TABLES ⟹

1) Standarization of HCl.

Sr. No.	Vol. of Na_2CO_3 (V_2)	Burette reading		Concordant value (V_1)	Indicator
		I	F		
	ml	ml		ml	
1.	20.0	0	19.8	19.8	methyl orange
2.	20.0	0	19.8		

2) Estimation of Na_2CO_3 and NaOH in a given mixture.

Sr. No.	Volume of the unknown solution (V_2)	Burette reading (V_1)		
		Initial	Volume consumed for phenolphthalein end point (A)	Total volume consumed for methyl orange end point (B)
	ml		ml	ml
1.	20	0	25	35
2.	20	0	25	35
Concordant value			A = 25	B = 35

CALCULATIONS ⟹

1) Titration 1: STANDARDIZATION OF HCl.

Volume of HCl = 19.8 ml (V_1 ml - end point)

Volume of Na_2CO_3 (V_2) = 20 ml

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DETERMINATION OF Na_2CO_3 AND NaOH MIXTURE BY TITRATION.

AIM ⟹

To determine the amount of Na_2CO_3 and NaOH in a mixture using HCl acid.

APPARATUS REQUIRED ⟹

Burette, pipette, standard measuring flask, beaker, funnel, wash bottle, etc.

REAGENTS ⟹

1) std. Hydrochloric acid.
2) sodium carbonate solution (0.1 N)
3) sodium hydroxide
4) methyl orange, phenolphthalein.

PRINCIPLE ⟹

When a known volume of the mixture is titrated with HCl in presence of phenolphthalein, the acid reacts with all the sodium hydroxide and with only half of the carbonate.

When the titration is continued with methyl orange indicator, the remaining half of CO_3^{2-} ions will be neutralized with HCl at the end point.

A = all hydroxide ions + carbonate ions

B = half the carbonate ions after phenolphthalein endpoint

2A = all carbonate ions

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Normality of Na_2CO_3 (N_2) = 0.05 N

∴ Normality of HCl (N_1) = $\frac{V_2 \times N_2}{V_1}$ = $\frac{20 \times 0.05}{19.8}$

= 0.0505 N

2) Titration 2 : ESTIMATION OF AMOUNT OF Na_2CO_3 AND NaOH.

- Estimation of amount of Na_2CO_3.

Here, A = 25 , B = 35 , C = B - A = 35 - 25 = 10.

Volume of HCl (V_1) = 2C = 2 × 10 = 20 ml

(where, 'C' is titre value after phenolphthalein end-point. i.e. C = B - A).

Normality of HCl (N_1) = 0.0505 N (From titration 1)

Volume of mixture (V_2) = 20 ml

Normality of Na_2CO_3 (N_2) = $\frac{V_1 \times N_1}{V_2}$ = $\frac{\cancel{20} \times 0.0505}{\cancel{20}}$

= 0.0505 N

∴ Amount of Na_2CO_3 present in whole of given solution = $\frac{N_2 \times \text{Eq. wt of } Na_2CO_3 (53)}{10}$

= $\frac{0.0505 \times 53}{10}$ = $\frac{2.6765}{10}$

= 0.26765 g/lit.

- Estimation of amount of NaOH.

Volume of HCl (V_1) = 15 ml (A - C)

Normality of HCl (N_1) = 0.0505 N (From titration 1)

Volume of mixture (V_2) = 20 ml

Normality of NaOH (N_2) = $\frac{V_1 \times N_1}{V_2}$ = $\frac{15 \times 0.0505}{20}$

= 0.037875 N

A-B = all hydroxide ions.

PROCEDURE ⟹

Titration 1: STANDARDIZATION OF HCl.

1) Burette solution = Hydrochloric acid.

2) Pipette solution = Std. Na_2CO_3 (0.1N)

3) Indicator = methyl orange (2-3 drops)

4) End point = yellow to orange.

Titration 2: ESTIMATION OF THE MIXTURE (Na_2CO_3 + NaOH).

1) Burette solution = Std. Hydrochloric acid.

2) Pipette solution = 20ml of the given mixture.

3) Indicator = phenolphthalein (2-3 drops)

4) End point = pink to colourless. Continue the titration by adding methyl orange (2-3 drops) and the end point is the colour change from yellow to orange.

$\therefore$ Amount of NaOH present in whole of the given solution =

$$\frac{N_2 \times \text{Eq. wt. of NaOH (40)}}{10}$$

$$= \frac{0.037875 \times 40}{10} = \frac{1.515}{10}$$

$$= 0.1515 \text{ g/lit.}$$

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RESULT ⟹

1) Amount of Na_2CO_3 present in the given solution = 0.26765 g/lit.

2) Amount of NaOH present in the given solution = 0.1515 g/lit.

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