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: 2008**

Instructions

1. This paper consists of two questions.

2. Answer all questions.

1. You are provided with the following:
Solution N containing 9.0 g of H_2X per dm^3 of the solution
Solution M containing 4.91 g of sodium hydroxide per dm^3 of the solution
Solution P is phenolphthalein indicator

Procedure
Put solution M into the burette. Pipette 25 cm^3 of solution N into the titration flask. Put two to three drops of P into the titration flask. Titrate solution M from the burette against solution N in the titration flask until a colour change is observed. Note the burette reading. Repeat the procedure to obtain three more readings. Record your results as shown in Table 1.

Table 1: Burette readings

Titration	Final reading (cm^3)	Initial reading (cm^3)	Volume used (cm^3)
Pilot	19.20	0.00	19.20
1	19.30	0.00	19.30
2	19.20	0.00	19.20
3	19.20	0.00	19.20

(a) Give the volume of the pipette used
25.00 cm^3

(b) Give the volume of solution M needed for complete neutralization of solution N
Average volume of M = (19.30 + 19.20 + 19.20)/3 = 19.23 cm^3

(c) Tell the colour change of the indicator at the end point of the titration
Pink to colourless

(d) Write the balanced chemical equation for the reaction between solution M and N
$H_2X + 2NaOH \text{ ----> } Na_2X + 2H_2O$

(e) Calculate the
(i) Molarity of solution M
Mass of NaOH = 4.91 g
Molar mass of NaOH = 40 g/mol
Moles = 4.91 ÷ 40 = 0.12275 mol
Molarity = 0.12275 mol/dm^3

(ii) Molar mass of H_2X
Volume of M = 19.23 cm^3 = 0.01923 dm^3
Moles of NaOH = 0.12275 × 0.01923 = 0.002361 mol
From equation: 2 mol NaOH react with 1 mol H_2X
Moles of H_2X = 0.002361 ÷ 2 = 0.0011805 mol

Volume of H_2X used = 25.00 cm^3 = 0.025 dm^3
Moles per dm^3 = 0.0011805 ÷ 0.025 = 0.04722 mol
Mass of H_2X = 9.0 g per dm^3
Molar mass = 9.0 ÷ 0.04722 = 190.6 g/mol

(iii) Mass of X in H_2X
$H_2X = 2H + X = 2(1) + X = 190.6$
$X = 190.6 - 2 = 188.6$ g/mol

2. Sample D is a simple salt containing one cation and one anion. Carry out carefully the experiments described below recording all your observations and appropriate inferences as shown in Table 2 to identify the cation and anion present in D.

Table 2

(a) Observe the appearance of salt D
Observation: White crystalline solid
Inference: Colourless ionic compound

(b) Put a little solid sample D in a clean and dry test tube and heat
Observation: No visible change or colourless gas evolved
Inference: No water of crystallization or presence of carbonate

(c) Add distilled water to a spatula of sample D, stir and divide into four portions:

(i) Add aqueous ammonia slowly to the first portion
Observation: Light blue precipitate dissolves in excess
Inference: Cu^{2+} present

(ii) Add aqueous ammonia slowly to the second portion
Observation: Repeats confirmatory test; light blue ppt forms
Inference: Confirms Cu^{2+}

(iii) Add potassium hexacyanoferrate(II) to the third portion
Observation: Reddish-brown precipitate
Inference: Confirms Cu^{2+} (forms $Cu_2[Fe(CN)_6]$)

(iv) Add dilute HCl followed by $BaCl_2$ to the fourth portion
Observation: White precipitate
Inference: SO_4^{2-} present

Conclusion

The cation in sample D is Cu^{2+} and the anion is SO_4^{2-}
The molecular formula of salt D is $CuSO_4$

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

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

Experiment: Add $BaCl_2$ solution
Observation: White precipitate forms
Inference: SO_4^{2-} present

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