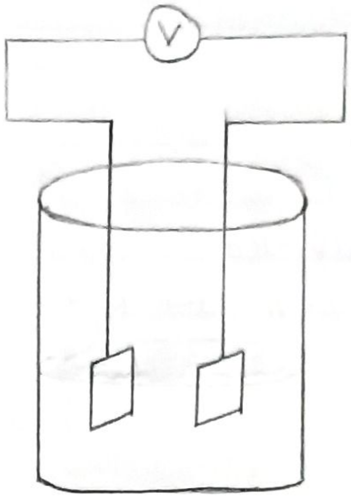
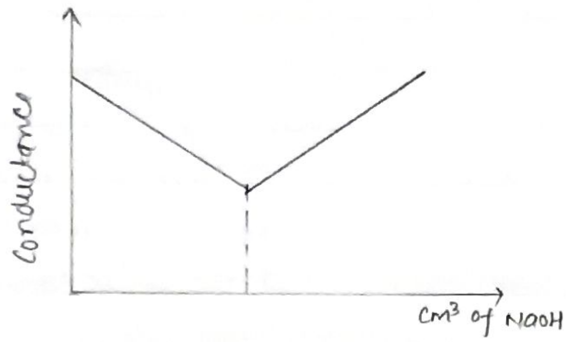
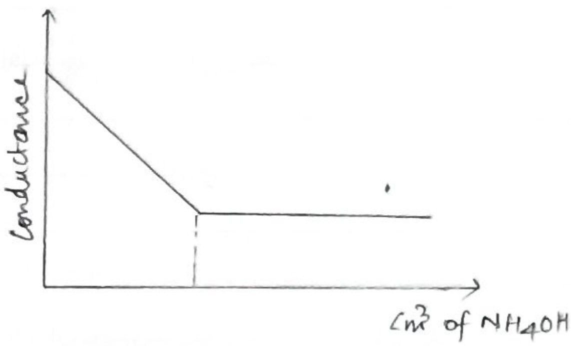
Conductivity Measurement setup



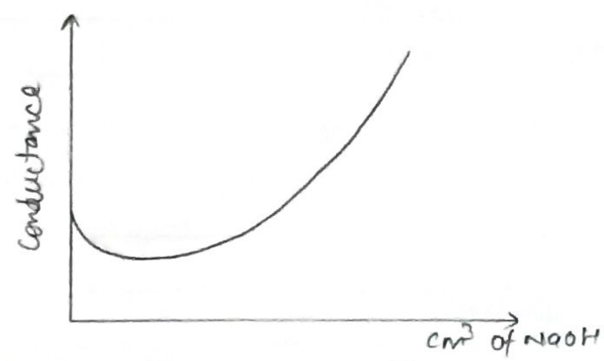
Types of Conductometric Titrations:



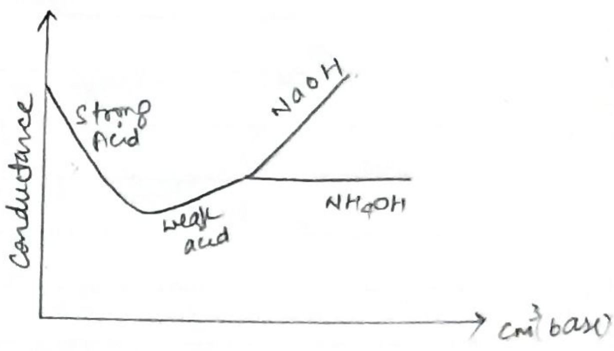
Strong acid (HCl) vs Strong Base (NaOH)



Strong Acid (HCl) vs weak base (NH_4OH)



weak acid (CH_3COOH) vs Strong Base (NaOH)



mixture of HCl & CH_3COOH vs base

Aim: Determine the concentration of HCl using Conductometry.

Apparatus Required: Direct reading conductivity meter, conductivity cell, 100 ml beaker, burette, tissue paper.

Chemicals Required: NaOH solution, HCl solution.

Principle: Compounds that wholly or partially dissociate into ions in water/solvents are called electrolytes. The conductance of a electrolyte follows Ohm's law, $i = V/R$. The conductance depends upon the concentration of the ions, temperature of solution and nature of ion. The resistance/conductance of an electrolyte is measured by immersing the electrodes in electrolyte and applying an electric field between the plates. The conductance of one cm^3 of a material, which is an inherent property of material, is called specific conductance (K). unit of K is mhos/cm or Siemens/cm. The conductance of a solution containing one mole/equivalent solute in 1 liter is called molar/equivalent conductivity ($\Lambda_{mol}/\Lambda_{eq}$). unit of Λ_{mol} is $S\,cm^2\,mol^{-1}$ and Λ_{eq} is $S\,cm^2\,eq^{-1}$.

$$\Lambda_{mol} = \frac{1000K}{C} \qquad \Lambda_{eq} = \frac{1000K}{C_{eq}}$$

The determination of end pt. of a titration using conductivity measurements is known as conductometric titration. It is advantageous as there is no need of indicator, temperature is maintained constant and errors are minimised as end point is determined graphically. Conductometry is also used to determine ionic product of water, solubility of sparingly soluble salts, chemical eq^m. in ionic reactions, etc.
In the experiment, $NaOH(aq) + HCl(aq) \longrightarrow NaCl(aq) + H_2O$.

