Alkalinity is due to the presence of OH^-, CO_3^{2-} & HCO_3^- ions. If these ions are present in water, they can be estimated by titrating it against a std HCl (or) H_2SO_4 soln..

$OH^- + H^+ \longrightarrow H_2O$ } HPh → ①.

$CO_3^{2-} + H^+ \longrightarrow HCO_3^-$ } HPh → ②

$HCO_3^- + H^+ \longrightarrow H_2O + CO_2$. } M.O. → ③.

HPh Alkalinity is for OH^- & CO_3^{2-} ions.
i.e complete neutralisation of OH^- & half neutralisation of CO_3^{2-}

MO alkalinity is meant for total alkalinity.

Determination of the amount of Na_2CO_3 & NaOH in a mixture by titration.

Titl I. Standardisation of Hcl.

S.No	Vol. of Na_2CO_3 (ml)	Burette Reading (ml) Initial	Final	Concordant value (ml)	Indicator
1.	20	0	19.6	19.2	Methyl Orange.
2.	20	0	19.2		
3.	20	0	19.2		

Calculation:

Volume of Hcl (V_2) = 19.2 ml.

Normality of Hcl (N_2) = ?

Volume of Na_2CO_3 (V_1) = 20 ml.

Normality of Na_2CO_3 (N_1) = 0.05 N.

$V_1 N_1 = V_2 N_2$.

Na_2CO_3 Hcl.

$$N_2 = \frac{V_1 N_1}{V_2} = \frac{20 \times 0.05}{19.2}$$

$$= 0.05208 \text{ N}.$$

Ex. No. 11 Estimation of

S.No	Volume of the mixture	Burette Reading. Initial	Final HPh	Final MO	Concordant value HPh (A)	Concordant value MO (B)	Indicator
1.	20	0	25.2	36.5			Phenolphthalein & Methyl Orange.
2.	20	0	25.4	36.3	25.2	36.5	
3.	20	0	25.2	36.5			

A - Phenolphthalein End point. - Volume of acid used upto HPh end point.

B - M.O end point - Total volume of acid used till MO end point.

(B-A) = C . Volume of acid used for $\frac{1}{2}$ CO_3^{2-} neutralisation

∴ 2C = Total volume of acid used for complete neutralisation of CO_3^{2-} ions.

Calculations :

1. Estimation of Na_2CO_3

Volume of Hcl (V_1) = 2C ml. (C = B-A)
= 36.5 - 25.2
= 11.3 × 2
= 22.6 ml.

Normality of Hcl (N_1) = 0.05208 N.

Volume of the mixture (V_2) 20 ml.

∴ Normality of the mixture N_2 = ?.

$V_1 N_1 = V_2 N_2$.

Hcl Mixture.

$$N_2 = \frac{V_1 N_1}{V_2} = \frac{22.6 \times 0.05208}{20}$$

$$= 0.05885 \text{ N}$$

in the whole of the given soln. } = $\frac{\text{Normality} \times \text{Eq. Wt of } Na_2CO_3}{10}$ of Na_2CO_3

$= \frac{0.05885 \times 53}{10}$

$= 0.3119$ g/l.

Estimation of NaOH.

Volume of HCl V_1 = A - C ml.

= 25.2 - 11.3 = 13.9 ml.

Normality of HCl N_1 = 0.05208 N.

Volume of mixture V_2 = 20 ml.

Normality of " N_2 = ?

$V_1 N_1 = V_2 N_2$.

HCl Mixture.

$N_2 = \frac{V_1 N_1}{V_2} = \frac{13.9 \times 0.05208}{20}$

$= 0.0362$ N.

∴ Amount of NaOH present in the whole of the given soln. } = $\frac{\text{Normality of NaOH} \times \text{Eq. Wt of NaOH}}{10}$

$= \frac{0.0362 \times 40}{10}$

$= 0.1448$ g/l.