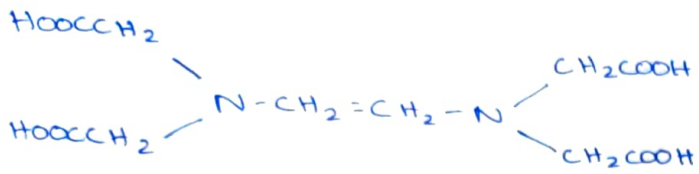
STRUCTURE OF DISODIUM SALT OF EDTA



Simple Procedure:

Contents	Titration -I	Titration - II	Titration -III
	Standardisation of EDTA	Estimation of total hardness	Estimation of Permanent hardness
Burette Solution	EDTA	Std. EDTA	Std EDTA
Pipette Solution	20ml of Standard hard water	20ml of hard water sample	20 ml of boiled hard water Sample.
Additional solution	5ml of ammonia buffer	5ml of ammonia buffer	5ml of ammonia buffer
Indicator	EBT	EBT	EBT
End Point	wine red to Steel blue	wine red to Steel blue	wine red to Steel blue.
Formula	---	$\frac{V_2}{V_1} \times 1000 ppm$	$\frac{V_3}{V_1} \times 1000 ppm$

DETERMINATION OF TOTAL PERMANENT AND TEMPORARY HARDNESS OF WATER SAMPLE BY EDTA METHOD

Aim:

To determine the permanent & temporary hardness present in the given sample of hard water by EDTA method. You are provided with a standard hard water sample and EDTA as link solution.

Principle:

Disodium salt of ethylene diamine tetra acetic acid (EDTA) is used as a complexing agent. Endochromic Black T indicator forms a wine red coloured weak complex with the metal ions present in the hard water.

$$\begin{pmatrix} Ca^{2+} \\ Mg^{2+} \end{pmatrix} + EBT \xrightarrow{PH=8-10} \begin{pmatrix} Ca \\ Mg \end{pmatrix} - EBT \text{ complex}$$

$$\begin{pmatrix} Ca \\ Mg \end{pmatrix} - EBT \text{ complex} + EDTA \xrightarrow{PH=8-10} \begin{pmatrix} Ca \\ Mg \end{pmatrix} - EDTA \text{ complex} + EBT$$

weak wine red — Stable complex — Steel blue

TITRATION - I

STANDARDIZATION OF EDTA

Standard hardwater vs EDTA Indicator : EBT

S.no.	Volume of Std. hard water (ml)	Burette reading (ml) Initial	Final	Volume of EDTA V_1 (ml)	Concordant Value V_1 (ml)
1.	20	0	19.4	19.4	19.4
2.	20	0	19.4	19.4	

Calculation:

Volume of Standard hard water = 20ml

Volume of EDTA Solution consumed V_1 = 19.4ml

1ml of hardwater contians 1mg of Calcium Carbonate

20ml of Standard hardwater contians 20mg of $CaCO_3$

20ml of Standard hardwater consumes V_1 ml of EDTA

$\therefore$ V_1 ml of EDTA Solution = 20mg of $CaCO_3$

$\therefore$ 1ml of EDTA Solution = $\frac{20}{19.4}$ mg of $CaCO_3$

$\therefore$ 1ml of EDTA Solution = 1.03 mg of $CaCO_3$.

Weak wine red coloured Solution is titrated against EDTA to form steel metal complex at pH 8 - 10. By titrating the wine red coloured complex with EDTA solution, The EDTA takes up metal ions from the indicator complex by leaving the indicator at which the wine red colour changes to steel blue which denote the end point of the titeration. From the volume of EDTA Consumed, the hardness can be Calculated.

TITRATION - II

ESTIMATION OF TOTAL HARDNESS

Std. EDTA Vs hard water sample Indicator: EBT

Sno.	Volume of hard water sample (ml)	Burette reading (ml)		Volume of EDTA V_2 (ml)	Concordant Value V_2 (ml)
		Initial	Final		
1.	20	0	14.4	14.4	14.4
2.	20	0	14.4	14.4	

Calculation:

Volume of hard water sample = 20ml

Volume of EDTA Consumed V_2 = 14.4 ml

20ml of given hard water consumes V_2 ml of EDTA

20ml of given hard water Contians.

$$\frac{20}{V_1} \times V_2 \text{ mg } CaCO_3$$

$$\frac{20}{19.4} \times 14.4 \text{ mg of } CaCO_3.$$

1000ml of given hard water sample contians

$$\frac{20}{19.4} \times 14.4 \times \frac{1000}{20} = 742.$$

Total hardness of the given sample of hard water = 742 ppm

TITRATION - III

ESTIMATION OF PERMANENT HARDNESS

Std. EDTA Vs Boiled hard water sample Indicator: EBT

S.No.	Volume of Boiled hard water (ml)	Burette reading (ml)		Volume of EDTA V_3(ml)	Concordant value V_3 (ml)
		Initial	Final		
1.	20	0	10.4	10.4	10.4
2.	20	0	10.4	10.4	

Calculation:

Volume of boiled Sample hardwater = 20ml

Volume of EDTA Consumed by V_3 = 10.4ml

20ml of given boiled hardwater consumes V_3ml of EDTA

20ml of given boiled hard water

Sample Contians $= \frac{20}{19.4} \times 10.4$ mg of $CaCO_3$

∴ 1000 ml of given boiled hard water contians.

