) Moles of Na_2CO_3 in 25.0 cm^3 = 0.1 × 25 ÷ 1000 = **0.0025 mol**

From equation: 1 mol Na_2CO_3 reacts with 2 mol HNO_3

Moles of HNO_3 = 0.0025 × 2 = **0.005 mol**

(e) Volume of HNO_3 used = 25.0 cm^3 = 0.025 dm^3

Concentration = 0.005 ÷ 0.025 = **0.2 mol/dm^3**

(f) Moles of HNO_3 in 250 cm^3 = 0.2 × 250 ÷ 1000 = 0.05 mol

Mass = 0.05 × 63 = **3.15 g**

2. You are given:

- Y1: sodium thiosulphate
- Y2: hydrochloric acid

(a) The mark "O" disappears because **sulfur is formed**, making the solution cloudy and eventually opaque.

(b) Completed table:

Trial	Y1 (cm^3)	Water (cm^3)	Y2 (cm^3)	Time (s)
1	10	0	10	19
2	8	2	10	25
3	6	4	10	34
4	4	6	10	48
5	2	8	10	71

(c)

Balanced chemical equation:

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

Ionic equation:

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

(d) As the concentration of Y1 decreases, **the reaction rate decreases**. This is because fewer thiosulphate ions are available to collide with H^+ ions, slowing down the reaction and increasing the time for cloudiness to form.

(e) Possible errors to avoid:

Delay in starting the stopwatch after mixing solutions

Misjudging the endpoint when the mark disappears (human error in visual judgement)

3. You are given salt **F**, suspected to be a nitrate of a heavy metal.

(i) Table of observations and inferences:

Test	**Observation**	**Inference**
Appearance	Greyish-white crystalline solid	Likely heavy metal salt
Heating	Brown fumes evolved	Presence of NO_3^- (nitrate)
NaOH (few drops)	Brown precipitate formed	Fe^{3+} suspected
NaOH (excess)	Precipitate remains	Confirms Fe^{3+}
Ammonia (few drops)	Brown precipitate formed	Confirms Fe^{3+}
Ammonia (excess)	Precipitate remains	Confirms Fe^{3+}
$FeSO_4$ + conc H_2SO_4 down side of tube	Brown ring at interface	Confirms NO_3^-
$BaCl_2$ + HCl	No precipitate	No sulfate present

(ii) Cation = **Fe^{3+}**, Anion = **NO_3^-**

Salt **F** is **iron(III) nitrate ($Fe(NO_3)_3$)**

(iii)

With NaOH:

Fe^{3+} (aq) + 3NaOH (aq) → $Fe(OH)_3$ (s) + $3Na^+$ (aq)

Brown ring test:

NO_3^- (aq) + $3Fe^{2+}$ (aq) + $4H^+$ (aq) → NO (g) + $3Fe^{3+}$ (aq) + $2H_2O$ (l)

(NO forms brown complex at the interface)

(iv) The **brown ring test** confirms the presence of nitrate ion (NO_3^-) by forming a distinct brown ring when NO gas complexes with Fe^{2+}.