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CONDUCTOMETRIC TITRATIONS

DETERMINATION OF STRENGTH OF HCl

★ **AIM:**

To determine the strength of a given solution of HCl by conductometric titration with a given NaOH sol.

★ **APPARATUS REQUIRED:**

Conductivity meter, conductivity cell, glass rod, beakers, burette, pipette, standard flask.

★ **REAGENTS REQUIRED:**

HCl, NaOH, Conductivity water

★ **PRINCIPLE:**

The principle based on the measurement of the change of conductance with the help of the conductivity meter. The conductance of the solution depends on the number of ions and their iconic mobility.

★ **PROCEDURE:**

→ Make up the given HCl solution to 100 ml in a standard flask.

→ Pipette out 10 ml of the made up HCl into a beaker.

→ Dilute the solution with distilled water, so that the conductivity cell can be immersed well in the solution.

→ Stir the solution well with the help of a glass rod.

→ Note down the conductance of the solution from meter.

→ Fill the burette with standard NaOH solution and run

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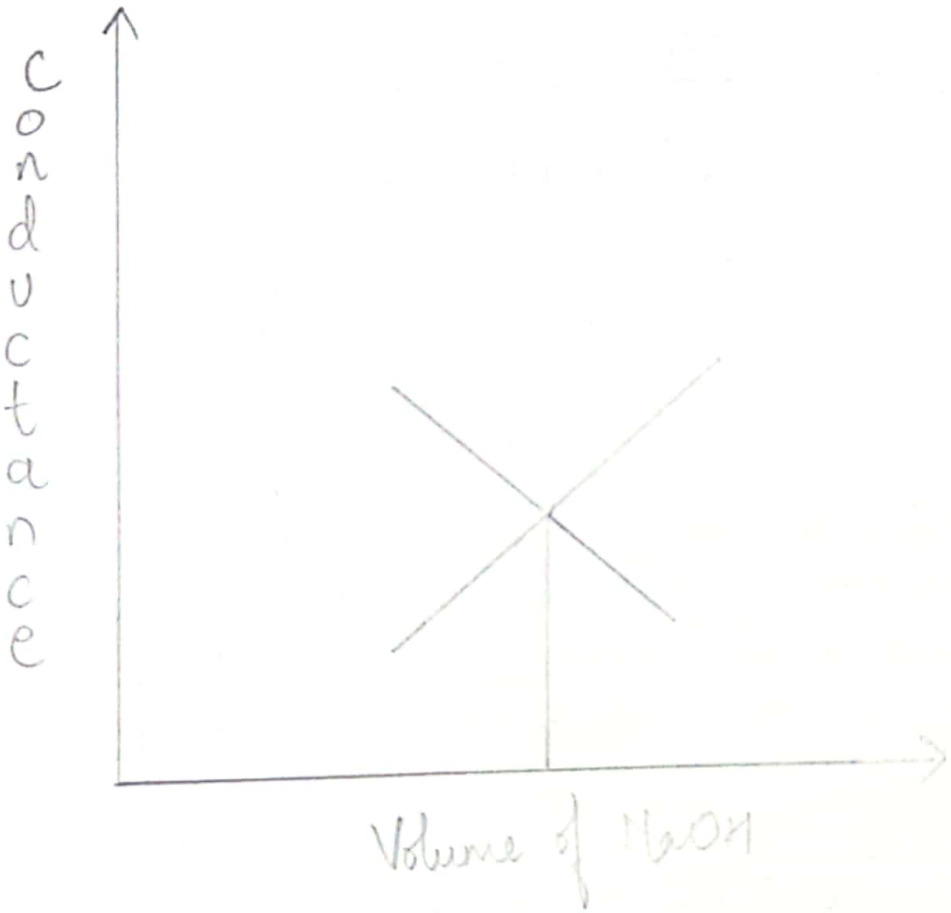

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down into the beaker in small increments [1ml or 2ml] with gentle stirring of the contents of the beaker.

→ After each addition, stir the contents of the beaker and after an equilibrium time of 2-3 minutes, note the corresponding conductance value and tabulate it.

→ Continue the titration till atleast 10 increments, after the conductance reaches a minimum and starts increasing.

→ After the completion of titration, wash the conductance cell with distilled water and immersed in water.

→ Plot a graph between conductivity against volume of NaOH added. The intersection of two lines to the volume axis gives the end point.

