

Chemistry III

015

30/11/ 2017 08.30 AM - 11.30 AM



Rwanda Education Board

ADVANCED LEVEL NATIONAL EXAMINATIONS, 2017

SUBJECT: CHEMISTRY

PAPER III: CHEMISTRY PRACTICAL

COMBINATIONS:

- PHYSICS-CHEMISTRY-MATHEMATICS (PCM)
- PHYSICS-CHEMISTRY-BIOLOGY (PCB)
- MATHEMATICS-CHEMISTRY-BIOLOGY (MCB)
- BIOLOGY-CHEMISTRY-GEOGRAPHY (BCG)

DURATION: 1Hour 30 minutes

INSTRUCTIONS TO CANDIDATES:

- 1) Write your names and index number on the **answer booklet cover** as written on your registration form.
- 2) Do not open this question paper until you are told to do so.
- 3) This paper consists of **one question**. (25marks)
- 4) Please read carefully before you start and make sure that you have **all the apparatus and chemicals** that you may need.
- 5) Answer the question in this paper and record your answers in the spaces provided.
- 6) Non-programmable scientific calculators may be used.
- 7) Use only a **blue** or **black** pen.

You are provided with the following:

- **FA₁** which is 0.1 M sodium sulphite Na₂SO₃ solution.
 - **FA₂** solution containing hydrated sodium thiosulphate which is Na₂S₂O₃.nH₂O of 24.80 g.dm⁻³ concentration by mass.
 - **FA₃** which is 0.1M iodine solution.
 - Solid sodium hydrogen carbonate, NaHCO₃.
 - Starch solution.
- (Atomic mass: S= 32, O= 16, H=1, Na=23)

Theory:

- a) SO₃²⁻ are oxidized by iodine to SO₄²⁻, in the presence of HCO₃⁻, according to the equation:
$$\text{SO}_3^{2-}(\text{aq}) + \text{I}_2(\text{aq}) + 2\text{HCO}_3^{-}(\text{aq}) \rightarrow \text{SO}_4^{2-}(\text{aq}) + 2\text{I}^{-}(\text{aq}) + \text{H}_2\text{O}(\text{l}) + 2\text{CO}_2(\text{g})$$
- b) Sodium thiosulphate ions S₂O₃²⁻ reduce iodine to iodide ions, forming tetrathionate ions, S₄O₆²⁻.
Ionic equation: $2\text{S}_2\text{O}_3^{2-}(\text{aq}) + \text{I}_2(\text{aq}) \rightarrow 2\text{I}^{-}(\text{aq}) + \text{S}_4\text{O}_6^{2-}(\text{aq})$

PROCEDURE.

1. Pipette 25.0 cm³ of **FA₃** into a conical flask and add 10cm³ of **FA₂** and 1.0g of solid sodium hydrogen carbonate to the mixture then shake well.
2. Titrate the excess iodine by **FA₁** solution from the burette using starch indicator (five drops).
3. Record your results in the table below:

Volume of the pipette used:cm³ **(1mark)**

	Titration 1	Titration 2	Titration 3
Final burette readings (cm ³)			
Initial burette readings (cm ³)			
Volume of FA ₁ (cm ³)			

(6 marks)

The average volume of FA₁ used = **(1mark)**

YOU ARE REQUIRED TO:

- a) Calculate the number of moles of iodine contained in 25.0 cm³ of 0.1 M iodine solution. **(2marks)**
- b) Calculate the number of moles of sulphite ions that reacted with excess iodine. **(2marks)**
- c) Determine the mole ratio of SO₃²⁻ to I₂. **(1mark)**
SO₃²⁻ : I₂ =
- d) Calculate the number of moles of excess iodine that reacted with **FA₁**. **(2marks)**
- e) Calculate the number of moles of iodine that reacted with S₂O₃²⁻. **(2marks)**

f) Determine the mole ratio of $\text{S}_2\text{O}_3^{2-}$ to I_2 . **(1mark)**
 $\text{S}_2\text{O}_3^{2-} : \text{I}_2 =$

g) Calculate the number of moles of $\text{S}_2\text{O}_3^{2-}$ that reacted with iodine, I_2 . **(1mark)**

h) Calculate the molar concentration of FA_2 : **(2marks)**

i) Calculate the relative molar mass of $\text{Na}_2\text{SO}_3 \cdot n\text{H}_2\text{O}$, knowing that: **(2marks)**

Molar concentration of $\text{FA}_2 = \text{concentration (g/dm}^3\text{)} / \text{Relative molar mass.}$

j) Determine the value of n : **(2marks)**