

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

Thursday, 12<sup>th</sup> May 2016 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, Mg = 24, S = 32, Na = 23, K = 39, Mn = 55.
  - Molar gas constant =  $8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ .



1. You are provided with the following:
- A<sub>1</sub>: 2.5 g of Na<sub>2</sub>CO<sub>3</sub>·xH<sub>2</sub>O dissolved in 250 cm<sup>3</sup> of water,
  - A<sub>2</sub>: 0.1 M hydrochloric acid,
  - A<sub>3</sub>: Phenolphthalein indicator.

**Procedure:**

- (i) Put solution A<sub>2</sub> into the burette.
- (ii) Pipette 25 cm<sup>3</sup> or 20 cm<sup>3</sup> of solution A<sub>1</sub> into a titration flask, add two or three drops of A<sub>3</sub>.
- (iii) Titrate the resulting mixture in (ii) against solution A<sub>2</sub> until colour change is observed. Record the titre value.
- (iv) Repeat the steps (i) to (iii) three times and record the results in a tabular form.

**Results:**

The volume of the burette used was \_\_\_\_\_ cm<sup>3</sup>.

The volume of the pipette used was \_\_\_\_\_ cm<sup>3</sup>.

**Summary:**

\_\_\_\_\_ cm<sup>3</sup> of solution A<sub>1</sub> required \_\_\_\_\_ cm<sup>3</sup> of solution A<sub>2</sub> for complete reaction.

**Questions:**

- (a) Write a balanced equation for the reaction taking place between A<sub>1</sub> and A<sub>2</sub>.
- (b) Calculate the concentration of A<sub>1</sub> in mol/dm<sup>-3</sup> and g/dm<sup>3</sup>.
- (c) What is the value of water of crystallization x?
- (d) How many moles of water of crystallization have been in the original 2.5 g?

2. You are provided with the following:

C<sub>1</sub>: 5 g hydrated ammonium oxalate, (COONH<sub>4</sub>)<sub>2</sub>·H<sub>2</sub>O,

C<sub>2</sub>: 5 g anhydrous sodium carbonate,

C<sub>3</sub>: distilled water,

Stirrer/glass rod,

Thermometer.

**Procedure:**

- (i) Record the room temperature.
- (ii) Pour 50 cm<sup>3</sup> of C<sub>3</sub> into a dry 100 cm<sup>3</sup> beaker containing a stirrer and thermometer.
- (iii) Stir C<sub>3</sub> and record the temperature, T<sub>w</sub>.
- (iv) Add 5 g of C<sub>2</sub> into a beaker containing C<sub>3</sub>, stir gently until dissolution is complete. Record the temperature of dissolution, T<sub>s</sub>.
- (v) Clean a beaker, stirrer and thermometer, and then repeat the experiment using 5 g of C<sub>1</sub> and record T<sub>w</sub> and T<sub>s</sub> as in (iii) and (iv). Tabulate your results as shown in Table 1.

Table 1: Table of results

Substance	Volume of water (cm <sup>3</sup> )	Mass of salt (g)	T <sub>w</sub> (°C)	T <sub>s</sub> (°C)	ΔT (°C)
Na <sub>2</sub> CO <sub>3</sub>	50	5			
(COONH <sub>4</sub> ) <sub>2</sub> ·H <sub>2</sub> O	50	5			



**Questions:**

- (a) Calculate the molar mass of each salt.  
(b) Calculate the enthalpy change of solution of each salt.  
(c) Calculate the molar enthalpy change of solution of each salt.
3. Sample **G** contains ONE cation and anion. Use the information given in the experiment column in Table 2 to complete the observations and inferences and hence identify the cation and anion.

Table 2

S/n	Experiment	Observations	Inferences
1	Make a solution of <b>G</b> in water and divide the solution into six portions in the test tubes.		
2	To the first portion add few drops of sodium hydroxide solution then in excess.	Green precipitate formed in excess.	
3	To the second portion, add few drops of nitric acid, boil and then add ammonia solution until alkaline.		
4	To the third portion, add few drops of ammonia solution then in excess.		
5	Perform confirmatory test for your deduction.		
6	To the fourth portion, add lead ethanoate.		
7	To the fifth portion, add barium chloride solution.		
8	Perform confirmatory test for your deductions.		

**Conclusion**

- (a) The cation in sample **G** is \_\_\_\_\_ and the anion is \_\_\_\_\_.  
(b) Indicating the colour of reacting species, write molecular equation for reaction of **G** with NaOH solution.