

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: 2000

Instructions

1. This paper consists of two questions.
2. Answer all questions.

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1. You are provided with the following solutions:

(i) Solution L; a solution containing 4.90 g of sulphuric acid in 1 dm³

(ii) Solution M; a monovalent metal P hydroxide (POH). Solution M was made by dissolving 1.00 g of POH in distilled water and making up to 250 cm³

(iii) Indicator; methyl orange

PROCEDURE

Pipette 25.00 cm³ of solution M into a titration conical flask provided. Add few drops of methyl orange indicator, then titrate this against solution L from the burette until an end point is reached.

Repeat this procedure to obtain three more readings and record your results in a tabular form as shown below:

(a)

(i) Table of results

Titration	Final reading (cm ³)	Initial reading (cm ³)	Volume used (cm ³)
Pilot	25.00	0.00	25.00
1	24.90	0.00	24.90
2	25.00	0.00	25.00
3	24.80	0.00	24.80

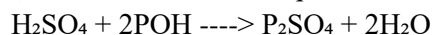
(ii) Volume of the pipette used was 25.00 cm³

(iii) Mean titre = $(24.90 + 25.00 + 24.80) \div 3 = 24.90$ cm³

(iii) Summary: 24.90 cm³ of solution L were required to react with 25.00 cm³ of solution M

(b)

(i) Balanced chemical equation:



(c)

(i) Calculate the molarity of solution L

$$\text{Mass} = 4.90 \text{ g}$$

$$\text{Molar mass of H}_2\text{SO}_4 = 98$$

$$\text{Moles} = 4.90 \div 98 = 0.05 \text{ mol}$$

$$\text{Volume} = 1 \text{ dm}^3$$

$$\text{Molarity} = 0.05 \text{ mol/dm}^3$$

(ii) Calculate the molarity of POH

$$\text{Moles of H}_2\text{SO}_4 \text{ in } 24.90 \text{ cm}^3 = 0.05 \times 0.02490 = 0.001245 \text{ mol}$$

From the equation, 1 mol H₂SO₄ reacts with 2 mol POH

$$\text{Moles of POH} = 0.001245 \times 2 = 0.00249 \text{ mol}$$

$$\text{Volume of POH used} = 25.00 \text{ cm}^3 = 0.025 \text{ dm}^3$$

$$\text{Molarity} = 0.00249 \div 0.025 = 0.0996 \text{ mol/dm}^3$$

(iii) Calculate the molar mass of POH

Mass of POH used = 1.00 g

Volume = 250 cm³ = 0.250 dm³

Moles = $0.0996 \times 0.250 = 0.0249$ mol

Molar mass = $1.00 \div 0.0249 = 40.16$ g/mol

(iv) Find the atomic mass of P

POH = P + 16 (O) + 1 (H) = P + 17

P + 17 = 40.16

P = 23.16 \approx 23

(v) Name element P and give its symbol

Element P is sodium, Na

2. Sample F is a simple salt containing ONE cation and ONE anion. Carefully, carry out the experiments and record your observations, inferences and hence identify the cation and the anion present in the sample salt F.

Test Experiment	Observation	Inference
----- ----- -----		
(a) Appearance of sample F Colourless ionic salt	White crystalline solid	
(b) Dissolve a spatula of F in distilled water Salt is soluble	Clear solution	
(c) Add potassium hydroxide solution to a portion of the solution Possible Pb ²⁺ , Zn ²⁺	White precipitate formed	
(d) Add NaOH to another portion till in excess Confirms Pb ²⁺	White precipitate, insoluble in excess	
(e) Add ammonia solution slowly till excess excess Confirms Pb ²⁺	White precipitate, insoluble in	
(f) Add potassium ferrocyanide to another portion Confirms Pb ²⁺	White precipitate formed	
(g) Add dil. HCl then BaCl ₂ to another portion Confirms SO ₄ ²⁻	White precipitate formed	
(h) Add lead acetate solution to another portion Confirms SO ₄ ²⁻	White precipitate formed	

Conclusion

The cation in F is Pb²⁺

The anion in F is SO₄²⁻

The compound is PbSO₄

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

Test	Experiment	Observation	Inference
(a)	Observe appearance of salt G	Green crystalline solid	Suggests presence of Fe^{2+}
(b)	Heat a little of G in a dry test tube	No water vapour or gas evolved	No water of crystallization
(c)	Add NaOH dropwise and in excess	Green precipitate formed, insoluble in excess	Confirms Fe^{2+} as $\text{Fe}(\text{OH})_2$
(d)	Add ammonium hydroxide dropwise and in excess	Green precipitate, unchanged in excess	Confirms Fe^{2+}
(e)	Add BaCl_2 followed by HCl	White precipitate persists	Confirms SO_4^{2-}
(f)	Flame test	No flame colour	Transition metal

Conclusion

The cation in the sample is Fe^{2+}

The anion in the sample is SO_4^{2-}