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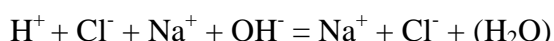
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CONDUCTOMETRIC TITRATION

(DETERMINATION OF THE STRENGTH OF A SOLUTION OF HYDROCHLORIC ACID BY A STANDARD SOLUTION OF SODIUM- HYDROXIDE.)

THEORY:

Neutralization between a strong acid (HCl) and a strong base (NaOH) is represented by



It is evident from the above equation that as NaOH solution is gradually added, the H^+ ion having high ionic conductance are replaced by Na^+ having lower ionic conductance and hence the conductivity of the solution gradually decrease. At the equivalent point the conductivity would be minimum due to replacement of all H^+ ion by Na^+ ion. After the equivalence point Na^+ and OH^- would accumulate in the solution and conductance of the solution will again increase. If the conductance corresponds to the volume of NaOH solution added be plotted, two straight lines having opposite slopes would be obtained. The point of intersection of the two straight lines would give the equivalence point.

The strength of NaOH solution should be at least 5 times greater than that of the HCl solution, so that the effect of volume change on the conductance be negligible.

PROCEDURE:

A. Preparation of 100ml (N\10) standard oxalic acid solution.

Equivalent weight of oxalic acid =63

Now, 1000ml of 1(N) oxalic acid solution will contain 0.63gm oxalic acid.

About 0.63gm of oxalic acid is weighed from a weighing bottle by difference and is poured into 100ml volumetric flask, dissolved in small volume of water by shaking and the volume is made up to the mark with distilled water and thoroughly shaken.

B.STANDARDISATION OF SUPPLIED NaOH SOLUTION WITH STANDARD OXALIC ACID SOLUTION:

10ml of standard oxalic acid solution is pipetted out into a 250ml conical flask and about 1-2 drops of phenolphthalein indicator was added. The NaOH solution is titrated against this solution with the end point being colorless to pink. Titration is done twice. Data is recorded in the Table 3.

C) CONDUCTOMETRIC TITRATION:

10ml of supplied HCl solution (strength in the order of N\10) is pipette out into a 250ml beaker and about 100ml of distilled water is added. The burette was filled with NaOH solutions and number of drops of NaOH solutions corresponding to a measured volume was calculated .From this calculation 1 drops corresponding to how much volume is estimated.

The conductivity cell is inserted into the acid solution in the beaker in such a way that the two electrodes completely dipped into the solution. The cell are connected to the digital conductometer to measure the conductance of the solution. The initial conductance of HCl solution is noted and then NaOH solution is added drop wise from the burette, 10 drops at a time in the beginning, 4 drops at a time near the end point. Near the end point there is a sharp rise in conductance. Beyond the end point 6 to 7 more reading by adding 10 drops of NaOH solution at a time is taken. After each addition of NaOH solution the beaker was shaken gently, waited for a minute and conductance was noted. The conductance against corresponding no. of drops of NaOH solution added are given in Table 4.

RESULT:

1. Recording of temperature:

Initial temperature($^{\circ}\text{C}$)	Final temperature($^{\circ}\text{C}$)	Mean temperature($^{\circ}\text{C}$)

2. Strength of Oxalic Acid:

Weight taken (gm)	Weight to be taken (gm)	Strength (N)
	0.63	

3. Standardization of supplied NaOH solution with standard Oxalic Acid:

SI No:	Oxalic Acid solution taken(ml)	Burette reading for NaOH (ml)			Mean value of NaOH used(ml)
		Initial burette reading (ml)	Final burette reading (ml)	Volume of NaOH used (ml)	
1.					
2.					

4. CONDUCTOMETRIC TITRATION:

No. of observation	Observed Conductance (ms/cm)	No. of drops of NaOH solution added
1.		0
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		
17.		
18.		
19.		
20.		

(Add extra sheet if required)

CALCULATION

Strength on NaOH solution:

$$V_1S_1 = V_2S_2$$

or, $S_2 =$

$$= \text{-----} (N)$$

Here, V_1 =volume of oxalic acid =10ml

S_1 =strength of oxalic acid

V_2 =volume of NaOH

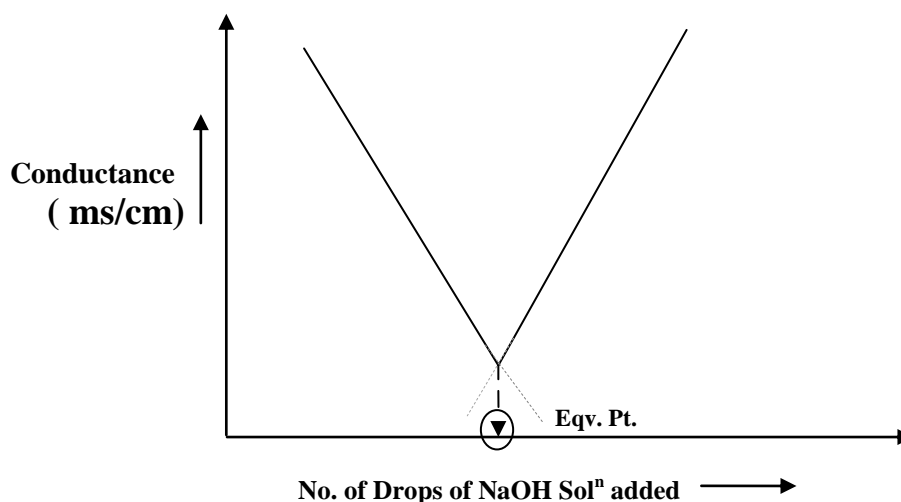
S_2 =strength of NaOH

1ml of burette =..... drops.

1drop of burette =ml.

Graph:

Conductance against corresponding no. of drops of NaOH solution added are plotted in graph. It shows the conductometric titrations curve of HCl solution by NaOH solution.



Calculation from Graph:

Let the point of intersection of the straight line obtained by plotting conductance against no. of drops of NaOH be A drops.

Thus, No of drops of NaOH required =(A) drops

=...V₁...ml

We know, $V_1 S_1 = V_2 S_2$

or, $S_2 = V_1 S_1 / 10 = \dots\dots\dots(N)$

Here, $V_2 = \text{vol of HCl solution} = 10 \text{ ml}$

$S_2 = \text{strength of HCl}$

$V_1 = \text{vol of NaOH solution required (from graph)}$

$S_1 = \text{strength of NaOH solution}$

DISCUSSION:

The conductance of the solution is measured through conductivity cell. Thus prior to the experiment the cell constant should be checked and the same cell should be used throughout the experiment. The conductivity of solution depends both on the concentration of the electrolyte as well as the temperature. The apparatus should thus be cleaned well by distilled water so that no contaminant present in the solution and the conductivity is solely due to HCl and NaOH only and the experiment must be carried out at the same temperature. Addition of NaOH solution, especially near the end point should be taken care of; neither there might be some error in finding out the exact equivalence point.

Conclusion:

From the conductometric titration the strength of the supplied HCl solution is found to be (N) at⁰C.