# SNS COLLEGE OF TECHNOLOGY

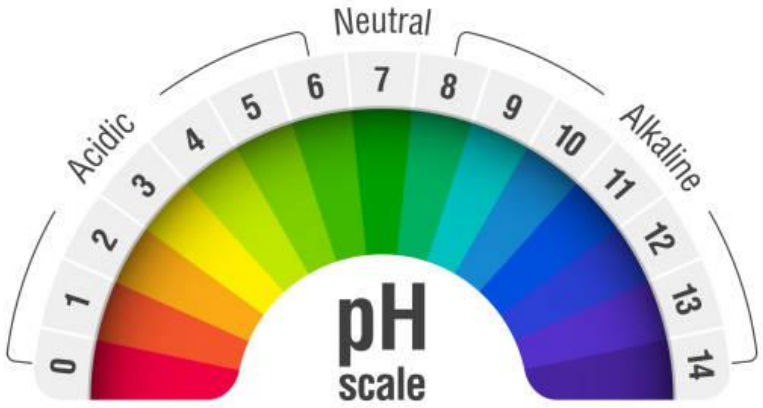
**AN AUTONOMOUS INSTITUTION**

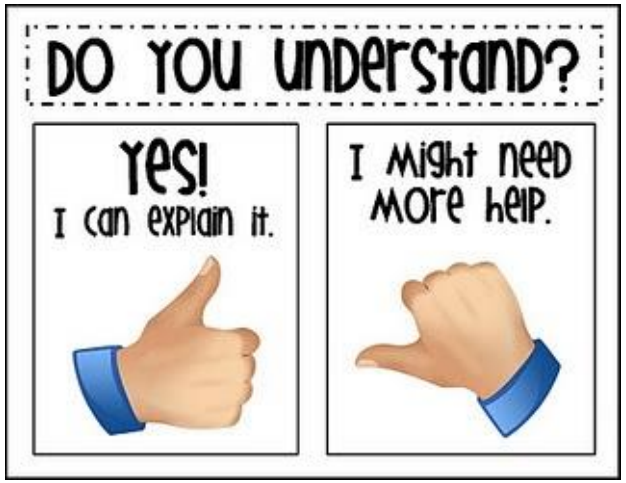
Coimbatore – 641035

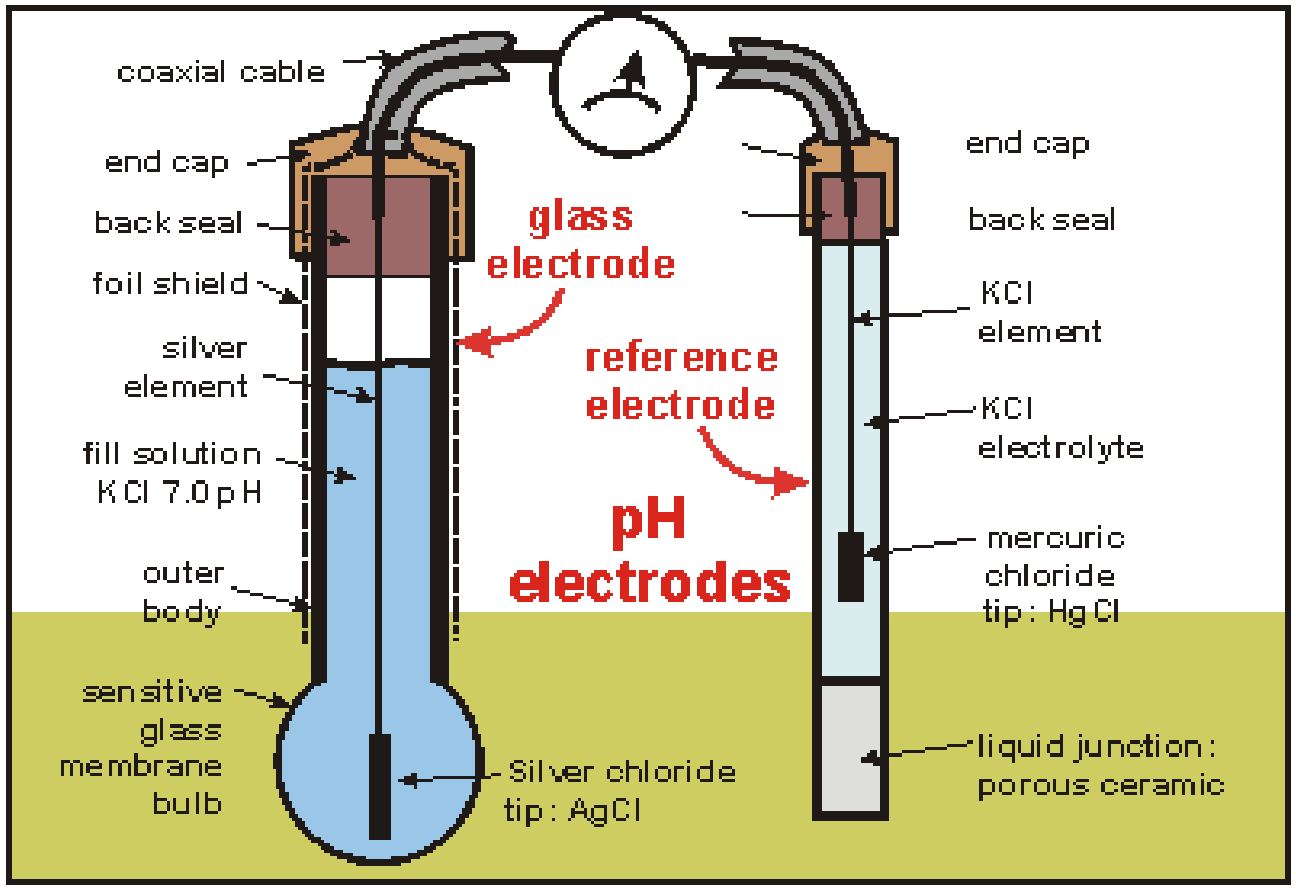
## 23CHT101-ENGINEERING CHEMISTRY

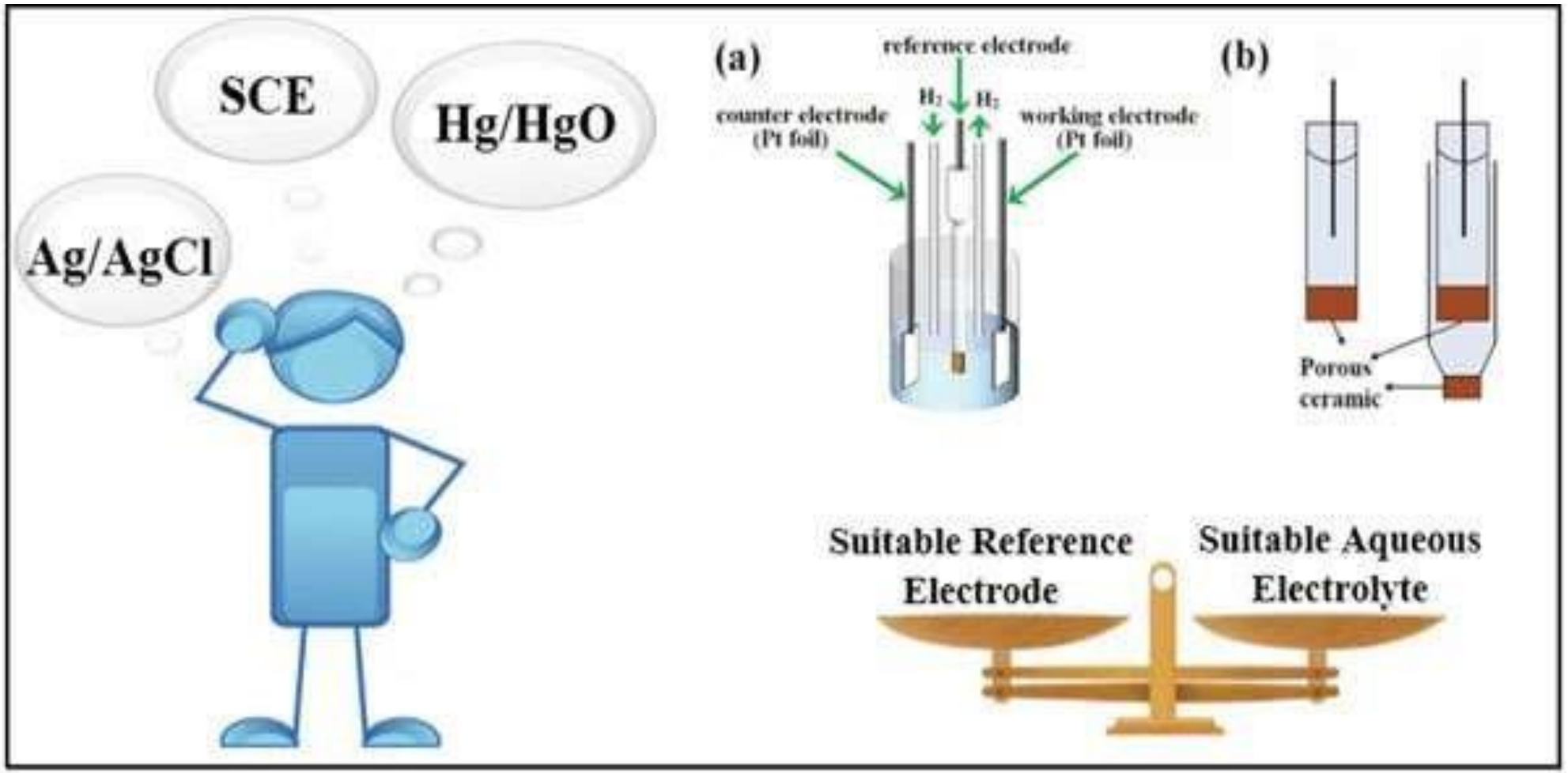
## UNIT 1 - ELECTROCHEMISTRY

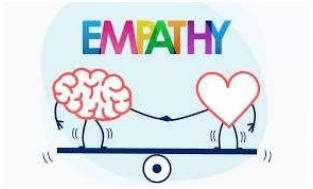
## 1.5 - Ion selective Electrode- pH by using Glass Electrode




DO YOU UNDERSTAND?
YES!
I can explain it.
I might need more help.


coaxial cable
end cap
back seal
foil shield
silver element
fill solution KCl 7.0 pH
outer body
sensitive glass membrane bulb