→ Volume of NaOH required for neutralisation is taken from graph (Fdis) titration intersection point which is corresponding to the volume axis (x).

→ In order to get accurate results, perform a fair titration, by adding NaOH in small increments near and beyond the end point.

→ Calculate the strength of given strong acid from the given NaOH can be calculated.

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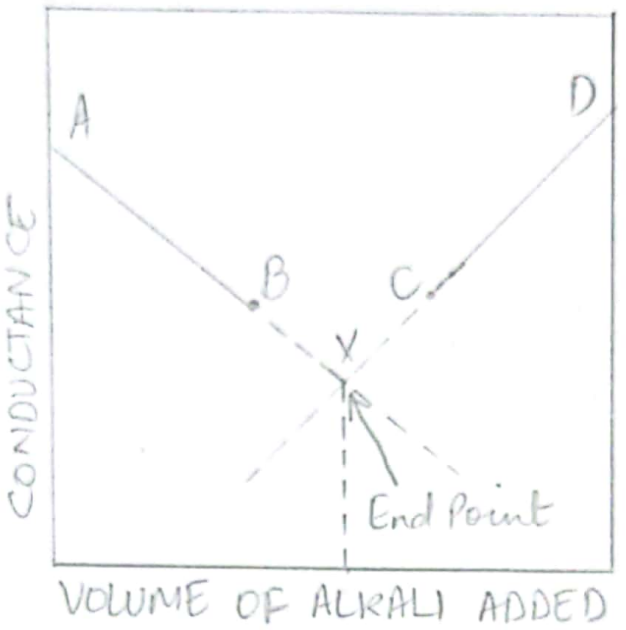
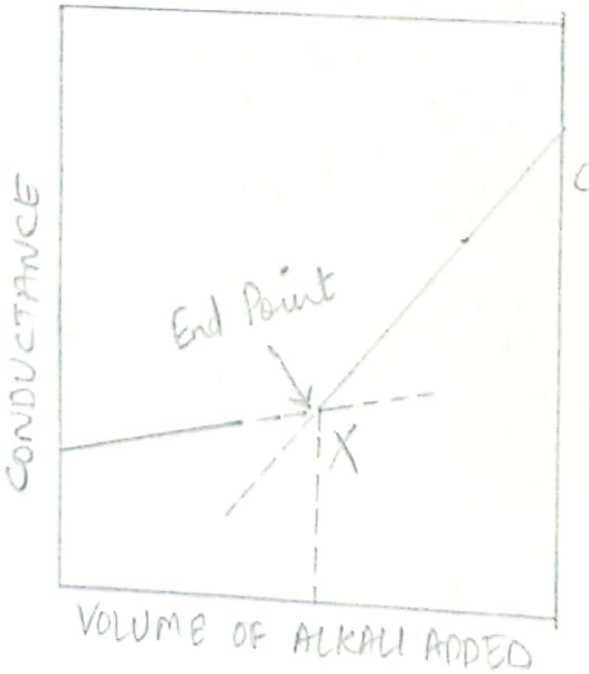
(1) STRONG ACID AGAINST A STRONG BASE:



Ex: HCl vs NaOH

$HCl + NaOH \rightarrow Na^+ + Cl^- + H_2O$

(2) WEAK ACID AGAINST A STRONG BASE:



Ex: CH_3COOH vs NaOH

$CH_3COOH + NaOH \rightarrow CH_3COO^- + Na^+ +$

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★ OBSERVATIONS:

(1) TABLE 1:

S.No.	Volume of NaOH (ml) added	Conductance in ohm^{-1}
1	0	4.5
2	1	4.2
3	2	3.9
4	3	3.7
5	4	3.3
6	5	3.0
7	6	2.7
8	7	2.3
9	8	2.1
10	9	1.836
11	9.4	1.543
12	10	1.289
13	11 → End Point	1.333
14	12	1.438
15	12.6	1.619
16	13	1.796
17	14	1.943
	15	
	16	

