Applications :-

By using potentiometry various types of titrations can be performed. They are

Acid-Base titrations :-

This type of titration involves H^+ and OH^- ions. here the indicator electrode is hydrogen electrode or glass electrode is connected to reference (calomel) electrode.

In this potential of electrode is

$$E = E^0 - 0.0591\,pH$$

Eg: weak acid V/S weak Base, weak acid V/S strong Base

mixture of acids V/S strong base ; poly basic acids V/S Bases etc ---

Redox titrations :- most of redox titrations are possible by using potentiometer to determine the end point.
This titration involves the transfer of electron from oxidised to reduced substances. so potential of redox titration is

$$E = E^0 + \frac{0.0591}{n} \log \left[\frac{ox}{red}\right]$$

here E – Electrode potential
E^0 – Standard electrode potential
n – No of electrons involved
ox, red → Conc of oxidant, reductant.

Eg: 1. ferrous ammonium sulphate vs KMnO4 (or) $K_2Cr_2O_7$ (dichrometry)
2. ferrous sulphate vs Cerric ammonium sulphate (Cerimetry)

precipitation titrations :-

potentiometric titration is possible only for limited types of reaction involving precipitation. potential is given by

$$E = E^0 + \frac{0.0591}{n} \log [m^{n+}]$$

here E – electrode potential
E^0 – Standard electrode potential
n – No. of electrons involved (or) electronic state
m^{n+} – Concentration of ions.

Complexometric titrations :- When a metal ion forms a complex with ligand its potential can be determined by using proper indicator electrode. various divalent, trivalent ions are titrated against EDTA can be determined by potentiometric method. Silver (or) mercury Chloride electrode are used as an indicator electrode and Calomel electrode is used as reference electrode

5) Biamperometry (Dead stop end point technique)

By using this technique to determine moisture content by karl fischer reagent:

Reaction takes place in titration of water with karl fisher reagent

$$3C_5H_5N + I_2 + SO_2 + H_2O \longrightarrow 2C_2H_5NHI + C_5H_5N{<}^{O}_{SO_2}$$

imidazole (Iodine) Sulfur dioxide

imadazolium iodide imidazolium methyl sulph

6) Assay of Drugs:

Various drugs are Assayed by potentiometry

→ Carbidopa, Cimetidine

→ Clonidine hydrochloride, Benzoflumazide

→ Ethinyl estradiol, Lomustine, flunitrazepam.

Dis advantages :-

→ It should be handled with care as the bulb is fragile.

→ The electrode becomes non functional incases of minutes scratches.

→ It must be hydrated all the time.

→ It is not used in highly alkaline solutions due to partial Exchange of other cations than H^+ ions.

→ Solvents like acetic acid, ethanol and gellatin are not suitable.

→ It requires frequent standardizations.