

Expt. - Conductometric Titrations - determination of strength of HCl (Strong acid vs strong base)

Aim

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

Apparatus Required.

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

Reagents required.

HCl, NaOH, conductivity Water.

Principle.

This principle is 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 mobility.

During acid - base titration the base is added to the strong acid,  $\text{H}^+$  ions are replaced by slow moving  $\text{Na}^+$  ions. So the conductance of the solution decreases. After the neutralization

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Table 1 : Pilot Titration: Std NaOH vs Unknown HCl

Sr. No.	Volume of NaOH	Conductance in Ohm <sup>-1</sup>
1.	0	3.8
2.	1	3.5
3.	2	3.3
4.	3	3.0
5.	4	2.6
6.	5	2.3
7.	6	2.0
8.	7	1.750
9.	8	1.448
10.	9	1.232
11.	10	1.381
12.	11	1.451
13.	12	1.542
14.	13	1.641
15.	14	1.744
16.	15	1.759

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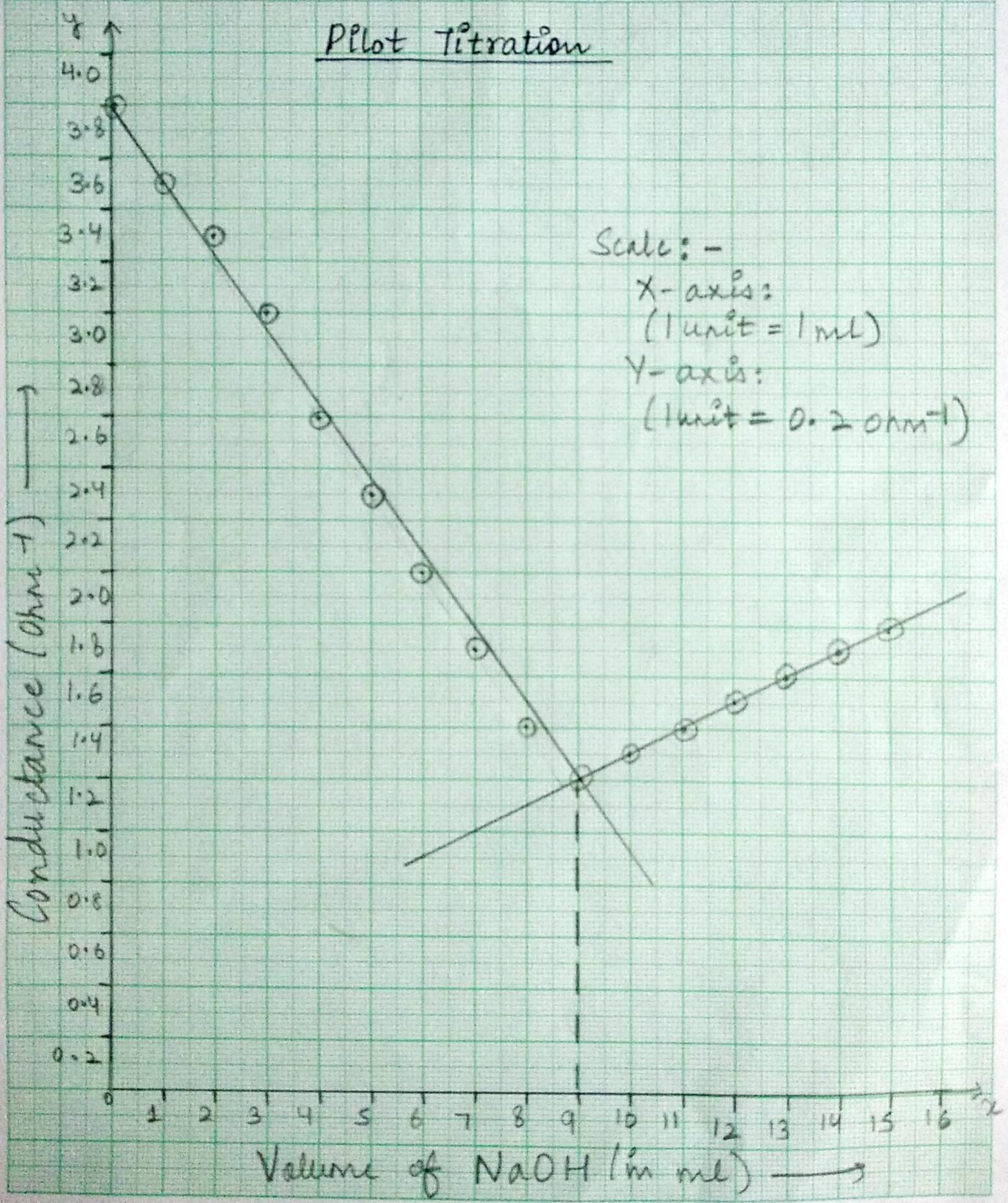
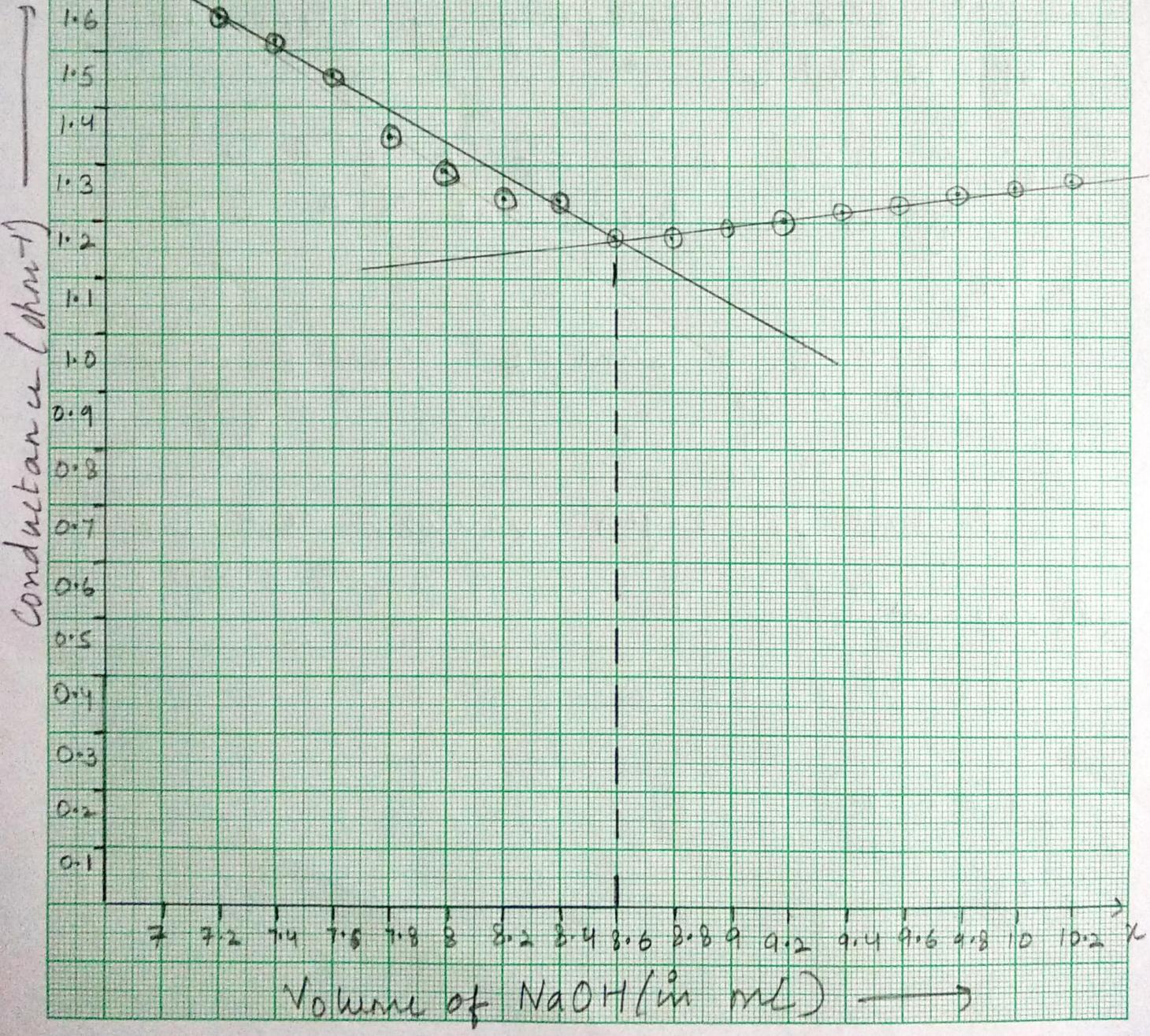


