

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.

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1. You are provided with the following:

1.1 Solution AA prepared by diluting 100 cm³ of 1M hydrochloric acid to 1000 cm³ with distilled water

1.2 Solution BB is sodium hydroxide solution

1.3 Phenolphthalein indicator

Procedure

Pipette 25 cm³ 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

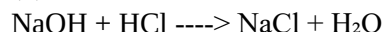
Titration	Final reading (cm ³)	Initial reading (cm ³)	Volume used (cm ³)
Pilot	20.10	0.00	20.10
1	20.00	0.00	20.00
2	19.90	0.00	19.90
3	20.00	0.00	20.00

(ii) The volume of pipette used was 25.00 cm³

(iii) The colour change at the end point was from pink to colourless

(vi) 20.00 cm³ of solution AA were required to neutralize 25.00 cm³ of solution BB

(b) Write a balanced chemical equation for the neutralization of the metal hydroxide by hydrochloric acid



(c)(i) Molarity of solution AA

Original HCl = 1M in 100 cm³ diluted to 1000 cm³

New molarity = $1 \times (100 \div 1000) = 0.1 \text{ mol/dm}^3$

(ii) Concentration in moles/dm³ of solution BB

From balanced equation, 1 mol HCl reacts with 1 mol NaOH

Moles of HCl = $0.1 \times 0.020 = 0.002 \text{ mol}$

Moles of NaOH = 0.002 mol

Volume = 25.00 cm³ = 0.025 dm³

Molarity of BB = $0.002 \div 0.025 = 0.08 \text{ mol/dm}^3$

(iii) Concentration in g/dm³ of solution BB

Molar mass of NaOH = 40 g/mol

Concentration = $0.08 \times 40 = 3.2 \text{ g/dm}^3$

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 $(\text{NH}_4)_2\text{CO}_3$

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-}