

Experiment - 8

Aim:- To determine the alkalinity of given water solution.

Readings	V ₁			CBR (V ₁)	V ₂			CBR (V ₂)
	I	II	III		I	II	III	
W.B A	1.2	1.3	1.2	1.2	5.3	5.5	5.3	5.3
W.B B	0	0	0	0	4.2	4.4	4.4	4.4

$$P = \frac{V_1 \times Z \times 50 \times 1000}{V}$$

$$M = \frac{V_2 \times Z \times 50 \times 1000}{V}$$

P for water A

$$P = \frac{1.2 \times 0.02 \times 50 \times 1000}{10}$$

M for water A

$$M = \frac{5.3 \times 0.02 \times 50 \times 1000}{10}$$

M = 530 ppm (Methyl orange)

1 for water B

$$P = 0 \text{ ppm}$$

M for water B

$$M = \frac{4.4 \times 0.02 \times 50 \times 100}{10}$$

$$\underline{\underline{M = 440 \text{ ppm.}}}$$

Case 1 :-

$$\underline{\underline{V_1 = 1.2}} \quad V_2 = 5.3$$

$$\underline{\underline{V_1 < V_2}} \quad V_1 < \frac{1}{2} V_2$$

$$P = 120 \quad M = 530 \quad P < \frac{1}{2} M$$

$$(\text{O}_3)^{2-} \rightarrow 2P = 240.$$

$$\text{H}(\text{O}_3)^- \Rightarrow M - 2P = 530 - (2 \times 120) \\ = 530 - 240 =$$

$$\underline{\underline{\text{Case 2: } V_1 = 0 \quad V_2 = 4.4}}$$

$$P = 0, \quad M = 440$$

$$\text{H}(\text{O}_3)^- \Rightarrow M = 440$$

water sample ON^- $(\text{O}_3)^{2-}$ $\text{H}(\text{O}_3)^-$
atb

water sample	OH^- alkalinity in ppm	CO_3^{2-} alkalinity in ppm	HCO_3^- alkalinity in ppm
① A ($v_1 < \frac{1}{2} v_2$)	-	240	190
② B ($v_1 = 0$)	0-	-	440

✓
✓

✓

$$\text{E.C.} = \sqrt{2.1 - V}$$

$$\sqrt{\frac{V}{2}} \times \sqrt{2.1 - V}$$

$$M \times 10^3 > 9 \quad \text{and} \quad M \times 10^3 = 9$$

$$\begin{aligned} \text{O.H.O} &= \text{V.C.} - \text{E.C.} \\ (\text{O.H.O}) - 0.83 &< \text{E.C.} - M < (\text{O.H.O}) \\ &= \text{O.H.O} - 0.83 \end{aligned}$$

$$\text{O.H.O} - V \quad \text{O.H.O} \quad (2.1 - V)$$

$$\text{O.H.O} - M \quad 0 > 9$$

$$\text{O.H.O} + M \quad 0 < 9.13 \text{ H}$$

$$111 \quad 9.0 \quad 10 \quad \text{and} \quad 111 \quad 9.13 \text{ H}$$

Experiment-8

Ques :-

To determine the alkalinity of the given water sample.

Apparatus :-

Conical flask, burette, burette stand, beaker, measuring cylinder, dropper / pipette.

Chemicals :-

Water sample A, water sample B, 0.02 N HCl, methyl orange indicator, phenophthalein indicator.

Procedure :-

1. Pipette out 10 ml of water sample A into the conical flask.
2. Add 1 drop of phenophthalein indicator and solution in the flask and fill the burette with 0.02 N HCl solution.
3. Titrate this against 0.02 N HCl solution until it becomes colorless [from pink].
4. After it becomes colorless, note down the readings [V_1], add methyl orange indicator in the flask and titrate again against 0.02 N HCl solution until it turns pinkish orange [from yellow].
5. Note down this reading [V_2], perform this three times [+ pilot range reading] with same water sample to get constant burette

Standard Reference Table :-

Sr No.	Relationship between V_1 & V_2	Relationship between P & M	Alkalinity (ppm)		
			OH^-	CO_3^{2-}	HCO_3^-
1.	$V_1 = 0$	$P = 0$	-	-	M
2.	$V_1 = V_2$	$P = M$	P	-	-
3.	$V_1 = \frac{1}{2}V_2$	$P = \frac{1}{2}M$	-	2P	-
4.	$V_1 < \frac{1}{2}V_2$	$P < \frac{1}{2}M$	-	2P	$(M - 2P)$
5.	$V_1 > \frac{1}{2}V_2$	$P > \frac{1}{2}M$	$(2P - M)$	$2(M - P)$	-

Observation Table :-

Readings	V_1				V_2				CBR (V_2)
	I	II	III	CBR (V_1)	I	II	III		
W.S.A	1.2	1.3	1.2	1.2	5.3	5.5	5.3	5.3	5.3
W.S.B	0	0	0	0	4.2	4.4	4.4	4.4	4.4

reading.

6. Perform the same for water sample 'B'.
7. Calculate P, M & quantities of ions in respective water samples.

Calculations :-

$$P = \frac{V_1 \times Z \times 50 \times 1000}{V}$$

$$M = \frac{V_2 \times Z \times 50 \times 1000}{V}$$

For water sample 'A'

$$V_1 = 1.2 \text{ ml} \quad V_2 = 5.3 \text{ ml}$$

$$V_1 < \frac{1}{2} V_2$$

$$P = V_1 \times 100 = 120 \text{ mg ppm} \quad P < \frac{1}{2} M$$

$$M = V_2 \times 100 = 530 \text{ mg ppm}$$

$$CO_3^{2-} \text{ alkalinity} = 2P = 2 \times 120 = 240 \text{ ppm}$$

$$HCO_3^- \text{ alkalinity} = M - 2P = 530 - 2(120) = 190 \text{ ppm}$$

For water sample 'B'

$$V_1 = 0 \text{ ml} \quad V_2 = 4.4 \text{ ml}$$

$$P = V_1 \times 100 = 0 \text{ ppm}$$

$$M = V_2 \times 100 = 440 \text{ ppm}$$

$$HCO_3^- \text{ alkalinity} = M = 360 \text{ ppm}$$

Results :-

Water Sample	OH^- alkalinity in ppm	CO_3^{2-} alkalinity in ppm	HCO_3^- alkalinity in ppm
A	-	240	190
B	-	-	440