CONCEPT BOOSTER

Hello everyone !! Hope you all had a lovely Durga puja, Dusshera, Kali puja, Deepawali and other festivals. I also believe that you continued your practice on your subjects. Coming back to CHEMISTRY, now it is the hard and perfect time that you become topic based and get into the depth as well as the surrounding areas of that. This is the only way you can master the subject. Keeping this in view. I have presented 'TITRATIONS' in this article. Hope you will enjoy reading it.

*Arunava Sarkar

In general, with the name 'Titrations' we do understand conductometric titrations, the basic principle of which is to replace one ion by the another where both have different ionic conductivities and as a result conductivity of the solution varies during the course of titration.

There are following types of titrations :

1. Acid-Base titration
2. Replacement titration
3. Redox titration
4. Precipitation titration

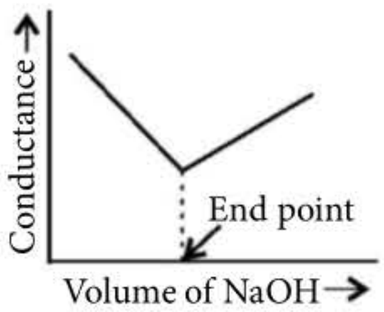
Acid-Base Titration

(a) Strong acid *vs* strong base

E.g., : HCl *vs* NaOH

Initially, conductance of HCl solution is high. High dissociation constant of HCl (K_a) and ionic mobility of H^+ (small size) are responsible for this.

Now, you add NaOH. OH^- combines with H^+ to give undissociated water (H_2O) molecules. H^+ is being replaced by Na^+. Conductance of the solution decreases and it continues upto equivalence point. Na^+ moves very slowly. At this point the solution contains only NaCl. If you add NaOH further then the solution contains more and more fast moving OH^- and conductance increases till NaOH is added.

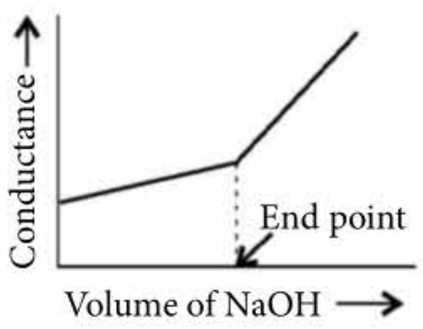


(b) Weak acid *vs* strong base

E.g., CH_3COOH *vs* NaOH

CH_3COOH has low K_a. So, initially conductance is poor. Addition of NaOH gives CH_3COONa, so fast moving H^+ being replaced by Na^+ which is slow moving. So conductance decreases. Another reason for decrease in the conductance is that due to common ion effect, dissociation of CH_3COOH further decreases. It is the initial scenario. Now if you add NaOH continuously, conductance will increase because NaOH will convert undissociated and weak electrolyte CH_3COOH into strong electrolyte CH_3COONa.

The increase in the conductance is maintained upto equivalence point and if beyond this point you continue adding NaOH then due to highly conducting OH^- ions, conductance continuously increases.



Graph near the equivalence point can be obtained by extrapolation method.

(c) Strong acid *vs* weak base

E.g., HCl *vs* NH_4OH

Monthly Test Drive CLASS XI ANSWER KEY

1. (d)	**2.** (d)	**3.** (a)	**4.** (c)	**5.** (c)
6. (b)	**7.** (b)	**8.** (c)	**9.** (d)	**10.** (b)
11. (d)	**12.** (c)	**13.** (a)	**14.** (a)	**15.** (a)
16. (a)	**17.** (c)	**18.** (c)	**19.** (c)	**20.** (b,d)
21. (a,c,d)	**22.** (a,c,d)	**23.** (b,d)	**24.** (1)	**25.** (2)
26. (4)	**27.** (a)	**28.** (b)	**29.** (a)	**30.** (b)

