

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: 2009

Instructions

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

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1. You are provided with the following solutions:

Solution WW containing 4.38 g of pure hydrochloric acid per dm^3 of solution

Solution ZZ containing 14.30 g of hydrated sodium carbonate ($\text{Na}_2\text{CO}_3 \cdot x\text{H}_2\text{O}$) per dm^3

Methyl orange indicator

Procedure

Put solution WW in the burette. Pipette 25 cm^3 of solution ZZ into a titration flask. Add about three to four drops of methyl orange indicator into the titration flask. Titrate solution WW against solution ZZ until the end point is reached. Note the burette reading. Repeat the procedure to obtain three more readings. Record your results as shown in the following table:

(a)(i) Burette readings

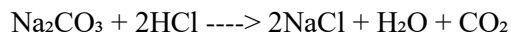
Titration	Final reading (cm^3)	Initial reading (cm^3)	Volume used (cm^3)
Pilot	25.00	0.00	25.00
1	25.00	0.00	25.00
2	25.00	0.00	25.00
3	25.00	0.00	25.00

(ii) The volume of pipette used was 25.00 cm^3

(iii) The volume solution WW needed for complete neutralization was 25.00 cm^3

(iv) The colour change at the end point was from yellow to orange-red

(b) Write down a balanced chemical equation for the reaction between solution ZZ and WW



(c) Calculate the molarity of

(i) Solution WW

Mass = 4.38 g

Molar mass of HCl = 36.5 g/mol

Moles = $4.38 \div 36.5 = 0.12 \text{ mol}$

Molarity = 0.12 mol/dm^3

(ii) Solution ZZ

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

Moles of HCl = $0.12 \times 0.025 = 0.003 \text{ mol}$

From equation: 2 mol HCl reacts with 1 mol Na_2CO_3

Moles of $\text{Na}_2\text{CO}_3 = 0.003 \div 2 = 0.0015 \text{ mol}$

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

Molarity of ZZ = $0.0015 \div 0.025 = 0.06 \text{ mol/dm}^3$

(d) Calculate the value of x in the formula $\text{Na}_2\text{CO}_3 \cdot x\text{H}_2\text{O}$

Mass of hydrated salt = 14.30 g in 1 dm^3

Moles = 0.06 mol

Molar mass = $14.30 \div 0.06 = 238.33$ g/mol

Molar mass of $\text{Na}_2\text{CO}_3 = 106$

$x\text{H}_2\text{O} = 238.33 - 106 = 132.33$

$x = 132.33 \div 18 = 7.35 \approx 7$

Value of $x = 7$

2. Sample M is a simple salt containing one cation and one anion. Carry out carefully the experiments described in the following table. Record all your observations and appropriate inferences to identify the ions present in M.

(a) Appearance of sample M

Observation: White crystalline solid

Inference: Colourless ionic compound

(b) Place a spatulaful of sample M in a test-tube and heat while rotating the tube. Test for any gas(es) evolved.

Observation: No gas evolved

Inference: No water of crystallization or decomposable anion present

(c) Place a spatulaful of sample M in a test tube and add dilute hydrochloric acid. Test for any gas(es) evolved. Add more of the acid until the test tube is half full. Divide the solution into three portions and then do the following:

(i) Add sodium hydroxide solution dropwise and then in excess to the first portion

Observation: White precipitate, soluble in excess

Inference: Zn^{2+} present

(ii) Add a few drops of potassium iodide solution to the second portion

Observation: No visible reaction

Inference: Pb^{2+} not present

(iii) Add ammonium hydroxide solution dropwise till excess to the third portion

Observation: White precipitate forms, dissolves in excess

Inference: Confirms Zn^{2+}

Conclusion

The cation in sample M is Zn^{2+} and the anion is likely Cl^-

3. Substance V is a simple salt containing one cation and one anion. Using systematic qualitative analysis procedures carry out tests on V and make appropriate systematic observations and inferences to identify the cation and anion in V. Record your experiments, observations and inferences as shown in the following table:

Experiment: Add NaOH solution

Observation: Reddish-brown precipitate

Inference: Fe^{3+} present

Experiment: Add BaCl_2 followed by dilute HNO_3

Observation: White precipitate persists

Inference: SO_4^{2-} present

Conclusion

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