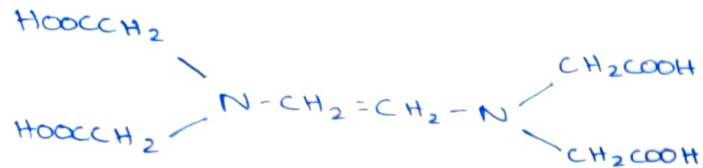


## STRUCTURE OF DISODIUM SALT OF EDTA



### Simple Procedure:

	Titration - I	Titration - II	Titration - III
Contents	Standardization 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	20ml 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	---	$\frac{V_2}{V_1} \times 1000 \text{ ppm}$	$\frac{V_2}{V_1} \times 1000 \text{ ppm}$

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

### EDTA METHOD

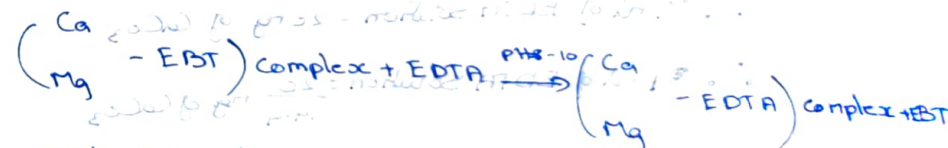
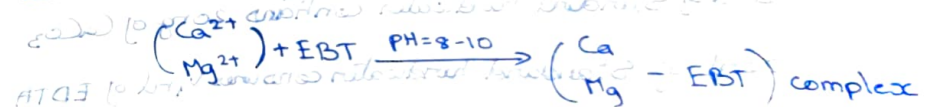
#### \* Aim:

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.



weak wine red

Stable complex Steel blue

## TITRATION-I

### STANDARDIZATION OF EDTA

Standard hardwater vs EDTA

Indicator: EBT

Sno.	Volume of Std. hard water (ml)	Burette reading (ml)		Volume of EDTA $V_1$ (ml)	Concordant Value $V_1$ (ml)
		Initial	Final		
1.	20	0	19.4	19.4	19.4
2.	20	0	19.4	19.4	

#### Calculation:

Volume of Standard hard water = 20 ml

Volume of EDTA solution consumed  $V_1 = 19.4$  ml

1 ml of hardwater contains 1 mg of Calcium Carbonate

20 ml of Standard hardwater contains 20 mg of  $\text{CaCO}_3$

20 ml of Standard hardwater consumes 19.4 ml of EDTA

$\therefore$  19.4 ml of EDTA solution = 20 mg of  $\text{CaCO}_3$

$\therefore$  1 ml of EDTA solution =  $\frac{20}{19.4}$  mg of  $\text{CaCO}_3$

$\therefore$  1 ml of EDTA solution = 1.03 mg of  $\text{CaCO}_3$

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 and colour changes to steel blue which denote the end point of the titration. 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

Sl. No.	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 = 20 ml

Volume of EDTA Consumed  $V_2$  = 14.4 ml

20 ml of given hard water consumes  $V_2$  ml of EDTA

20 ml of given hard water contains .

$$\frac{20}{V_1} \times V_2 \text{ mg CaCO}_3$$

$$\frac{20}{14.4} \times 14.4 \text{ mg of CaCO}_3$$

1000 ml of given hard water sample contains

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

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

Sno.	Volume of Boiled hard water (ml)	Burette reading (ml)		Volume of EDTA $V_2$ (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  $V_3$  ml of EDTA

20ml of given boiled hardwater

Sample Contains

$$= \frac{20}{10.4} \times 10.4 \text{ mg of CaCO}_3$$

$\therefore$  1000 ml of given boiled hardwater contains.

$$= \frac{20}{10.4} \times 10.4 \times \frac{1000}{20} \text{ mg of CaCO}_3 = 536$$

$\therefore$  Permanent hardness of given water sample = 536ppm

#### ESTIMATION OF TEMPORARY HARDNESS

temporary hardness = total hardness - permanent

$$= 742 - 536$$

temporary hardness = 206 ppm

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11 - methyl red 12 - phenolphthalein 13 - chromate

