Topic ⇒ Conductometric Titrations

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Conductometric Titrations

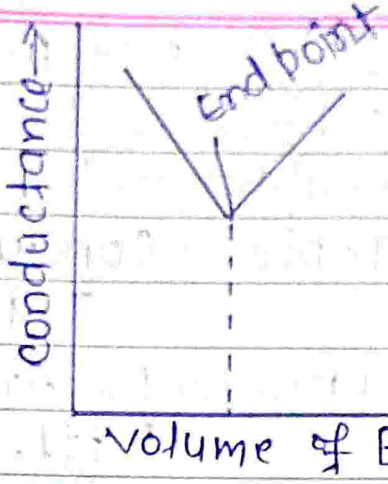
Titrations in which conductance measurements are made use of in determining the end-point of acid-alkali reactions, some displacement reactions or precipitation reactions are called conductometric Titrations.

e.g.

① Conductometric titration of a strong acid with a strong base ⇒ Consider the reaction in which HCl is to be titrated against NaOH solution. The conductance of the acid soln. is noted initially as well as after successive additions of small amount of NaOH solution. Evidently the conductance of the acid soln. in the beginning is very high but on adding NaOH soln., the conductance of the soln. keeps on falling till the end point is reached. As a result, the conductance of the solution decreases and continues to fall.

$$H^+ + Cl^- + Na^+ + OH^- \longrightarrow Na^+ + Cl^- + H_2O$$

The point of minimum conductance, therefore, coincides with the end-point of the titration.

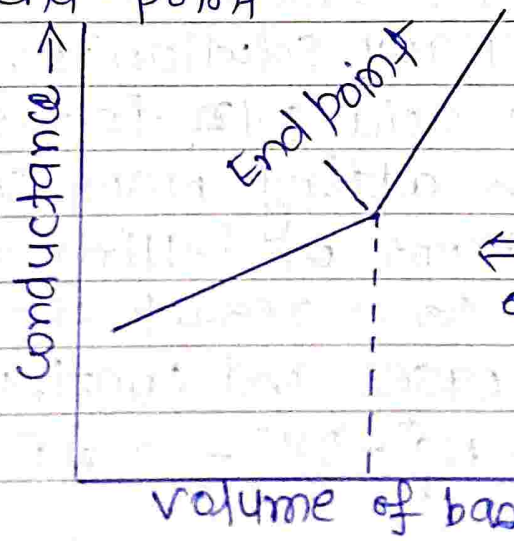


← fig:- conductometric titration curve for strong acid and strong base.

(2) Titration of a weak acid against a strong base ⇒ When a weak acid like CH_3COOH is titrated against a strong base like NaOH. The initial conductance of the soln is low because of the poor dissociation of the weak acid. on adding NaOH highly ionised sodium acetate is formed. After a while the conductance begins to increase because the conducting power of highly ionised salt exceeds that of the weak acid.

$$CH_3COOH + Na^+ + OH^- \longrightarrow CH_3COO^- + Na^+ + H_2O$$

Thus the conductance value shows a sharp increase. The point of intersection of the two curve gives the end-point.



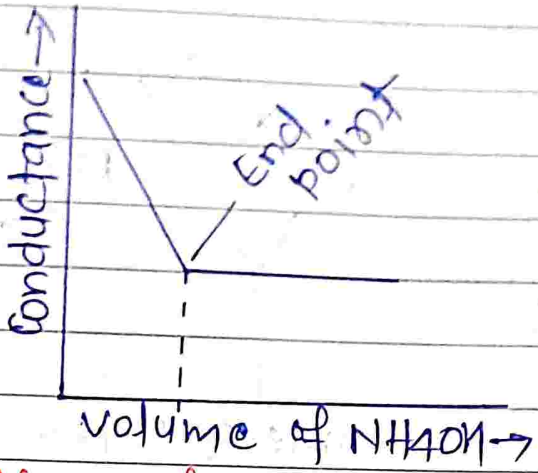
← Fig:- Curve for titration of a weak acid against a strong base.

(3) Titration of a strong acid against a weak base ⇒ Let us consider the titration of HCl against NH_4OH solution. In this case, the conductance of the solution will first decrease due to the fixing up of the fast moving H^+ ions and their

replacement by slow moving NH_4^+ ions.

$$H^+ + Cl^- + NH_4OH \longrightarrow NH_4^+ + Cl^- + H_2O$$

When the end point is reached, further addition of NH_4OH does not cause much change in the conductance.



⇐ Fig:- Curve for titration of a strong acid against a weak base.

④ Titration of a weak acid against a weak base ⇒ Let us consider the titration of CH_3COOH with NH_4OH:

The initial conductance of the solution in this case is low due to the poor dissociation of the weak acid. But it starts increasing as the salt CH_3COONH_4 is formed. After the end-point, the conductivity remains almost constant because the free base NH_4OH is a weak electrolyte. The end-point is quite sharp.

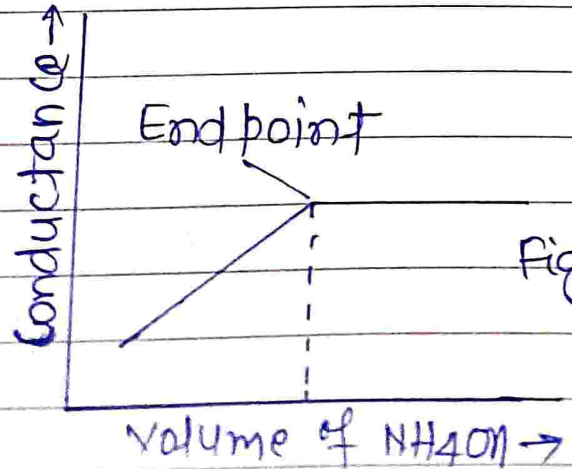


Fig :- Curve for titration of Acetic acid against ammonium hydroxide.

⑤ Precipitation reactions ⇒ The end point in precipitation reactions can be accurately determined by conductometric titration.

$Ag^+ + NO_3^- + K^+ + Cl^- \longrightarrow K^+ + NO_3^- + AgCl$ (ppt.)

After the end-point, there is a sharp increase in conductance due to an increase in the number of free ions in solution.

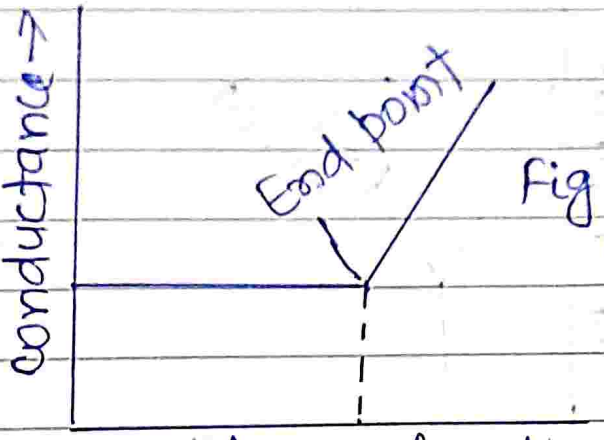


Fig:- Titration of KCl against $AgNO_3$.

Advantage of Conductometric Titrations

① Coloured solution where no indicator is found to work satisfactorily can be successfully titrated by this method.

② This method is useful for the titration of weak acids against weak bases which donot give a sharp change of colour with indicators in ordinary volumetric analysis.

③ More accurate results are obtained because the end-point is determined graphically.

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