Table 2: Fair titration : std. NaOH vs Unknown HCl

Sr. No.	Volume of NaOH	conductance in ohm <sup>-1</sup>
1.	7	1.636
2.	7.2	1.564
3.	7.4	1.523
4.	7.6	1.467
5.	7.8	1.355
6.	8	1.298
7.	8.2	1.242
8.	8.4	1.242
9.	8.6	1.176
10.	8.8	1.179
11.	9	1.193
12.	9.2	1.207
13.	9.4	1.222
14.	9.6	1.236
15.	9.8	1.251
16.	10	1.265
17.	10.2	1.279
18.	10.4	1.296
19.	10.6	1.312
20.	10.8	1.330

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## FAIR TITRATION



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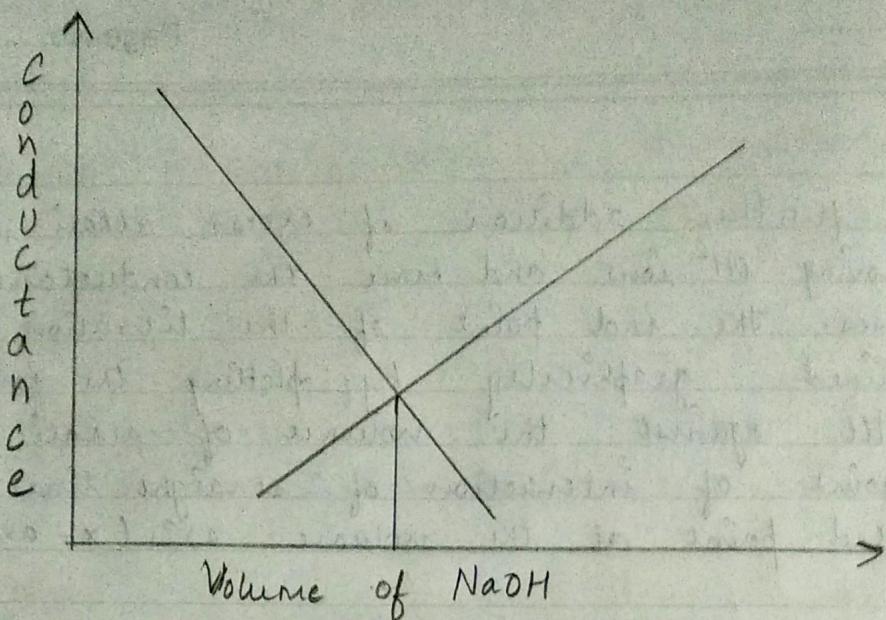
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point, further addition of excess alkali introduces fast moving  $\text{OH}^-$  ions and hence the conductance increases. The end point of the titration is determined graphically by plotting the conductance of HCl against the volume of alkali added. The point of intersection of straight lines gives the end point at the volume axis (x-axis).

#### Procedure:

Make up the given HCl solution to 100 ml in a standard flask. Pipette out 10 ml of made up HCl in to a beaker. Dilute the solution with distilled water, so that the conductivity cell can be immersed well in the solution (100 ml). Stir the solution well with the help of a glass rod. Note down the conductance of the solution from the meter.

Fill the burette with standard NaOH solution and run down into the beaker in small increment [1 (or) 2 ml] with gentle stirring of the content of the beaker.



Calculation:

Strength of Hydrochloric acid :

$$\text{Volume of HCl} (V_1) = 10 \text{ ml}$$

$$\text{Normality of HCl} (N_1) = ?$$

$$\text{Volume of NaOH} (V_2) = 8.42 \text{ ml}$$

$$\text{Normality of NaOH} (N_2) = 0.1 \text{ N}$$

$$\text{Normality of HCl} (N_1) = N_1 V_1 = N_2 V_2$$

$$10 \times N_1 = 0.1 \times 8.42$$

$$N_1 = \frac{0.1 \times 8.42}{10}$$

$$N_1 = 0.0842 \text{ N}$$

Result:

The strength of given HCl solution is  
0.0842 N

After each addition, stir the contents of the beaker & 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 the minimum and starts increasing. After the completion of Titration, wash the conductance cell with distilled water & 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 neutralization is taken from graph (Fair) titration intersection point which is corresponding to the volume axis (x). In order to get accurate result Perform a Fair titration, by adding NaOH in small increments near and beyond the end.