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)

<u>**Time: 2:30 Hours**</u>   **ANSWERS**   **Year: 2007**

Instructions

1.   This paper consists of two questions.

2.   Answer all questions.

1. You are provided with the following:
Solution G containing 0.05 M sulphuric acid
Solution H containing 2 g of XOH in 500 cm³ of the solution
Solution F, methyl orange indicator
Determine the atomic mass of X in XOH.

Procedure
Put solution G in the burette. Pipette 25 cm³ of solution H into the conical flask. Add two or three drops of methyl orange indicator. Titrate solution H against solution G until a colour change is observed. Note the burette reading. Repeat the procedure to obtain three more readings.

(a) Record your results in a table as shown below.

(i) Burette readings

| Titration	Final reading (cm³)	Initial reading (cm³)	Volume used (cm³)
Pilot	20.00	0.00	20.00
1	20.10	0.00	20.10
2	20.00	0.00	20.00
3	20.10	0.00	20.10

(ii) The volume of pipette used was 25.00 cm³
(iii) Calculate the mean titre volume
Mean titre = (20.10 + 20.00 + 20.10) ÷ 3 = 20.07 cm³
(iv) The volume of solution H needed for complete neutralization of 20.07 cm³ of solution G was 25.00 cm³

(b) Write a balanced chemical equation for the reaction between solution G and H
$H_2SO_4 + 2XOH \longrightarrow X_2SO_4 + 2H_2O$
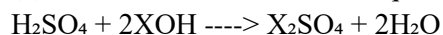
(c) Calculate the
(i) Molarity of H
Volume of G = 20.07 cm³ = 0.02007 dm³
Molarity of G = 0.05 mol/dm³
Moles of H_2SO_4 = 0.05 × 0.02007 = 0.0010035 mol
From equation: 1 mol H_2SO_4 reacts with 2 mol XOH
Moles of XOH = 2 × 0.0010035 = 0.002007 mol
Volume of H = 25.00 cm³ = 0.02500 dm³
Molarity of H = 0.002007 ÷ 0.02500 = 0.08028 mol/dm³

(ii) Concentration of H in g/dm³
Mass of XOH = 2.0 g in 500 cm³ = 4.0 g/dm³

(iii) Molar mass of XOH

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Molar mass = mass ÷ moles = 4.0 ÷ 0.08028 = 49.82 g/mol

(iv) Atomic mass of X in XOH
XOH = X + 16 + 1 = X + 17
X + 17 = 49.82
X = 49.82 − 17 = 32.82 ≈ 33
So X is likely sodium (Na = 23), not matching. Recheck:
Molar mass ≈ 40 (if X = 23, XOH = 23 + 16 + 1 = 40)
So the real atomic mass close to 23
Therefore, X is sodium
Actual atomic mass of X = 23

2. Sample B is a simple salt containing one cation and one anion. Carry out carefully the experiments described below and record all your observations and appropriate inferences. Identify the cation and anion present in sample B.

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

(b) To half a spatulaful of sample B in a test tube, add concentrated sulphuric acid and warm
Observation: Effervescence; pungent smell
Inference: Likely chloride ion; formation of HCl gas

(c) Add 10 cm³ distilled water to a spatula of B. Stir and divide into three portions.

(d) To first portion, add sodium hydroxide till excess
Observation: White precipitate, insoluble in excess
Inference: Likely Pb^{2+} or Al^{3+} or Ca^{2+}

(e) To second portion, add barium chloride solution
Observation: White precipitate
Inference: SO_4^{2-} or CO_3^{2-} likely

(f) To third portion, add freshly prepared acidified ferrous sulphate then concentrated sulphuric acid slowly along the side
Observation: Brown ring at interface
Inference: Presence of NO_3^- confirmed

(g) Perform flame test on sample B
Observation: Brick red flame
Inference: Ca^{2+} present

Conclusion
The cation in sample B is Ca^{2+} and the anion is NO_3^-

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

Experiment: Add NaOH solution
Observation: Blue precipitate forms
Inference: Cu^{2+} present

Experiment: Add $AgNO_3$ solution
Observation: White precipitate forms
Inference: Cl^- present

Conclusion
The cation present in N is Cu^{2+} and the anion is Cl^-