Silver chloride tip: AgCl
glass electrode
reference electrode
pH electrodes
end cap
back seal
KCl element
KCl electrolyte
mercuric chloride tip: Hg Cl
liquid junction: porous ceramic


SCE
Hg/HgO
Ag/AgCl
(a)
reference electrode
counter electrode
(Pt foil)
working electrode
(Pt foil)
(b)
Porous
ceramic
Suitable Reference
Electrode
Suitable Aqueous
Electrolyte

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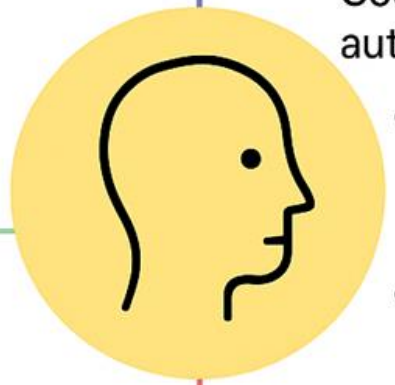
## SAY

- The electrode gives accurate results, but it breaks easily.
- Calibration takes time – I need something faster.
- Temperature affects the readings – that's frustratirg.

## THINK

- Why can't we design a tougher, more durable electrode?
- Could the device adjust automatically for tempenture?
- Maybe a digital or self-cali⁻b rating system would reduce errors.
- If only it were portable and wireless for field testing!



## DO

- Handle the glass electrode carefully to avold breaking.
- Calibrate it frequently using buffer solutions.
- Compare readings with standard references to ensure accuracy.

☺ Satisfied when pH readings are accurate and stable.

☹ Frustrated when electrodes break or drift in readings.

