



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

132/3B

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

Time: 3:20 Hours

Friday, 12<sup>th</sup> 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, N = 14, O = 16, S = 32, Cl = 35.5, Na = 23, K = 39, Mn = 55, Fe = 56.
  - Molar gas constant =  $8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ .



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1. You are provided with the following:
- A: A mixture solution containing NaOH and  $\text{Na}_2\text{CO}_3$ ;
  - B: 0.2 M hydrochloric acid solution;
  - C: Methyl orange indicator;
  - D: Phenolphthalein indicator.

**Procedure:**

- (i) Pipette  $25 \text{ cm}^3$  or  $20 \text{ cm}^3$  of A into a clean conical flask.
- (ii) Add to it 4 drops of D and titrate the resulting solution with B until a colour change is observed.
- (iii) Record the first titre volume.
- (iv) Add 4 drops of C in the mixture solution and continue titrating until the colour changes to just red.
- (v) Record the second titre volume.
- (vi) Repeat procedures (i) to (v) three times.
- (vii) Record your results in a tabular form.

**Summary**

\_\_\_\_\_  $\text{cm}^3$  of A required \_\_\_\_\_  $\text{cm}^3$  of B in the presence of D and \_\_\_\_\_  $\text{cm}^3$  of B in the presence of C for complete reaction.

**Questions:**

- (a) Write the ionic equations for the reactions taking place in:
    - (i) Procedure (ii)
    - (ii) Procedure (iv).
  - (b) Calculate the:
    - (i) Molarity of NaOH and  $\text{Na}_2\text{CO}_3$  in solution A.
    - (ii) Concentration of NaOH and  $\text{Na}_2\text{CO}_3$  in g/l.
    - (iii) Percentage composition by mass of NaOH in the mixture solution A.
2. You are provided with the following:
- J<sub>1</sub>: A solution containing  $49.6 \text{ gdm}^{-3}$  of  $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$ ;
  - J<sub>2</sub>: A Solution of dilute  $\text{HNO}_3$ ;
  - J<sub>3</sub>: Distilled water;
- Stop watch/clock.

**Procedure:**

- (i) Draw a clear letter "X" on a piece of white paper and place a  $100 \text{ cm}^3$  beaker on top of the letter such that it is visible through the solution.
- (ii) Measure  $5 \text{ cm}^3$  of J<sub>1</sub> into a beaker followed by  $5 \text{ cm}^3$  of J<sub>2</sub> and immediately start a stop watch. Stir gently and record the time for letter "X" to disappear.
- (iii) Repeat procedure (i) and (ii) varying the volume of water and J<sub>1</sub> as indicated in Table 1.

Table 1: Volume of the mixture

S/n	Volume, J <sub>1</sub> $\text{cm}^3$	Volume, H <sub>2</sub> O $\text{cm}^3$	Volume, J <sub>2</sub> $\text{cm}^3$
1	5	0	5
2	4	1	5
3	3	2	5
4	2	3	5

**Questions:**

- (a) Plot a graph of  $[S_2O_3^{2-}]$  against time,  $t$ .
- (b) Plot a graph of  $\frac{1}{t}$  against  $[S_2O_3^{2-}]$ .
- (c) From the graphs in (a) and (b), deduce the order of reaction with respect to  $Na_2S_2O_3 \cdot 5H_2O$ . Give reasons to your answer.
3. Sample **B** 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 B.		
(b)	Place a little solid sample into a test tube and add 1 ml of conc. $H_2SO_4$ solution.		
(c)	To a solid sample <b>B</b> in a test tube, add manganese dioxide followed by conc. $H_2SO_4$ and heat.		
(d)	Make a solution of <b>B</b> in water and divide the resulting solution into four portions.		
(e)	To the first portion, add copper sulphate solution followed by sodium hydroxide.		
(f)	To the second portion, add sodium hydroxide solution and warm.		
(g)	To the third portion, add sodium hydroxide solution followed by $NH_4OH$ solution.		

**Conclusion**

- (i) The cations in sample **B** were \_\_\_\_\_ and \_\_\_\_\_.
- (ii) The anion in sample **B** was \_\_\_\_\_.
- (iii) Sample **B** contained \_\_\_\_\_ and \_\_\_\_\_ salts.
- (iv) Write ionic equations which took place at experiment (b) and (f).