

**THE UNITED REPUBLIC OF TANZANIA**  
**NATIONAL EXAMINATIONS COUNCIL**  
**CERTIFICATE OF SECONDARY EDUCATION EXAMINATION**

**032/2B**

**CHEMISTRY 2B**

**(ACTUAL PRACTICAL B)**

(For Both School and Private Candidates)

**Time: 2:30 Hours**

**ANSWERS**

**Year: 2010**

**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 W – containing 3.0 g of acetic acid ( $\text{CH}_3\text{COOH}$ ) per  $0.5 \text{ dm}^3$  of solution

Solution Q – containing 2.2 g of impure sodium bicarbonate per  $0.25 \text{ dm}^3$  of solution

Methyl orange indicator solution

#### Procedure

Put solution W in the burette. Pipette  $25 \text{ cm}^3$  of solution Q into a titration flask. Add a few drops of methyl orange indicator in the titration flask. Titrate solution Q against W until an end-point is reached. Note the burette reading. Repeat the titration to obtain three more titre values. Record your titre results as shown in the following table:

(a)

(i) Burette readings

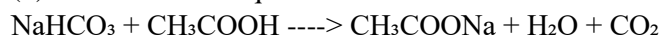
Titration	Final reading ( $\text{cm}^3$ )	Initial reading ( $\text{cm}^3$ )	Volume used ( $\text{cm}^3$ )
Pilot	24.90	0.00	24.90
1	25.00	0.00	25.00
2	24.80	0.00	24.80
3	24.80	0.00	24.80

(ii) Volume of pipette used was  $25.00 \text{ cm}^3$

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

(iv) The volume of solution W needed for complete neutralization reaction was  $24.87 \text{ cm}^3$

(b) If the balanced equation for the above neutralization reaction is



Calculate the

(i) Molarity of the acid solution W

Mass of  $\text{CH}_3\text{COOH} = 3.0 \text{ g}$  in  $0.5 \text{ dm}^3$

Molar mass of  $\text{CH}_3\text{COOH} = 12 + 3 + 12 + 16 + 16 + 1 = 60 \text{ g/mol}$

Moles =  $3.0 \div 60 = 0.050 \text{ mol}$

Molarity =  $0.050 \div 0.5 = 0.10 \text{ mol/dm}^3$

(ii) Molarity of the base solution Q

Volume of W used =  $24.87 \text{ cm}^3 = 0.02487 \text{ dm}^3$

Moles of  $\text{CH}_3\text{COOH} = 0.10 \times 0.02487 = 0.002487 \text{ mol}$

From the equation, 1 mol of acid reacts with 1 mol of base

Moles of  $\text{NaHCO}_3 = 0.002487 \text{ mol}$

Volume of Q used =  $25 \text{ cm}^3 = 0.025 \text{ dm}^3$

Molarity of Q =  $0.002487 \div 0.025 = 0.09948 \text{ mol/dm}^3$

(iii) Concentration of  $\text{NaHCO}_3$  in solution Q in  $\text{g/dm}^3$

Molar mass of  $\text{NaHCO}_3 = 23 + 1 + 12 + 48 = 84 \text{ g/mol}$

Concentration =  $0.09948 \times 84 = 8.36 \text{ g/dm}^3$

(c) The impurity in the sodium hydrogen carbonate does not react with the acid. Calculate the percentage by weight of the unreactive material (impurity in the sodium bicarbonate solution)

Mass of impure sample = 2.2 g in  $0.25 \text{ dm}^3$

Pure  $\text{NaHCO}_3 = 8.36 \text{ g/dm}^3$

Pure mass in  $0.25 \text{ dm}^3 = 8.36 \times 0.25 = 2.09 \text{ g}$

Impurity =  $2.2 - 2.09 = 0.11 \text{ g}$

Percentage impurity =  $(0.11 \div 2.2) \times 100 = 5\%$

Percentage of unreactive material = 5%

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

(a) Appearance of sample A

Observation: White crystalline solid

Inference: Likely a colorless ionic salt

(b) Put a spatulaful of the sample in a test-tube. Add water until the test-tube is three quarters full. Shake to dissolve the salt. Divide the solution into six portions and then do the following to the portions of the solution of sample:

(i) Add potassium iodide solution to the first portion

Observation: Yellow precipitate

Inference: Presence of  $\text{Pb}^{2+}$

(ii) Add sodium hydroxide solution till excess to the second portion

Observation: White precipitate, insoluble in excess

Inference: Confirms  $\text{Pb}^{2+}$

(iii) Add ammonia solution till the ammonia is in excess to the third portion

Observation: White precipitate, slightly soluble

Inference: Confirms  $\text{Pb}^{2+}$

(iv) Add potassium ferrocyanide solution to the fourth portion

Observation: White/cream precipitate

Inference: Confirms  $\text{Pb}^{2+}$

(v) Add dilute hydrochloric acid followed by barium chloride solution to the fifth portion

Observation: White precipitate

Inference: Presence of  $\text{SO}_4^{2-}$

(vi) Add lead acetate solution to the sixth portion

Observation: White precipitate

Inference: Presence of  $\text{SO}_4^{2-}$

(vii) Into the resulting reaction mixture in (vi) add ammonium acetate solution till excess

Observation: Precipitate remains

Inference: Confirms  $\text{SO}_4^{2-}$

Conclusion

The cation in sample A is  $\text{Pb}^{2+}$  and the anion is  $\text{SO}_4^{2-}$

3. Sample L is a salt containing one cation and one anion. Using systematic qualitative analysis procedures carry out tests on L and make appropriate observations and inferences to identify the cation and anion respectively.

Experiment: Add NaOH

Observation: Reddish-brown precipitate

Inference:  $\text{Fe}^{3+}$  present

Experiment: Add  $\text{BaCl}_2$  then  $\text{HNO}_3$

Observation: White precipitate remains

Inference:  $\text{SO}_4^{2-}$  present

Conclusion

The cation present in L is  $\text{Fe}^{3+}$  and the anion is  $\text{SO}_4^{2-}$