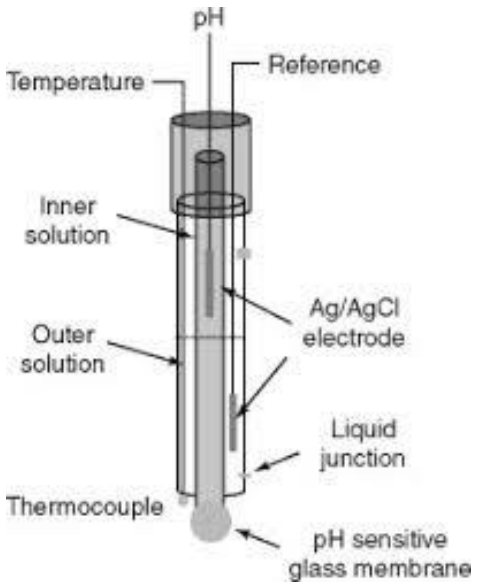
ION-SELECTIVE ELECTRODE

These are the electrodes having the ability to respond only to a particular ions and develop potential, ignoring the other ions in a mixture. The potential developed by an ion selective electrode depends only on the concentration of particular ions.

GLASS ELECTRODE

The glass electrode is the most widely used hydrogen ion responsive electrode. When a glass membrane is immersed in a solution, a potential is developed between the two surface of the membrane which is a linear function of the hydrogen ion concentration of the solution i.e. pH value.



CONSTRUCTION

- A glass electrode consists of thin walled glass bulb (the glass is a special type having low melting point and high electrical conductivity) containing a Pt wire in 0.1 M HCl. The glass electrode is represented as
    - Pt = 0.1 M HCl / Glass

HCl in the bulb furnishes a constant H^+ ion concentration. Glass electrode is used as the internal reference electrode. The pH of the solution especially coloured solution containing oxidizing or reducing agent can be determined. The thin walled glass bulb called Glass membrane functions as an ion exchange resin and equilibrium is set up between the Na^+ ions of glass and H^+ ions in solution.

- The potential difference varies with H+ ions concentration and its emf is given by the expression

$$E_G = E^o_G + 0.0591 \text{ pH}$$

Determination of pH of a solution using Glass Electrode

The Glass electrode is placed in the solution under test and is coupled with saturated calomel electrode.

The emf of the cell is measured from the emf, the pH of the solution is calculated as follows:

$$E \text{ cell} = E \text{ right} - E \text{ left}$$

$$E \text{ cell} = 0.2422 \text{ V} - [E^o_{\text{Glass}} + 0.0591 \text{ V pH}]$$

$$E \text{ cell} = 0.2422 \text{ V} - E^o_{\text{Glass}} - 0.0591 \text{ V pH}$$

$$\text{pH} = \frac{0.2422 \text{ V} - E^o_G - E \text{ cell}}{}$$

ADVANTAGES

- The results are accurate.
- It is not easily poisoned.
- Equilibrium is rapidly achieved.
- It can be easily constructed and readily used.

DISADVANTAGES

Since the resistance is quote high, special electronics potentiometers are employed for measurement.
The Glass electrode can be used in solutions only with pH range of 0 to 10. However above the pH 12 (high alkalinity) cations of the solution affect the Glass and make the electrode useless.

APPLICATIONS OF ISEs

ISEs are used in determining the concentrations of cations like H^+, Na^+, K^+, Ag^+, Li^+.

- ISEs are used for the determination of hardness (Ca^{2+} and Mg^{2+} ions)
- pH of the solution can be measured by using gas sensing electrode.
- Concentrations of anions like NO_3-, CN-, S^{2-}, halides (X^-) can be determined.