POTENTIOMETRIC TITRATIONS

Principle

Emf of a cell depends on the concentration of the electrolytes with which the electrodes are in contact. Therefore, the electrode reaction is,

As the concentration of M^{n+} changes, the emf of the cell also changes correspondingly.

Potentiometric titrations involves the measurement of the potential of a suitable indicator electrode with respect to a reference electrode as a function of titrant volume. ... **Titration** involves measuring and recording the cell potential (in units of millivolts or pH) after each addition of titrant.

Types of Potentiometric Titrations

- Acid-base titrations
- Complexometric Titrations
- Oxidation-Reduction Titrations
- Precipitation Titrations
- Non-Aqueous solvents

Acid-Base Titration:

This type of potentiometric titration is used to determine the concentration of a given acid/base by neutralizing it exactly using a standard solution of base/acid whose concentration is known.

Redox Titration:

This type of potentiometric titration involves an analyte and titrant that undergo a redox reaction. An example of this type of titration would be the treatment of an iodine solution with a reducing agent which produces iodide ion (a starch indicator is used to get the endpoint).

Complexometric Titration:

This type of titration can also be referred to as chelatometry. In this method, a coloured complex is formed, indicating the end point of the titration. This method is used to determine a mixture of metal ions in a given solution.

Precipitation Titration:

This type of titration involves a reaction between the given analyte and the titrant wherein an insoluble precipitate is formed. The end-point of this titration is noted when the addition of the titrant no longer forms a precipitate.

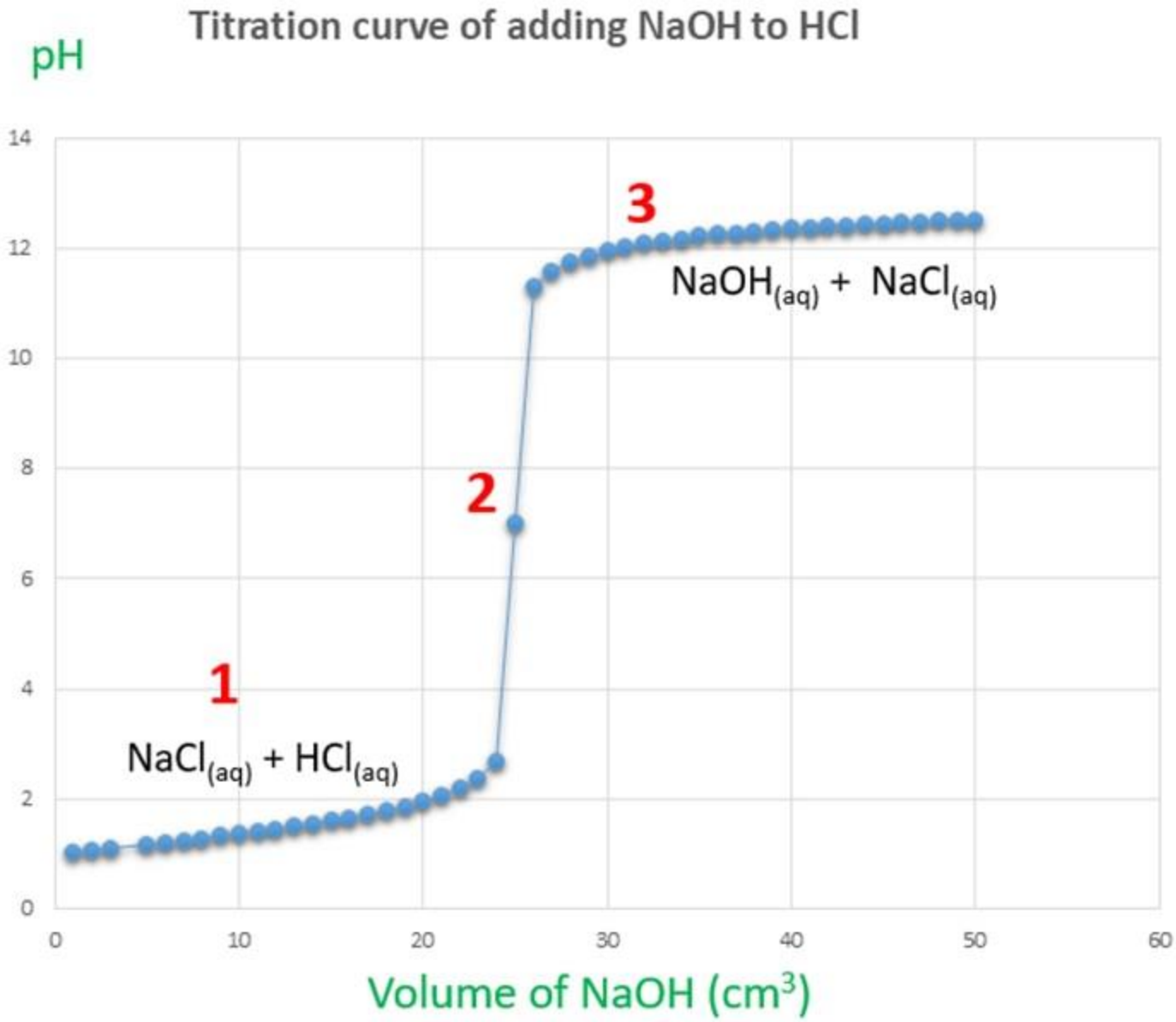
Potentiometric Titration is done via the usage of two electrodes – an indicator electrode and a reference electrode (generally a hydrogen electrode or a silver chloride electrode). One half-cell is formed with the indicator electrode and the ions of the analyte, which is generally an electrolyte solution. The other half-cell is formed by the reference electrode.

Acid-Base Titration

Pt, H2 (1atm)| H+ || KCl solution; HgCl2(s)|Hg

The emf of the cell is measured potentiometrically.

- $E=E_R-E_L$
- $=0.244-0.0591\log H^+$
- $=0.2422+0.0591p^H$
- As the titration proceeds, the H+ ion goes on decreasing, p^H increases.
- Hence, emf increases.


Titration curve of adding NaOH to HCl
pH
14
12
10
8
6
4
2
0
0
10
20
30
40
50
60
Volume of NaOH (cm3)
1
NaCl(aq) + HCl(aq)
2
3
NaOH(aq) + NaCl(aq)