Observations and Calculations:

concentration of NaOH = 0.1M

Vol. of NaOH	Conductance	Vol. of NaOH	Conductance
0	2.06	2.8	0.98
0.2	1.92	3.0	1.05
0.4	1.86	3.2	1.14
0.6	1.78	3.4	1.21
0.8	1.63	3.6	1.30
1.0	1.49	3.8	1.4
1.2	1.34	4.0	1.5
1.4	1.24	4.2	1.58
1.6	1.09	4.4	1.64
1.8	0.95	4.6	1.72
2.0	0.86	4.8	1.83
2.2	0.72	5.0	1.89
2.4	0.82	5.2	1.99
2.6	0.88	5.4	2.07

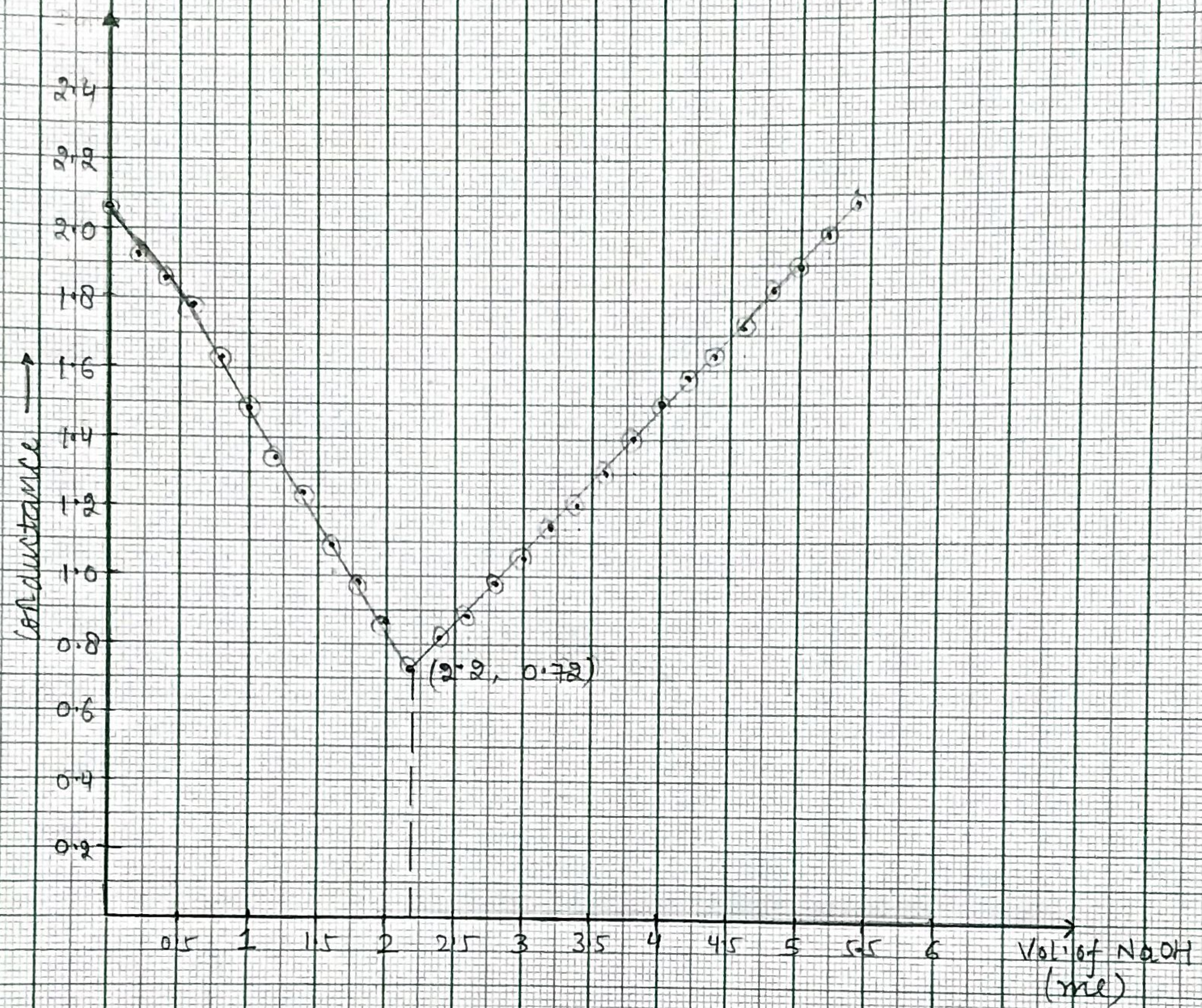
from the graph; end point of titration is when 2.2 mL NaOH is consumed. At, the end pt;

$$M_{NaOH} \times V_{NaOH} = M_{HCl} \times V_{HCl}$$

$$0.1 \times 2.2 = M_{HCl} \times 25$$

$$M_{HCl} = 0.0088\,M$$

Scale: X axis: 1 cm = 0.5 ml NaOH
Y axis: 1 cm = 0.2 unit of conductance



Date

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Procedure:

1) Take NaOH (0.1N) solution in a 50 ml burette and adjust zero reading.
2) Pipette out 25ml of the given HCl solution in a 100/150 ml beaker. Add 25ml of water to this.
3) Now add the NaOH solution from the burette in 0.2ml increments and record the conductance after mixing the solution.
4) Continue the titration until you reach the initial conductance.
5) Repeat the experiment twice.
6) Plot the graph of volume of NaOH vs conductance and determine the equivalence point of titration.
7) Calculate the normality of HCl solution.

Result:

Conductometric titration was performed to determine the concentration of a given acid sample.

Molarity/Normality of given HCl = 0.0088 M.

Precautions:

1) There should be no air bubbles in the burette.
2) Mixture should be stirred before taking reading.
3) Volume of NaOH poured must be correctly measured.

Teacher's Signature