



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

132/3A

CHEMISTRY 3A
ACTUAL PRACTICAL A
(For Both School and Private Candidates)

Time: 3:20 Hours

Thursday, 11th May 2017 a.m.

Instructions

1. This paper consists of **three (3)** questions. Answer **all** the questions.
2. Question number **one (1)** carries 20 marks and the other **two (2)**, 15 marks each.
3. Mathematical tables and non programmable calculators may be used.
4. Cellular phones are **not** allowed in the examination room.
5. Write your **Examination Number** on every page of your answer booklet(s).
6. You may use the following constants:
 - Atomic masses: H = 1, C = 12, O = 16, S = 32, Na = 23, K = 39, Mn = 55, Fe = 56, I = 127.
 - Molar gas constant = $8.314 \text{ J K}^{-1} \text{ mol}^{-1}$.

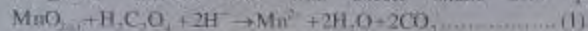


I. You are provided with the following:

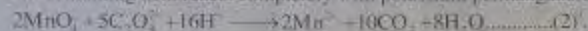
- D₁:** A 250 cm³ solution containing 1 g of impure manganese dioxide (MnO₂) and 2.2 g of oxalic acid crystals (H₂C₂O₄·2H₂O);
- D₂:** A solution of 0.02 M potassium permanganate;
- D₃:** 1 M sulphuric acid solution.

Theory:

Manganese dioxide react with excess oxalic acid quantitatively as follows:



The remaining acid reacts completely with potassium permanganate as



Procedure:

- Pipette 20 cm³ or 25 cm³ of solution **D₁** into a 250 cm³ pyrex conical flask.
- Add 20 cm³ of solution **D₃** to (i) above and then heat the contents of the flask to about 70°C.
- Put solution **D₂** into the burette. Titrate the hot **D₁** solution with **D₂** until the solution becomes just pinkish.
- Repeat procedure (i) to (iii) to get three more readings.
- Record your result in a tabular form.

Summary:

_____ cm³ of solution **D₁** required _____ cm³ of solution **D₂** for complete reaction.

Questions:

- With the aid of oxidation – reduction half reaction equations, write specifically the oxidizing and reducing agents in the equations (1) and (2).
- Calculate the concentration of oxalic acid in:
(i) mol/dm³.
(ii) g/dm³.
- Calculate the percentage purity by mass of manganese dioxide in the sample.

2. You are provided with the following:
- AE: A solution of hydrogen peroxide;
 - AF: A solution of sodium thiosulphate;
 - AG: A solution of potassium iodide;
 - AH: A starch solution;
 - AJ: 0.5 M sulphuric acid.

Theory:

In this experiment the rate of reaction is not affected by the presence of sodium thiosulphate. The chemical reaction is represented by the following equation:

$2\text{I}^- + \text{H}_2\text{O}_2 + 2\text{H}^+ \longrightarrow \text{I}_2 + 2\text{H}_2\text{O}$, hence you can investigate the rate of reaction between hydrogen peroxide and acidified potassium iodide.

Procedure:

- (i) Measure 5 cm³ of AE and pour it into a beaker.
- (ii) Measure 10 cm³ of AE and pour it into the same beaker in (i).
- (iii) Measure 10 cm³ of AG and pour it into another beaker and add 5 cm³ of distilled water followed by 5 cm³ of AJ and then add three drops of AH solution.
- (iv) Transfer the contents of the beaker in step (iii) into the beaker of step (ii) and start the stop watch immediately.
- (v) Swirl the contents of the beaker in step (iv) and note the time taken for the blue colour to appear.
- (vi) Repeat steps (i) to (v) varying the volume of AE and water as indicated in Table 1.

Table 1

Experiment	1	2	3	4	5
Volume of AE, cm ³	30	25	20	15	10
Volume of water, cm ³	5	10	15	20	25
Time t, sec					
$\frac{1}{t}, \text{sec}^{-1}$					

Questions:

- (a) From the experimental results, explain how the concentration of AE affects the rate of the reaction.
- (b) Plot a graph of $\frac{1}{t}, \text{sec}^{-1}$ against volume of AE.
- (c) From the graph, determine the order of reaction with respect to H₂O₂.
- (d) Calculate the value of the rate constant.
- (e) What is the essence of using sodium thiosulphate in this reaction?

3. Sample C contains two cations and a common anion. Use the information given in the experiment column in Table 2 to complete the observations and inferences and hence identify the two cations and the common anion.

Table 2

S/n	Experiment	Observations	Inferences
(a)	Observe the appearance of sample C.		
(b)	Add dilute hydrochloric acid to a dry sample C.		
(c)	Place a little solid sample into a test tube and add 1 ml of concentrated sulphuric acid solution.		
(d)	Perform flame test.		
(e)	Heat a small sample in a test tube.		
(f)	Make a solution of C in water and divide the solution into four portions.		
(g)	To the first portion, add ammonium solution.		
(h)	To the second portion, add potassium hexacyanoferrate (II).		
(i)	To a solid sample C in a test tube add MnO_2 followed by concentrated H_2SO_4 .		

Conclusion

- (i) The cations in sample C were _____ and _____.
- (ii) The anion in sample C was _____.
- (iii) Write the ionic equation which took place at stage (c).
- (iv) Sample C contained _____ and _____ salts.