THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

032/2A **CHEMISTRY 2A**

(ACTUAL PRACTICAL A)

(For Both School and Private Candidates)

Time: 2:30 Hours **ANSWERS** **Year: 2004**

Instructions

1. This paper consists of two questions.

2. Answer all questions.

1. You are provided with the following:
1.1 Solution AA prepared by diluting 100 cm^3 of 1M hydrochloric acid to 1000 cm^3 with distilled water
1.2 Solution BB is sodium hydroxide solution
1.3 Phenolphthalein indicator

Procedure
Pipette 25 cm^3 of solution BB into a titration flask. Add two drops of phenolphthalein indicator. Titrate solution BB against solution AA from the burette until a colour change is observed. Note the burette reading. Repeat the procedure to obtain three more readings.

(a)(i) Table of results

Titration	Final reading (cm^3)	Initial reading (cm^3)	Volume used (cm^3)
Pilot	20.10	0.00	20.10
1	20.00	0.00	20.00
2	19.90	0.00	19.90
3	20.00	0.00	20.00

(ii) The volume of pipette used was 25.00 cm^3
(iii) The colour change at the end point was from pink to colourless
(vi) 20.00 cm^3 of solution AA were required to neutralize 25.00 cm^3 of solution BB

(b) Write a balanced chemical equation for the neutralization of the metal hydroxide by hydrochloric acid
$NaOH + HCl \text{ ----> } NaCl + H_2O$

(c)(i) Molarity of solution AA
Original HCl = 1M in 100 cm^3 diluted to 1000 cm^3
New molarity = $1 \times (100 \div 1000) = 0.1$ mol/dm^3

(ii) Concentration in moles/dm^3 of solution BB
From balanced equation, 1 mol HCl reacts with 1 mol NaOH
Moles of HCl = $0.1 \times 0.020 = 0.002$ mol
Moles of NaOH = 0.002 mol
Volume = 25.00 cm^3 = 0.025 dm^3
Molarity of BB = $0.002 \div 0.025 = 0.08$ mol/dm^3

(iii) Concentration in g/dm^3 of solution BB
Molar mass of NaOH = 40 g/mol
Concentration = $0.08 \times 40 = 3.2$ g/dm^3

2. Sample M is a simple salt containing one cation and one anion. Carry out the experiments described below. Record carefully your observations and appropriate inferences and hence identify the anion and cation present in the sample.

(a) Appearance of sample M
Observation: White crystalline solid
Inference: Colourless ionic salt

(b) Heat a little M in a dry test-tube
Observation: No water vapour observed
Inference: No water of crystallization

(c) To a little M in a test tube add dilute HCl
Observation: Effervescence observed
Inference: CO_3^{2-} present

(d) To a little M in a test tube add distilled water and stir it
Observation: Clear solution formed
Inference: Salt is soluble

(e) To the salt solution of sample M add KOH solution and warm it
Observation: Ammonia gas evolves (pungent smell)
Inference: NH_4^+ present

(f) To the salt solution of M add $MgSO_4$ solution
Observation: White precipitate
Inference: CO_3^{2-} confirmed

Conclusion
The cation in M is NH_4^+ and the anion is CO_3^{2-}
The molecular formula of salt M is $(NH_4)_2CO_3$

3. Sample E is a simple salt containing one cation and one anion. Using systematic qualitative analysis procedures, carry out experiments on sample E. Make appropriate observations and inferences to identify the cation and the anion present in sample E.

Experiment: Add NaOH solution
Observation: Reddish-brown precipitate
Inference: Fe^{3+} present

Experiment: Add $BaCl_2$ followed by HNO_3

Observation: White precipitate persists
Inference: SO_4^{2-} confirmed

Conclusion
The cation in E is Fe^{3+} and the anion is SO_4^{2-}