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, 12th 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 J $K^{-1}mol^{-1}$.

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1. You are provided with the following:
   - A_1: 2.5 g of $Na_2CO_3.xH_2O$ dissolved in 250 cm^3 of water,
   - A_2: 0.1 M hydrochloric acid,
   - A_3: Phenolphthalein indicator.

Procedure:
(i) Put solution A_2 into the burette.
(ii) Pipette 25 cm^3 or 20 cm^3 of solution A_1 into a titration flask, add two or three drops of A_3.
(iii) Titrate the resulting mixture in (ii) against solution A_2 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^3.
The volume of the pipette used was _____ cm^3.

Summary:
_____ cm^3 of solution A_1 required _____ cm^3 of solution A_2 for complete reaction.

Questions:
(a) Write a balanced equation for the reaction taking place between A_1 and A_2.
(b) Calculate the concentration of A_1 in mol/dm^{-3} and g/dm^3.
(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_1: 5 g hydrated ammonium oxalate, $(COONH_4)_2.H_2O$,
   - C_2: 5 g anhydrous sodium carbonate,
   - C_3: distilled water,
   - Stirrer/glass rod,
   - Thermometer.

Procedure:
(i) Record the room temperature.
(ii) Pour 50 cm^3 of C_3 into a dry 100 cm^3 beaker containing a stirrer and thermometer.
(iii) Stir C_3 and record the temperature, Tw.
(iv) Add 5 g of C_2 into a beaker containing C_3, stir gently until dissolution is complete. Record the temperature of dissolution, Ts.
(v) Clean a beaker, stirrer and thermometer, and then repeat the experiment using 5 g of C_1 and record Tw and Ts as in (iii) and (iv). Tabulate your results as shown in Table 1.

Table 1: Table of results

Substance	Volume of water (cm^3)	Mass of salt (g)	Tw (°C)	Ts (°C)	ΔT (°C)
Na_2CO_3	50	5			
$(COONH_4)_2.H_2O$	50	5			

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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 **G** 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.		
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.

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