pka value and Isoelectric bonds

Titration Curve of a Weak Acid with Strong Base

In the titration of weak acid versus strong base, protons get transferred from weak acid to strong base takes place. Let us take an example of titration of acetic acid (weak acid) with sodium hydroxide (strong base).

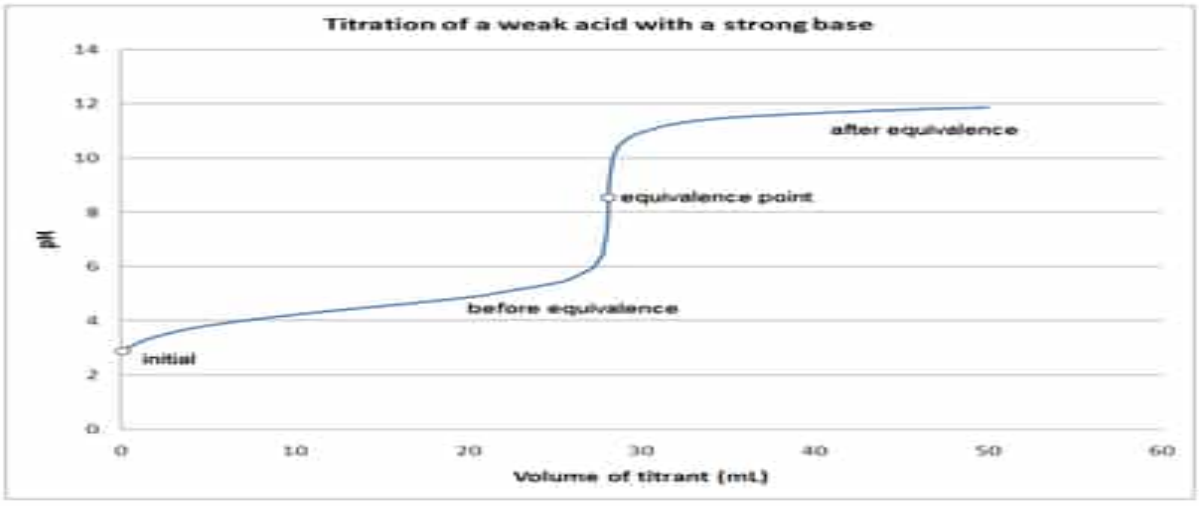
$C_2H_4O_2(aq)+OH^-(aq) \rightarrow C_2H_3O_2^-(aq)+H_2O(l)$

The titration curve generally reflects the strength of the base and acid in which a change in pH takes place.

For acetic acid and sodium hydroxide, it is observed that:

1. In the beginning, there will be a sharp increase in pH because of the common ion effect.
2. After this, a change in curve takes place very slowly and gradually because the solution will act as a buffer now.
3. At the middle of the curve, half neutralization will take place at which the concentration of both weak acid and its conjugate base becomes equal.
4. At the equivalence point, pH >7 because after the addition of NaOH, all acid gets converted to its conjugate base and at this point due to the common ion effect, the reaction will move backwards and produce hydroxide ion.
5. After the equivalence point, the curve becomes typical.

Graphical representation:



Buffer solution: A mixture of a weak acid along with its conjugate base or vice versa is known as a buffer solution. On the addition of a small amount of either acid or base, buffer solution resists a change in pH.

Working on a buffer solution:

A mixture of acetic acid and sodium hydroxide acts as a buffer solution. When a small amount of either of these takes place, the concentration of hydronium ion remains constant. In addition to a small amount of NaOH, [OH]- will react with few [H]+ ions. As a result, more of the acetic acid tends to react with water due to which [H]+ ions remain restored to their original value.

$$CH_3COOH + H_2O \longrightarrow H_3O^+ + CH_3CO_2^-$$

On the addition of HCl acid, H+ ions will react with acetate ions and this reaction can be represented as:

$$H_3O^+ + CH_3CO_2^- \longrightarrow CH_3COOH + H_2O$$

Again, there is a very minute change in [H]+ ions due to which pH remains the same.

A mixture of acetic acid and sodium hydroxide is an acidic buffer solution (weak acid and strong base). pH for such solutions can be calculated by using **Henderson- Hasselbalch equation.**

pH= pKa+ log [conjugate base or salt]/[acid]