$= \frac{20}{19.4} \times 10.4 \times \frac{1000}{20}$ mg of $CaCO_3 = 536$

∴ Permenant hardness of given water sample = 536ppm

ESTIMATION OF TEMPORARY HARDNESS

temporary hardness = total hardness - permenant

= 742 - 536

temporary hardness = 206 ppm

RESULT:

1. Total hardness of given water Sample = 742
2. Permenant hardness of given water Sample = 536
3. temporary hardness of given water Sample = 206

SIMPLE PROCEDURE:

Contents	titration - I	titration - II
	Standardisation of HCL	Estimation of diffrent types of alkalinity
Burette reading	HCL	Std. HCL
Pipette Solution	Std. Sodium Carbonate	Water Sample
Indicator	Methyl Orange	i) Phenolphthalein ii) Methyl orange
End Point	Colour change from straw yellow to reddish orange	Phenophthalin end point Disappearence of pink colour. Methyl orange end point colour change from straw yellow to reddish orange.

DETERMINATION OF DIFFRENT TYPES AND AMOUNTS OF ALKALITY IN WATER BY INDICATOR METHOD

Aim:

to determine and to estimate the amount of diffrent types of alkality present in the given water sample.

Principle:

Alkanity in water is due to the presence of OH^-, CO_3^{2-} and HCO_2^- ions. The alkanity of a given sample of water can be obtained by neutralizing the above mentioned ions with standard HCL. titrating the given sample of water at a pH of 8.3 or till the decolourisation of phenolpthalin indicator will indicate the complete neutralization of OH^- ions and half of CO_3^{2-}. titrating the same sample of water at a pH of 4.4 or till sharp colour change from yellow to reddish orange of methyle orange indicator indicates the total alkalinity i.e. The amount of OH^-, CO_3^{2-}, HCO_3^- present in the given water sample can be determined.

$$OH^- + H^+ \longrightarrow H_2O$$

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

$$HCO_3^- + H^+ \longrightarrow H_2CO_3$$

CONDITION TABLE:

Volume of P and M	Alkalinity is due to		
	OH^-	CO_3^{2-}	HCO_3^-
P = 0	0	0	M
P < ½ M	0	2P	M - 2P
P = ½ M	0	2P	0
P > ½ M	2P - M	2M - P	0
P = M	M	0	0

i) P = M only OH^- ions are present

ii) P = ½ M only CO_3^{2-} ions are present.

iii) P = 0 only HCO_3^- ions are present

iv) P > ½ M only OH^-, CO_3^{2-} ions are present

v) P < ½ M only HCO_3^-, CO_3^{2-} ions are present

OH^- and HCO_3^- concl cannot exist in water together because they combine instantaneously to form CO_3^{2-} ions.

$$OH^- + HCO_3^- \longrightarrow CO_3^{2-} + H_2O$$

$$NaOH + NaHCO_3 \longrightarrow Na_2CO_3 + H_2O$$

It is for the same reason the three ions OH^-, CO_3^{2-} & HCO_3^- cannot exist together.

TITRATION - I

Estimation of different types of Alkalinites sample. water Vs Std Hcl.

Sl.No	Volume of water Sample (ml)	Volume of Hcl (ml)	
		Pheropthalein end point [P]	Methyl orange end point [M]
1.	20 ml	14	19.5
2.	20 ml	14	19.5
Concordant Value		14	19.5

Calculation:

$P > \frac{1}{2}M$

Amount of alkalinity due to OH^- ions $= \frac{[2P-M] \times O \times 50 \times 1000}{20}$

$= \frac{[2 \times 14 - 19.5] \times 0.1N \times 50 \times 1000}{20}$

$= 2125$ ppm

Amount of alkalinity due to CO_3^{2-} ions $= \frac{2[M-P] \times 0.1N \times 50 \times 1000}{20}$

$= \frac{2[19.5-14] \times 0.1N \times 50 \times 1000}{20}$

$= 2750$ ppm

Result:

The given water sample contians

a) Hydroxide alkalinity = 2125 ppm

b) Carbonate alkalinity = 2750 ppm.

c) Bicarbonate alkalinity = --- NIL ---