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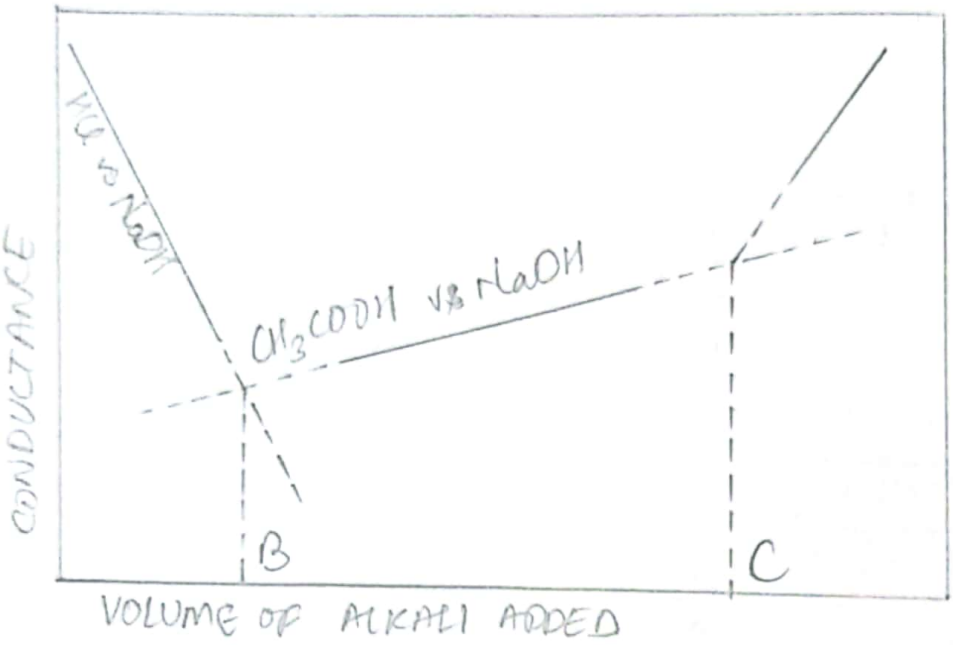
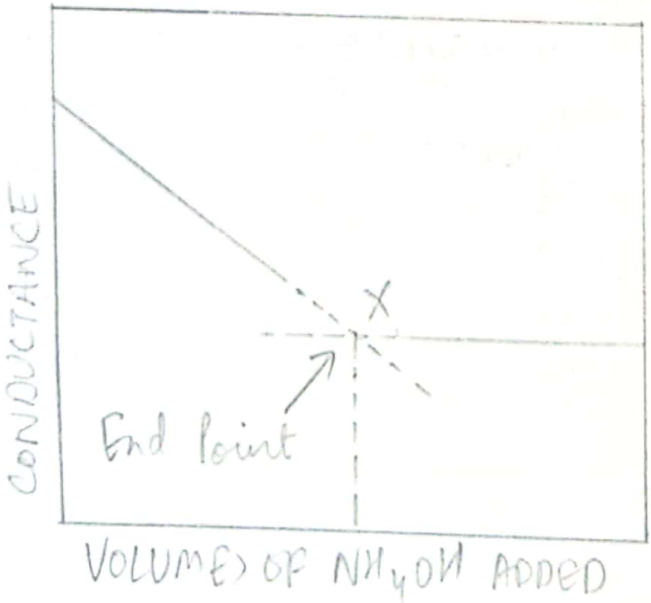
(3) MIXTURE OF STRONG ACID & WEAK ACID AGAINST A STRONG BASE:



Ex: Mixture of HCl & CH_3COOH vs NaOH

(4) STRONG ACID AGAINST A WEAK BASE:



Ex: $HCl + NH_4OH \rightarrow NH_4^+ + Cl^- + H_2O$

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(2) TABLE 2:

S.No.	Volume of NaOH (ml) added	Conductance in ohm^{-1}
1	0	4.9
2	9.4	1.846
3	9.6	1.790
4	9.8	1.716
5	10	1.677
6	10.2	1.625
7	10.4	1.547
8	10.6	1.508
9	10.8	1.454
10	11	1.385
11	11.2	1.363
12	11.4	1.375
13	11.6	1.390
14	11.8	1.407
15	12	1.421
16	12.2	1.446
17	12.4	1.467

★ CALCULATIONS:

Strength of hydrochloric acid = ?

Volume of HCl (V_1) = 10 ml

Normality of HCl (N_1) = ?

Volume of NaOH (V_2) = 11.2 ml

Normality of NaOH (N_2) = 0.1 N

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$\therefore N_1 = \frac{V_2 N_2}{V_1} = \frac{11.2 \times 0.1}{10} = 0.112\ N$

So, Strength of hydrochloric acid = 0.112 N

★ **RESULT:**

The Strength of the given HCl solution is 0.112 N.

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