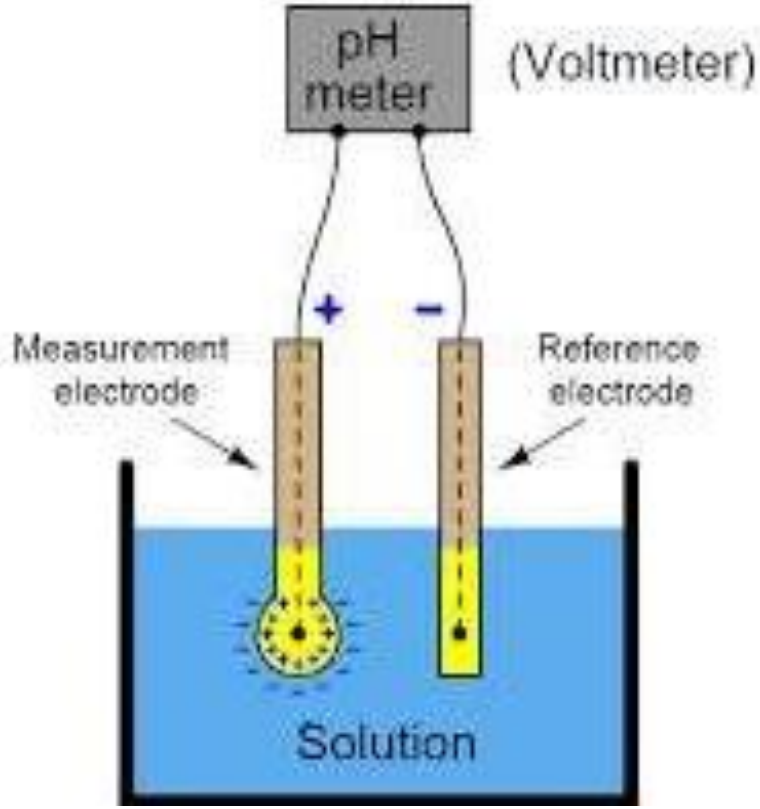
☹ Concerned about maintenance and calibration effort.

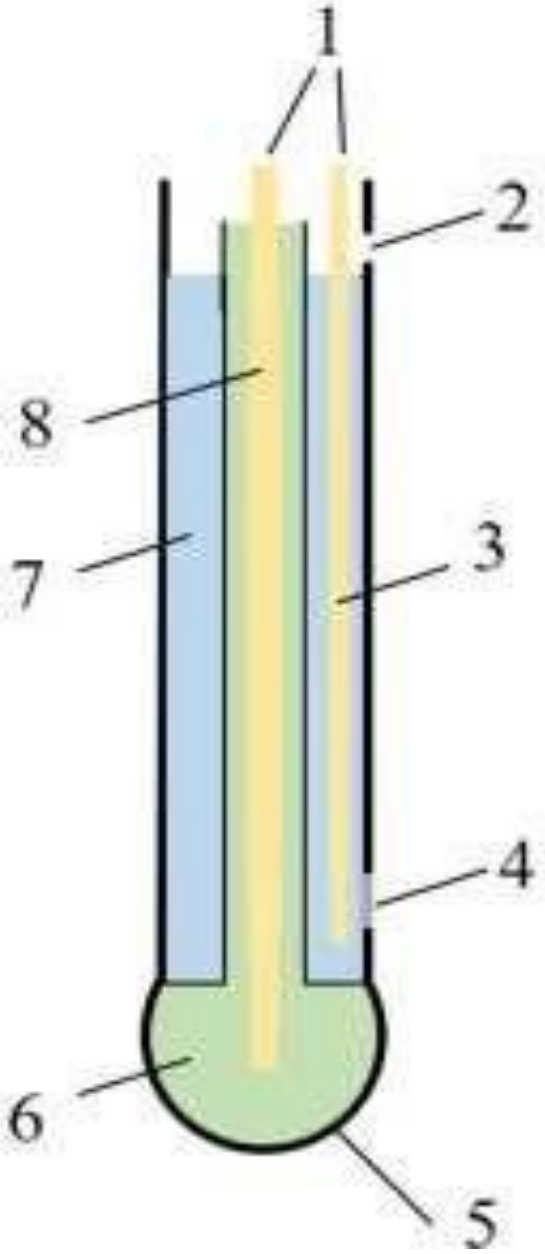
# GLASS ELECTRODE

| Parameter | Standard Condition |
|---|---|
| **Thin-walled glass bulb** | Made of special glass sensitive to $H^+$ ions. |
| **Internal solution** | Usually 0.1 M HCl |
| **Internal reference electrode** | (Ag/AgCl) electrode |
| External reference electrode | Calomel electrode (connected through a salt bridge) |


How can we accurately measure the pH of a solution without relying on color indicators or human observation?

