

THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

032/2A

CHEMISTRY 2A

(ACTUAL PRACTICAL A)

(For Both School and Private Candidates)

Time: 2:30 Hours

ANSWERS

Year: 2017

Instructions

1. This paper consists of two questions.
2. Answer all questions.

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1. You are provided with the following:

PP: A solution of 0.1 M hydrochloric acid

RR: A solution of 1.39 g of impure sodium carbonate anhydrous in 250 cm³ of solution

Indicator: Methyl orange

(a)(i) Titrate solution PP against 25 cm³ of RR until the colour changed. Assume average titre volume was 24.50 cm³

(ii) The colour changed because methyl orange turned from yellow to orange-red, indicating neutralization.

(iii) The average titre volume was 24.50 cm³

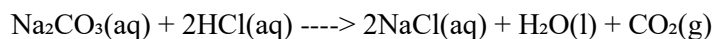
(iv) 24.50 cm³ of PP was required to neutralize 25.00 cm³ of RR

(v) If sulphuric acid was used instead, the volume required would be half because H₂SO₄ is diprotic (releases two H⁺ ions per molecule), while HCl is monoprotic.

(b) (i) Apparatus used to measure PP: 25 cm³ pipette

(ii) It is best because it gives accurate, fixed volumes suitable for titration.

(c) Balanced chemical equation:



(d)(i) Molarity of RR:

$$\text{Moles of HCl} = 0.1 \times 0.0245 = 0.00245 \text{ mol}$$

$$\text{Mole ratio Na}_2\text{CO}_3 : \text{HCl} = 1:2$$

$$\text{Moles of Na}_2\text{CO}_3 = 0.00245 \div 2 = 0.001225 \text{ mol}$$

$$\text{Volume of RR} = 25 \text{ cm}^3 = 0.025 \text{ dm}^3$$

$$\text{Molarity of RR} = 0.001225 \div 0.025 = 0.049 \text{ mol/dm}^3$$

(ii) Percentage purity of RR:

$$\text{Moles in 250 cm}^3 = 0.049 \times 0.25 = 0.01225 \text{ mol}$$

$$\text{Mass} = 0.01225 \times 106 = 1.2985 \text{ g}$$

$$\text{Actual mass} = 1.39 \text{ g}$$

$$\text{Percentage purity} = (1.2985 \div 1.39) \times 100 = 93.38 \text{ percent}$$

(e) Two applications of volumetric analysis:

- Used to determine concentration of unknown solutions
- Used in quality control for titrations in industries

2. (a) Completed Table 1:

Volume of E (cm ³)	Volume of G (cm ³)	Time taken (s)
25	0	20
20	5	24

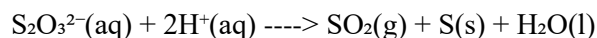
15	10	30	
10	15	38	
5	20	50	

(b)

(i) Plot of volume – time graph is shared below.

(ii) The graph shows that time increases as volume of E decreases, indicating slower reaction at lower concentrations.

(c) Ionic equation:



(d) The letter X disappeared because sulphur formed in the reaction turned the solution cloudy, blocking the visibility of the cross.

(e) Two uses of sulphur:

- Used in vulcanization of rubber
- Used in the manufacture of sulphuric acid

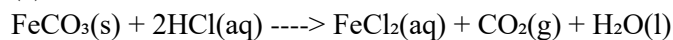
3. (a) Table 2

Experiment	Observation	Inference	
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Observe Q	Green crystalline solid	Transition metal salt	
Add water	Dissolved, green solution	Soluble ionic compound	
Add dilute HCl	Effervescence	CO_3^{2-} present	
Add conc H_2SO_4	Effervescence	CO_3^{2-} confirmed	
Add NaOH	Green precipitate, insoluble	Fe^{2+} present	
Add NH_3	Green precipitate	Confirms Fe^{2+}	
Add $\text{K}_3\text{Fe}(\text{CN})_6$	Deep blue precipitate	Fe^{2+} confirmed	
Add $\text{Pb}^{2+} + \text{CH}_3\text{COOH}$	White precipitate	CO_3^{2-} confirmed	

(b) Conclusion:

- The cation in sample Q is Fe^{2+}
- The anion in sample Q is CO_3^{2-}
- The compound Q is FeCO_3

(c) Reaction with HCl:



(d) Three chemical properties of Fe^{2+} :

- Forms green precipitate with NaOH
- Reacts with potassium hexacyanoferrate(III) to give a blue complex
- Oxidizes slowly to Fe^{3+} in air

(e) Two uses of Q:

- Used in pigments and ceramics
- Used in synthesis of iron-based compounds