

pH, Buffers, and Isotonic Solutions

pH

Definition of pH

- **pH** is a numerical scale used to specify the acidity or alkalinity of an aqueous solution.
- It is defined as the negative base-10 logarithm of the activity (concentration) of hydrogen ions (H^+):

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

- **Hydrogen ion concentration ($[H^+]$)** is measured in moles per liter (mol/L).

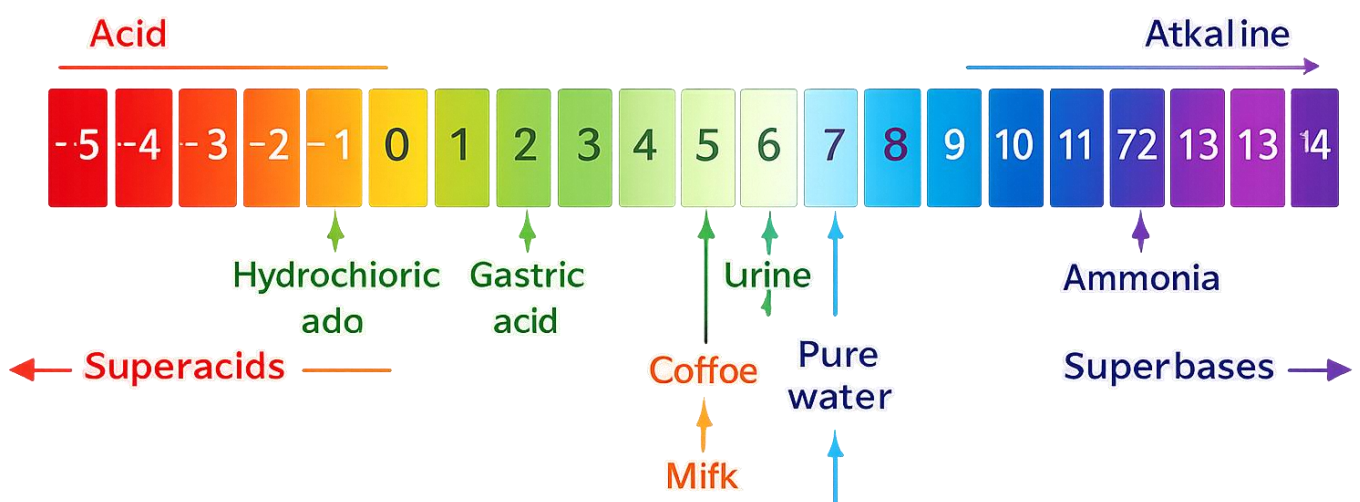
pH Scale

- The pH scale typically ranges from **0 to 14**, although values can be less than 0 or greater than 14 for very strong acids or bases.
- **Neutral solution:** $pH = 7$ (e.g., pure water at $25^\circ C$).
- **Acidic solution:** $pH < 7$ (higher concentration of H^+ ions).
- **Basic (alkaline) solution:** $pH > 7$ (lower concentration of H^+ ions).

Importance of pH

- **Chemical Reactions:** pH influences reaction rates and equilibria.
- **Biological Systems:** Enzyme activity and metabolic processes are pH-dependent.
- **Environmental Science:** pH affects water quality and soil chemistry.
- **Medicine:** Blood pH is tightly regulated; deviations can be life-threatening.

Sorensen's pH Scale



- The pH scale is a numerical representation of the acidity or alkalinity of a solution.

- It was introduced by Danish chemist Søren Peder Lauritz Sørensen in 1909.
- Sørensen developed this scale to simplify the expression of hydrogen ion concentrations in solutions, which can vary over a wide range.

Definition of pH

- The term "pH" stands for "potential of hydrogen" and is defined mathematically as:

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

Where:

- $[H^+]$ is the molar concentration of hydrogen ions in the solution.

Logarithmic Nature

- The logarithmic scale means that each whole number change in pH represents a tenfold change in hydrogen ion concentration.
- For example, a solution with a pH of 3 is ten times more acidic than one with a pH of 4.

Scale Range

- The pH scale typically ranges from **0 to 14**:
 - **Acidic Solutions:** $\text{pH} < 7$
 - **Neutral Solutions:** $\text{pH} = 7$
 - **Basic (Alkaline) Solutions:** $\text{pH} > 7$

Importance

- The pH of a solution affects chemical reactions, biological processes, and the solubility of compounds.
- It is crucial in various fields, including:
 - Chemistry
 - Biology
 - Medicine
 - Agriculture
 - Environmental Science

pH Determination

- Accurate pH measurement is essential in laboratories, industry, and research.



pH Measurement Methods

Electrometric Methods

Colorimetric Methods

1. Electrometric Methods

Principle:

- Based on the measurement of the electromotive force (EMF) of a galvanic cell that includes a pH-sensitive electrode.

Components:

- **Glass Electrode:** Sensitive to hydrogen ion activity; develops a potential proportional to pH.
- **Reference Electrode:** Provides a constant potential; commonly a silver/silver chloride or calomel electrode.
- **pH Meter:** Reads the potential difference and displays the pH.

Procedure:

1. Calibrate the pH meter using standard buffer solutions of known pH.
2. Rinse electrodes with distilled water.
3. Immerse electrodes in the test solution.
4. Record the stable pH reading.

Advantages:

- High accuracy and precision.
- Suitable for a wide pH range.
- Can measure pH in colored or turbid solutions.

Applications:

- Research laboratories.
- Quality control in manufacturing.
- Clinical diagnostics.

2. Colorimetric Methods

Principle:

- Utilize pH indicators that change color depending on the pH of the solution.

Indicators:

- Weak acids or bases with different colors in protonated and deprotonated forms.
- Common indicators include litmus, phenolphthalein, methyl orange, and bromothymol blue.

Procedure:

1. Add a few drops of indicator to the test solution.
2. Observe the color change.



FREE PREVIEW

[Click here to visit our website](#)

PHARMACY PREMIUM NOTES

Complete subject
and semesters are
available on
FirstHope app only.



[Scan or click here](#)

Click here to get the app



Available on Google Play

JOIN THE FIRSTHOPE COMMUNITY

Join our Telegram channel

Click here to join Telegram



[Scan or click here](#)

@FirstHopeNotes

Instagram

@firsthope.official

[Click here to follow >](#)

YouTube channel

FirstHope-Pharmacy / Live streams

[Click here to watch >](#)

WhatsApp channel

Follow FirstHope on WhatsApp

[Click here to join >](#)

FirstHope website

firsthopenotes.com

[Click here to visit >](#)

B.Pharm / D.Pharm / M.Pharm / Pharm.D

Preview notes. Complete subjects and semesters in the FirstHope app.