Use a potentiometric pH meter with a **glass electrode + reference electrode**






1. Wires to pH meter
2. Filling hole
3. Reference electrode (Ag/AgCl)
4. Porous junction
5. Glass membrane
6. Glass electrode internal solution
7. Reference electrode internal solution
8. AgCl coated silver wire

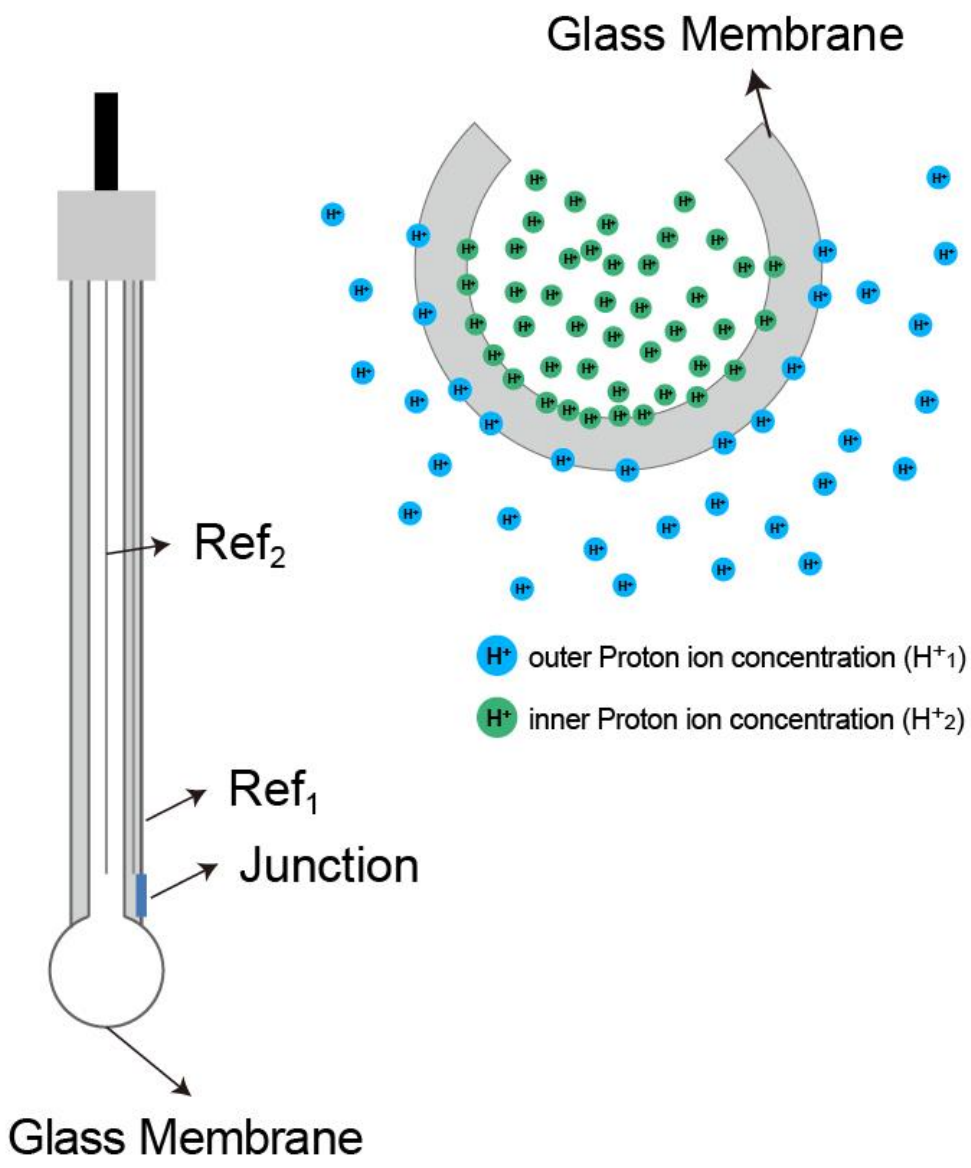
# Ideate – Developing the Concept

**Working Principle:**

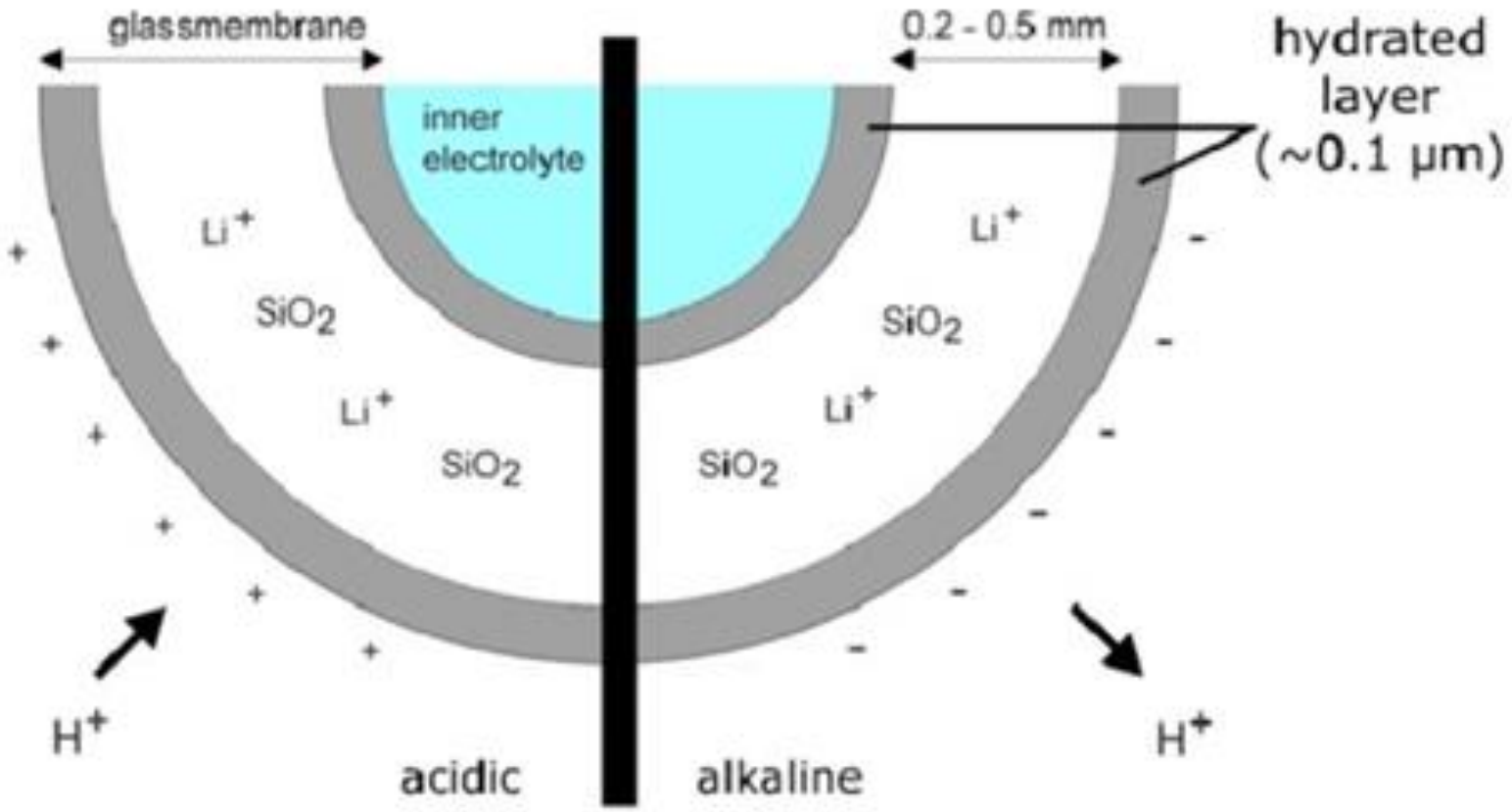
$H^+$ ion concentration between internal and external solutions.

