

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: 2013

Instructions

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

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1. You are provided with the following solutions:

T: Containing 1.825 g of hydrochloric acid in 0.50 dm³ of solution

Z: Containing 3.575 g of pure hydrated sodium carbonate, Na₂CO₃·xH₂O per 0.25 dm³ of solution

Methyl orange indicator

Questions

(a) Is the use of phenolphthalein indicator for this experiment as suitable as the methyl orange? Give a reason for your answer.

No, phenolphthalein is not suitable. Methyl orange is more appropriate because it gives a clearer endpoint in strong acid vs weak base titrations, such as HCl and sodium carbonate.

(b) Titrate the acid (in a burette) against the base (in a conical flask) using two drops of indicator and obtain three titre values.

Assume average titre volume of T used = 25.00 cm³ for 25.00 cm³ of Z.

(c) (i) ____ cm³ of acid required ____ cm³ of base for complete reaction.

25.00 cm³ of acid required 25.00 cm³ of base for complete reaction.

(c) (ii) With state symbols, write a balanced molecular equation and the corresponding ionic equation for the reaction between T and Z.

Molecular: Na₂CO₃(aq) + 2HCl(aq) ----> 2NaCl(aq) + CO₂(g) + H₂O(l)

Ionic: CO₃²⁻(aq) + 2H⁺(aq) ----> CO₂(g) + H₂O(l)

(d) Showing your procedures clearly, determine the value of x in the formula Na₂CO₃·xH₂O and hence name the compound.

Volume of acid = 25.00 cm³ = 0.025 dm³

Molar mass of HCl = 36.5 g/mol

Moles of HCl = (1.825 ÷ 36.5) = 0.05 mol in 0.5 dm³ → 0.1 mol/dm³

Moles of acid = 0.1 × 0.025 = 0.0025 mol

Mole ratio HCl : Na₂CO₃ = 2 : 1 → Moles Na₂CO₃ = 0.0025 ÷ 2 = 0.00125 mol

Mass in 25.00 cm³ of Z = (3.575 ÷ 250) × 25 = 0.3575 g

Molar mass = 0.3575 ÷ 0.00125 = 286 g/mol

Molar mass of Na₂CO₃ = 106 g/mol → 286 – 106 = 180

180 ÷ 18 = 10

x = 10, compound is sodium carbonate decahydrate (Na₂CO₃·10H₂O)

2. You are provided with the following:

P₁: 0.5 mol/dm³ sodium thiosulphate

P₂: 0.1 mol/dm³ hydrochloric acid

Distilled water

Stop watch

Plain paper

Table 1 Completion

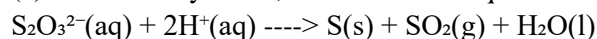
Experiment	Volume of P ₁ (cm ³)	Volume of Water (cm ³)	Volume of P ₂ (cm ³)	Time (s)
1	30	0	10	10
2	25	5	10	13
3	20	10	10	18
4	15	15	10	27

Questions

(b) Why did the solution become opaque after mixing P₁ and P₂?

Because sulphur precipitate was formed, making the solution cloudy and obscuring the mark.

(c) With state symbols, write the ionic equation for the reaction.



(d) List four factors which can affect the reaction in (c).

- Concentration of reactants
- Temperature
- Nature of the acid used
- Presence of catalyst

(e) Plot a graph of volume P₁ against time.

(f) Inspect your graph and comment on the effect of concentration on the rate of chemical reaction.

As the volume of P₁ (thiosulphate) increases, the reaction time decreases. This shows that the rate of reaction increases with concentration.

Sample N contains one cation and one anion. Using systematic qualitative analysis procedures, identify the cation and anion.

S/n	Experiment	Observation	Inference
a	Observe appearance	White crystalline solid	Ionic salt
b	Add NaOH till excess	White ppt, soluble in excess	Zn ²⁺ suspected
c	Add NH ₃ till excess	White ppt, soluble in excess	Confirms Zn ²⁺
d	Add AgNO ₃ and HNO ₃	White ppt, soluble in NH ₃	Confirms Cl ⁻

Conclusion

(i) The cation present in sample N is Zn²⁺

(ii) The anion present in sample N is Cl⁻