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.

1. You are provided with the following solutions:
(i) Solution L; a solution containing 4.90 g of sulphuric acid in 1 dm^3
(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 cm^3
(iii) Indicator; methyl orange

PROCEDURE
Pipette 25.00 cm^3 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 cm^3
(iii) Mean titre = (24.90 + 25.00 + 24.80) ÷ 3 = 24.90 cm^3
(iii) Summary: 24.90 cm^3 of solution L were required to react with 25.00 cm^3 of solution M

(b)
(i) Balanced chemical equation:
$H_2SO_4 + 2POH \text{ ----> } P_2SO_4 + 2H_2O$

(c)
(i) Calculate the molarity of solution L
Mass = 4.90 g
Molar mass of H_2SO_4 = 98
Moles = 4.90 ÷ 98 = 0.05 mol
Volume = 1 dm^3
Molarity = 0.05 mol/dm^3

(ii) Calculate the molarity of POH
Moles of H_2SO_4 in 24.90 cm^3 = 0.05 × 0.02490 = 0.001245 mol
From the equation, 1 mol H_2SO_4 reacts with 2 mol POH
Moles of POH = 0.001245 × 2 = 0.00249 mol
Volume of POH used = 25.00 cm^3 = 0.025 dm^3
Molarity = 0.00249 ÷ 0.025 = 0.0996 mol/dm^3

(iii) Calculate the molar mass of POH
Mass of POH used = 1.00 g
Volume = 250 cm^3 = 0.250 dm^3
Moles = 0.0996 × 0.250 = 0.0249 mol
Molar mass = 1.00 ÷ 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 ≈ 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	White crystalline solid	Colourless ionic salt
(b)	Dissolve a spatula of F in distilled water	Clear solution	Salt is soluble
(c)	Add potassium hydroxide solution to a portion of the solution	White precipitate formed	Possible Pb^{2+}, Zn^{2+}
(d)	Add NaOH to another portion till in excess	White precipitate, insoluble in excess	Confirms Pb^{2+}
(e)	Add ammonia solution slowly till excess to third portion	White precipitate, insoluble in excess	Confirms Pb^{2+}
(f)	Add potassium ferrocyanide to another portion	White precipitate formed	Confirms Pb^{2+}
(g)	Add dil. HCl then $BaCl_2$ to another portion	White precipitate formed	Confirms SO_4^{2-}
(h)	Add lead acetate solution to another portion	White precipitate formed	Confirms SO_4^{2-}

Conclusion
The cation in F is Pb^{2+}
The anion in F is SO_4^{2-}
The compound is $PbSO_4$

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 $Fe(OH)_2$
(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-}