**Nernst equation:**

$$E = E0 + 0.0591 \log[H+inside/H+outside]$$



# Measuring electrode: glass membrane



PROTOTYPE

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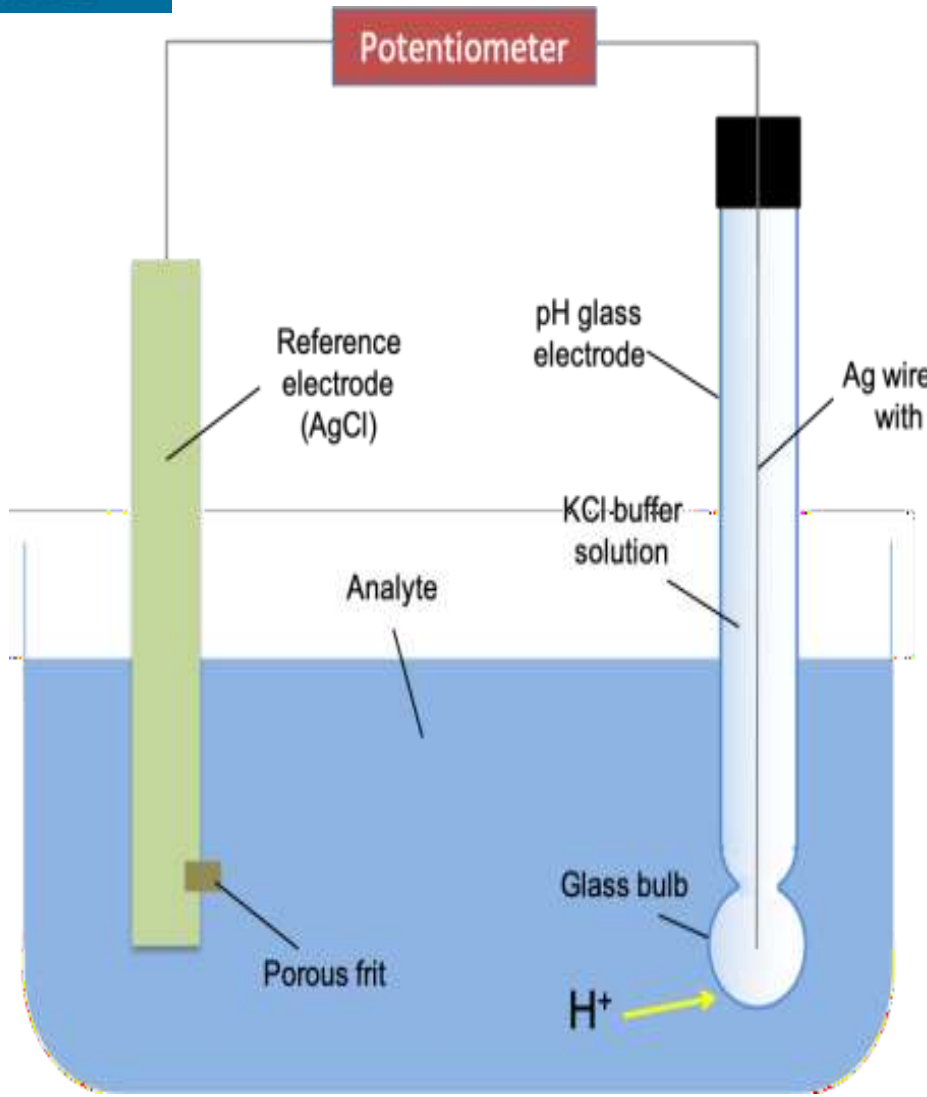
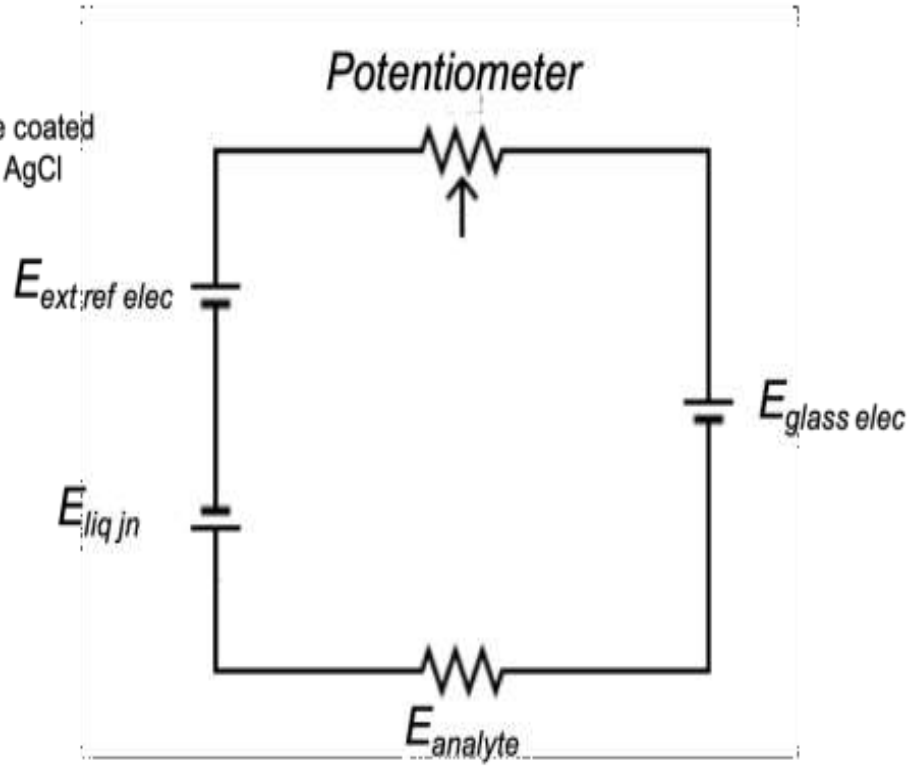
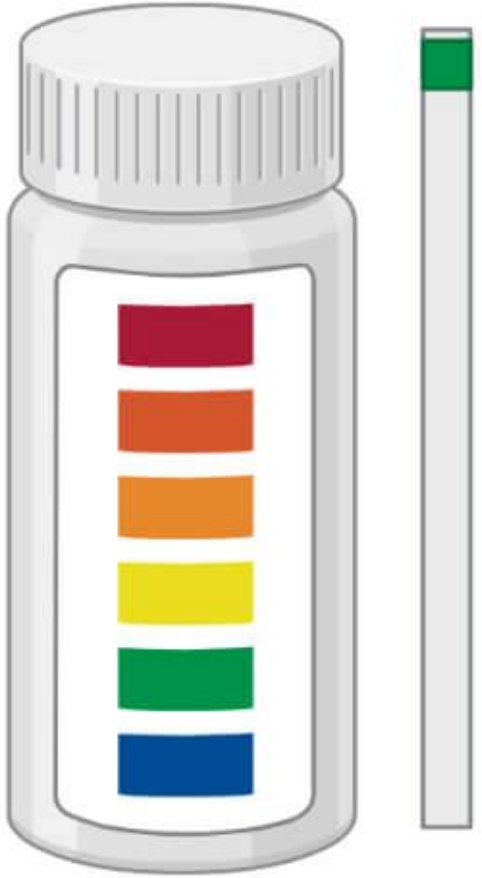
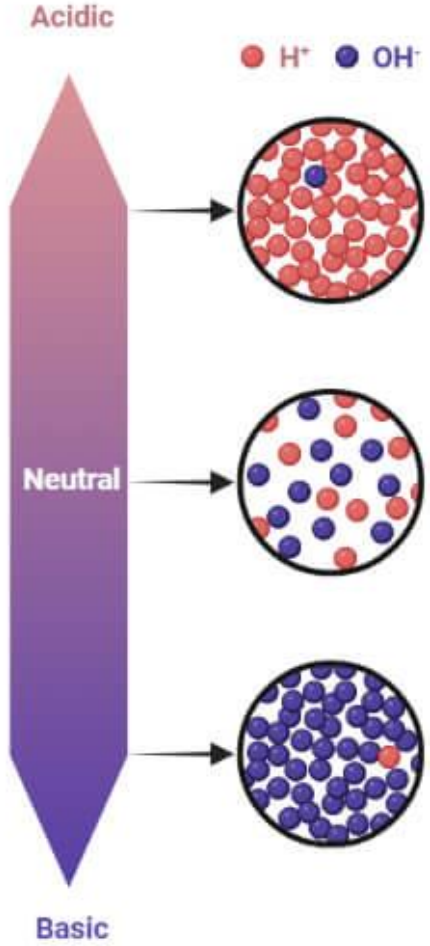


# pH Meter- Principle, Parts, Types, Uses, Examples





# Applications

# pH

## Definition

- Measure of hydrogen ion concentration
- Indicates acidity or alkalinity of a solution

## Formula

- $pH = -\log[H^+]$
- $[H^+] = 10^{-pH}$

## Measurement Methods

- Indicator method
  litmus, phenolphtahalein, methyl orange
- pH paper: color comparison
- pH meter: using glass electrode (accurate method)

## Scale

- A1 rage 0 – 14
- Acidic: pH = 7
- Neutral: pH = 7 (puré ωate)
- Basic: pH > 7

## Applications

- Water quality testing
- Soil analysis in agric ulture
- Pharmaceutical formulation
- Industrial effluent control

## Factors Affecting pH

- Temperature
- Concentration of acids/bases
- Dilution

# References

https://www.toadkk.com/english/support/useful/useful01.html

https://en.wikipedia.org/wiki/Glass_electrode