Titration of Determination of Alkalinity

Aim:- Determination of total Alkalinity of water sample.

Apparatus:- Burette, burette stand, conical flask and beaker, pipette, etc.

Chemicals:- HCl /H_2SO_4 (N/10), phenolphthalein and methyl orange, water sample, etc.

Procedure:-

1. 20 ml of water is transferred into a conical flask and two drops of phenolphthalein indicator is added.

2. Then the water sample is titrated against a standard HCl until the pink color just disappears.

3. The titrated value is then recorded.

4. Then 2–3 drops of Methyl Orange indicator are added to the same solution and titration is continued until color changes from yellow to orange red.

5. Again the titrated value is recorded from the beginning of experiment as 'M' end point.

6. The alkalinity is then calculated according to the table.

Observation table:-

Sr No.	Volume of water	Volume of HCl rundown		Mean end point	
		End pt. 'P'	End pt. 'M'	P	M
1	20 ml				
2	20 ml				
3	20 ml				

Calculations: -

I) For Phenolphthalein End point (P): (water) Vs (HCl)

N1V1 = N2V2

N(p) x 20 = N/10 x (P end point)

N(p) = _____

Strength = ?

Strength = N(p) x Equivalent weight of $CaCO_3$ x 1000

= _____ x 50 x 1000

= _____ ppm

II) For Methyl Orange End point (M) : (water) Vs (HCl)

$N_1V_1 = N_2V_2$

N(m) x 20 = N/10 x (M end point)

N(m) = _____

Strength = ?

Strength = N(m) x Equivalent weight of $CaCO_3$ x 1000

= _____ x 50 x 1000

= _____ ppm

III) On the basis of both strengths we can decide the suitable combination for Alkalinity

1. If P = 0 ,alkalinity is due to HCO_3^-
2. If P = 1/2 ,alkalinity is due to CO_3^{2-}
3. If P = M ,alkalinity is due to OH^-
4. If P > ½ M ,alkalinity is due to OH^- & CO_3^{2-}
5. If P < ½ M ,alkalinity is due to CO_3^{2-} and HCO_3^-

IV) And after finding the suitable combination of alkalinity, then calculate for the extent of alkalinity as per the given table.

Result :-

1. The alkalinity due to _____ ions is _____ ppm.
2. The alkalinity due to _____ ions is _____ ppm.
3. The total alkalinity of the water sample is _____ ppm

Calculation explanation

1.Phenolphthalein alkalinity (P) = 0; that means the volume of acid used till the completion of reaction (1) and (2) is 0. This can only happen when both OH^- and CO_3^{2-} ions are not present in water. Alkalinity is present due to HCO_3^- ion only which can be determined using methyl orange indicator and called methyl orange alkalinity (M).

2. P = ½ M; indicates that only CO_3^{2-} ions are present. Using phenolphthalein indicator neutralization reaches upto HCO_3^- but using methyl orange indicator the complete neutralization of HCO_3^- takes place.

3.P > ½M; implies OH^- ions are also present along with CO_3^{2-} ions. Upto phenolphthalein alkalinity OH^- ions will be neutralized completely whereas CO_3^{2-} will be neutralized upto HCO_3^- ion. But using methyl orange indicator HCO_3^- will be completely neutralized along with OH^- and CO_3^{2-}.

4.P < ½ M; indicates that beside CO_3^{2-} ions HCO_3^- ions are also present. The volume of acid required for the neutralization upto phenolphthalein end point correspond half neutralization of CO_3^{2-} (equation 2). Neutralization using methyl orange indicator corresponds to HCO_3^- obtained from CO_3^{2-} and HCO_3^- originally present in the water sample

5.P = M; indicates only OH^- ions are present.