

**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

Wednesday, 6th May 2015 a.m.

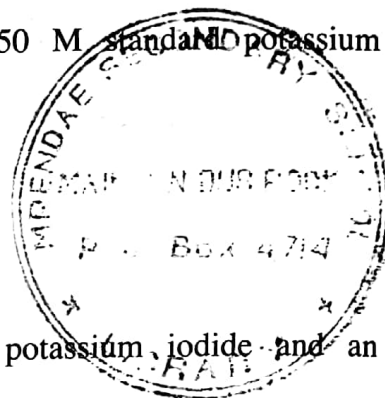
Instructions

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, Cr = 52, Mn = 55, Fe = 56, I = 127.
 - Molar gas constant = $8.314 \text{ J K}^{-1} \text{ mol}^{-1}$.



1. You are provided with the following:

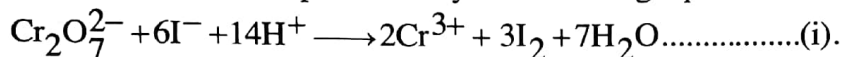
- S:** A solution made by diluting 10.00 cm³ of 0.50 M standard potassium dichromate solution to exactly 250 cm³ of water;
Q: Sodium thiosulphate solution;
A: Dilute sulphuric acid solution;
B: Starch solution;
C: A 10% potassium iodide solution.



Theory

Potassium dichromate reacts quantitatively with acidified potassium iodide and an equivalent amount of iodine is liberated.

The reaction can be represented by the following equations:



The liberated iodine is titrated with thiosulphate in which the reaction taking place is represented as follows: $2\text{S}_2\text{O}_3^{2-} + \text{I}_2 \longrightarrow \text{S}_4\text{O}_6^{2-} + 2\text{I}^- \dots\dots\dots(\text{ii}).$

Procedure

- (i) Pipette 25 cm³ of solution **S** into a conical flask. Add 25 cm³ of solution **C**, then 20 cm³ of solution **A**.
- (ii) Titrate the liberated iodine with solution **Q** until the solution is pale yellow green in colour.
- (iii) Add 2 cm³ of solution **B** and continue titrating until the blue colour just disappears and a pale green colour remains. Record the volume used.
- (iv) Repeat procedure (i) to (iii) three times and record your results in a tabular form.

Questions

- (a) Calculate the concentration of **S** in moles per dm³.
- (b) Write down the half reaction equations to show the oxidation and reduction processes for the reactions in procedures (i) and (ii).
- (c) Calculate the:
 - (i) Molarity of **Q**.
 - (ii) Concentration in g/dm³ of **Q**.
- (d) The orange colouration during the experiment indicates the presence of _____ in solution and the pale green colouration at the end of the experiment indicates the presence of _____ in solution.

2. You are provided with the following:

- P₁:** A solution containing 20 g of Na₂S₂O₃.5H₂O in 0.5 dm³ of solution;
P₂: A solution of dilute hydrochloric acid;
P₃: Distilled water;
Stop watch.

Procedure

- (i) Draw a clear letter "W" on a piece of white paper provided and place a 100 cm³ beaker on top of the letter "W" in such a way that the letter is visible when viewed from the top.
- (ii) Measure 10 cm³ of **P₁** into a beaker in (i) followed by 2 cm³ of **P₃**.

- (iii) Add 5 cm³ of **P₂** into the solution in (ii) and immediately start the stop watch, Swirl the mixture and record the time taken for the letter “W” to disappear completely.
- (iv) Repeat procedures (i) to (iii) using the specifications given in Table 1.

Table 1: Volume of the mixture

S/n	Volume of P₁	Volume of P₂	Volume of P₃
1	10	5	0
2	8	5	2
3	6	5	4
4	4	5	6

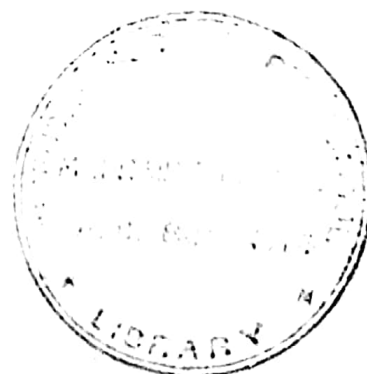
- (v) Record your results as indicated in Table 2.

Table 2

S/n	T (Sec)	$\frac{1}{t}(\text{Sec}^{-1})$	[P₁]/M
1			
2			
3			
4			

Questions

- (a) Plot a graph of [**P₁**] against time, t.
- (b) Plot a graph of $\frac{1}{t}$ against [**P₁**].
- (c) From the graphs in (a) and (b):
- What is the effect of concentration of **P₁** on the rate of the reaction?
 - What is the order of reaction with respect to **P₁**? Give a reason for your answer.



3. Substance **T** contains **two cations** and a common **anion**. Use the information given in the experiment column in Table 3 to complete the observations and inferences and hence identify the two cations and the common anion.

Table 3

S/n	Experiment	Observations	Inference
(a)	Appearance.		
(b)	Heat a little of sample T in a dry test tube.		
(c)	Dissolve a little of sample T in water and divide the resulting solution into four portions.		
	(i) To one portion add NaOH solution and warm gently.		
	(ii) To the second portion add AgNO ₃ solution till excess.		
	(iii) To the third portion add few drops of potassium hexacyanoferrate (III).		
	(iv) To the fourth portion add ethanoic acid followed by lead ethanoate solution.		
(d)	To a little sample T in a dry test tube, add dilute sodium hydroxide solution.		

Conclusion

- The cations in sample **T** are _____ and _____.
- Write the molecular formula of sample **T**.
- Write the reaction equation in experiment (d).