transfer to methyl red 14 - methyl red 15 - chromate

16 - 17 - 18 - 19 - 20 - 21 - 22 - 23 - 24 - 25 - 26 - 27 - 28 - 29 - 30 - 31 - 32 - 33 - 34 - 35 - 36 - 37 - 38 - 39 - 40 - 41 - 42 - 43 - 44 - 45 - 46 - 47 - 48 - 49 - 50 - 51 - 52 - 53 - 54 - 55 - 56 - 57 - 58 - 59 - 60 - 61 - 62 - 63 - 64 - 65 - 66 - 67 - 68 - 69 - 70 - 71 - 72 - 73 - 74 - 75 - 76 - 77 - 78 - 79 - 80 - 81 - 82 - 83 - 84 - 85 - 86 - 87 - 88 - 89 - 90 - 91 - 92 - 93 - 94 - 95 - 96 - 97 - 98 - 99 - 100 - 101 - 102 - 103 - 104 - 105 - 106 - 107 - 108 - 109 - 110 - 111 - 112 - 113 - 114 - 115 - 116 - 117 - 118 - 119 - 120 - 121 - 122 - 123 - 124 - 125 - 126 - 127 - 128 - 129 - 130 - 131 - 132 - 133 - 134 - 135 - 136 - 137 - 138 - 139 - 140 - 141 - 142 - 143 - 144 - 145 - 146 - 147 - 148 - 149 - 150 - 151 - 152 - 153 - 154 - 155 - 156 - 157 - 158 - 159 - 160 - 161 - 162 - 163 - 164 - 165 - 166 - 167 - 168 - 169 - 170 - 171 - 172 - 173 - 174 - 175 - 176 - 177 - 178 - 179 - 180 - 181 - 182 - 183 - 184 - 185 - 186 - 187 - 188 - 189 - 190 - 191 - 192 - 193 - 194 - 195 - 196 - 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#### RESULT:

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

## SIMPLE PROCEDURE:

Contents	titration - I	titration - II
	Standardization of HCL	Estimation of different 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	Phenolphthalein end point Disappearance of pink colour. Methyl orange end point colour change from straw yellow to reddish orange.

## DETERMINATION OF DIFFERENT TYPES OF AND AMOUNTS OF ALKALITY IN WATER BY INDICATOR METHOD

### Aim:

to determine and to estimate the amount of different types of alkalinity present in the given water sample.

### Principle:

Alkalinity in water is due to the presence of  $\text{OH}^-$ ,  $\text{CO}_3^{2-}$  and  $\text{HCO}_3^-$  ions. The alkalinity 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 decolorisation of phenolphthalein indicator will indicate the complete neutralization of  $\text{OH}^-$  ions and half of  $\text{CO}_3^{2-}$ . Titrating the same sample of water at a pH of 4.4 or till sharp colour change from yellow to reddish orange of methyl orange indicator indicates the total alkalinity i.e. the amount of  $\text{OH}^-$ ,  $\text{CO}_3^{2-}$ ,  $\text{HCO}_3^-$  present in the given water sample can be determined.



# CONDITION TABLE:

Volume of P and M	Alkalinity is due to		
	$\text{OH}^-$	$\text{CO}_3^{2-}$	$\text{HCO}_3^-$
$P=0$	0	0	M
$P < \frac{1}{2}M$	0	$2P$	$M - 2P$
$P = \frac{1}{2}M$	0	$2P$	0
$P > \frac{1}{2}M$	$2P - M$	$2M - P$	0
$P = M$	M	0	0

- i)  $P = M$  only  $\text{OH}^-$  ions are present
- ii)  $P = \frac{1}{2}M$  only  $\text{CO}_3^{2-}$  ions are present
- iii)  $P = 0$  only  $\text{HCO}_3^-$  ions are present
- iv)  $P > \frac{1}{2}M$  only  $\text{OH}^-$ ,  $\text{CO}_3^{2-}$  ions are present
- v)  $P < \frac{1}{2}M$  only  $\text{HCO}_3^-$ ,  $\text{CO}_3^{2-}$  ions are present

$\text{OH}^-$  and  $\text{HCO}_3^-$  conc. cannot exist in water together

Because they combine instantaneously to form  $\text{CO}_3^{2-}$  ions



It is for the same reason the three ions  $\text{OH}^-$ ,  $\text{CO}_3^{2-}$  &  $\text{HCO}_3^-$  cannot exist together.

## TITRATION-I

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

SNo	Volume of water Sample (ml)	Volume of HCl (ml)	
		phenolphthalein 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  $\text{OH}^-$  ions =  $\frac{[2P-M] \times 0.1N \times 50 \times 1000}{20}$

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

$$= 2125 \text{ ppm}$$

Amount of alkalinity due to  $\text{CO}_3^{2-}$  ions =  $\frac{2[M-P] \times 0.1N \times 50 \times 1000}{20}$

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

$$= 2750 \text{ ppm}$$

\* Result:

The given water sample contains

a) Hydroxide alkalinity = 2125 ppm

b) Carbonate alkalinity = 2750 ppm.

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