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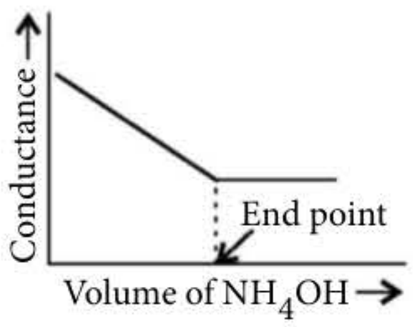
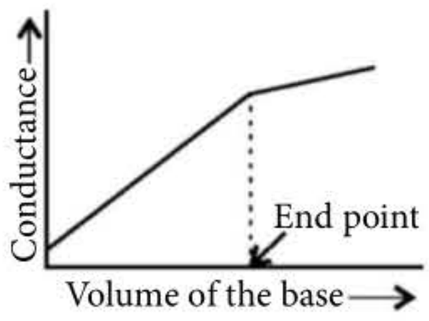
Initially conductance was high due to high dissociation constant of HCl and fast moving H^+ ions. On addition of NH_4OH, NH_4Cl starts producing *i.e.*, fast moving H^+ being replaced by NH_4^+ (slow moving). This decrease in conductance continues upto equivalence point. Beyond this point even after the addition of NH_4OH conductance nearly remains the same as NH_4OH is weak base and it dissociates to very small extent. Moreover, due to common ion effect, dissociation even more decreases.



(d) Weak acid *vs* weak base :

E.g., CH_3COOH *vs* NH_4OH

Initial nature of curve remains same as that of weak acid *vs* strong base. Because, CH_3COOH is almost an undissociated molecule but after the addition of NH_4OH, it gives CH_3COONH_4 and it is strongly ionizable though complete replacement is never happening here as both CH_3COOH and NH_4OH are weakly ionizable. After the equivalence point, conductance remain nearly same as due to the weak nature and common ion effect, NH_4OH remains almost undissociated.



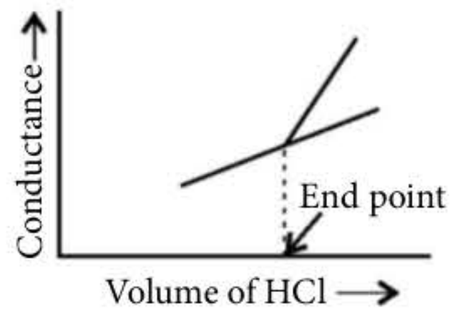
Displacement or Replacement Titration

Let the titration happen between salt of weak acid and strong acid. The anion of weak acid is replaced by that of strong acid and the weak acid is liberated in undissociated form.

E.g., $CH_3COO\overset{-}{N}a^+ + HCl \longrightarrow CH_3COOH + \overset{+}{N}aCl^-$

- CH_3COO^-: acetate ion (anion of weak acid)
- Cl^-: chloride ion (anion of strong acid)

In the above example, initially conductance increases as Cl^- ions are slightly fast moving than CH_3COO^-. Till the equivalence point don't expect the ionization of CH_3COOH as enough CH_3COONa remains in the solution to suppress the ionization of CH_3COOH. After equivalence point CH_3COOH is ionized to a good extent and affect the conductivity and a rounded portion in curve is obtained. Beyond equivalence point, when excess of HCl is added, conductivity increases rapidly as HCl is strong electrolyte.



Unscramble the words given in column I and match them with their explanations in column II.

Column I	Column II
1. GSIRIDREV	(a) The non-sugar compound remaining after replacement of the glycosyl group from a glycoside by a hydrogen atom.
2. TTAGNREOE	(b) A precipitate that has aggregated in wooly masses.
3. ONYLCGA	(c) Greenish basic salts of copper. Basic copper acetate is a true example of this.
4. RAFEINRRNST	(d) Pharmaceutical solutions, frequently containing alcohols, used as a sweetening or flavouring agents for drugs.
5. ELTNCCOLFU	(e) A chemical which produces malfunction, generally in the form of mutations or tumours.
6. RSIXILE	(f) Polysaccharides generally containing galacturonic acid, xylose and arabinose residues which swells in water.
7. FERIIRALC	(g) A protein which is main mode of transport of iron.
8. ESGALICUM	(h) Large tanks with continuous feed and outflow in which the suspended matter is allowed to settle and is removed.

Readers can send their responses at editor@mtg.in or post us with complete address by 10th of every month.
Names of solution senders will be published in next issue.