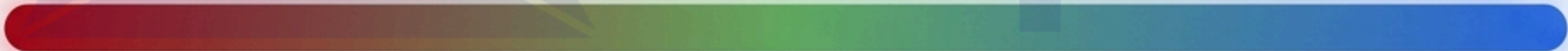


JEE CHEMISTRY / IONIC EQUILIBRIUM

The Number That Measures Acidity



Decoding the pH Scale

What is pH?

The Power of Hydrogen

A logarithmic scale designed to conveniently express hydronium ion concentration. In dilute solutions ($< 0.01\text{ M}$), the activity of the **hydrogen** ion is equal in **magnitude to its molarity**.

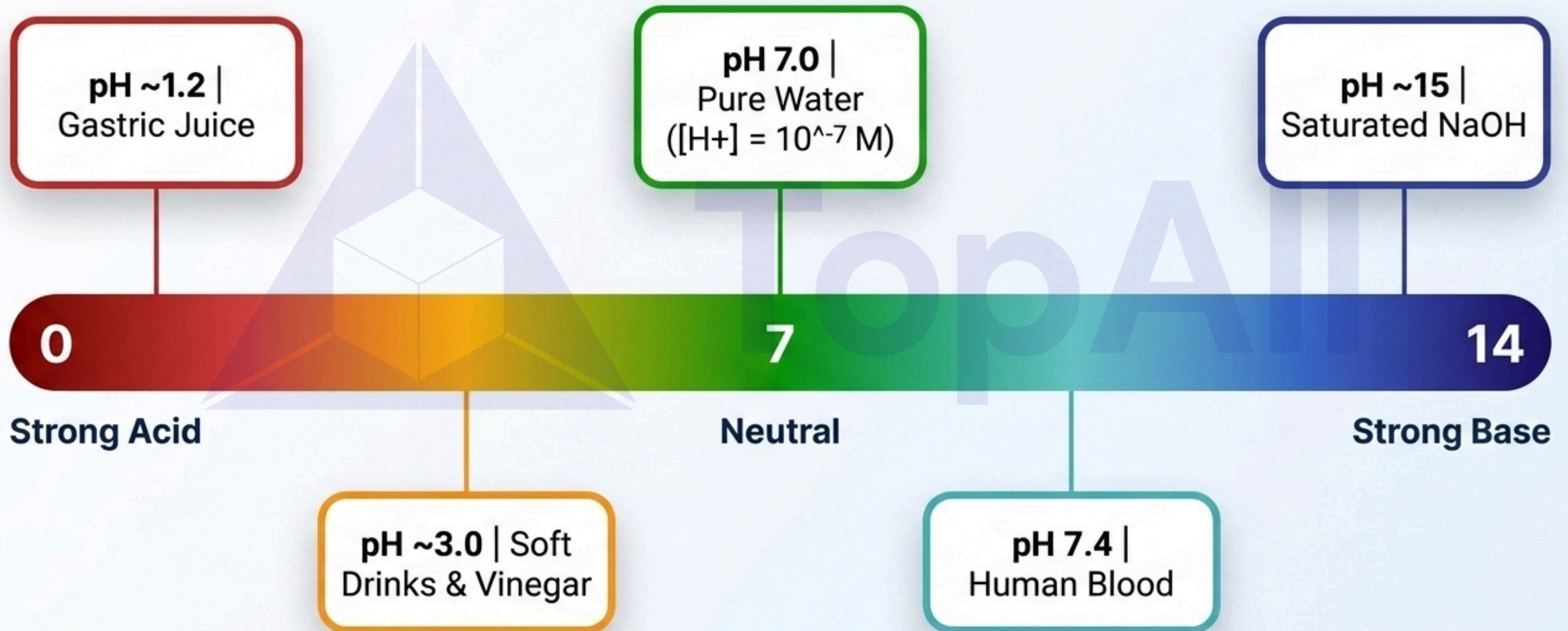
Activity has no units.

CORE EQUATIONS

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

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

The pH Spectrum (at 298 K)





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$$E=mc^2$$



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The Inverse Relationship



BLUE EXPLANATION

Acidic:

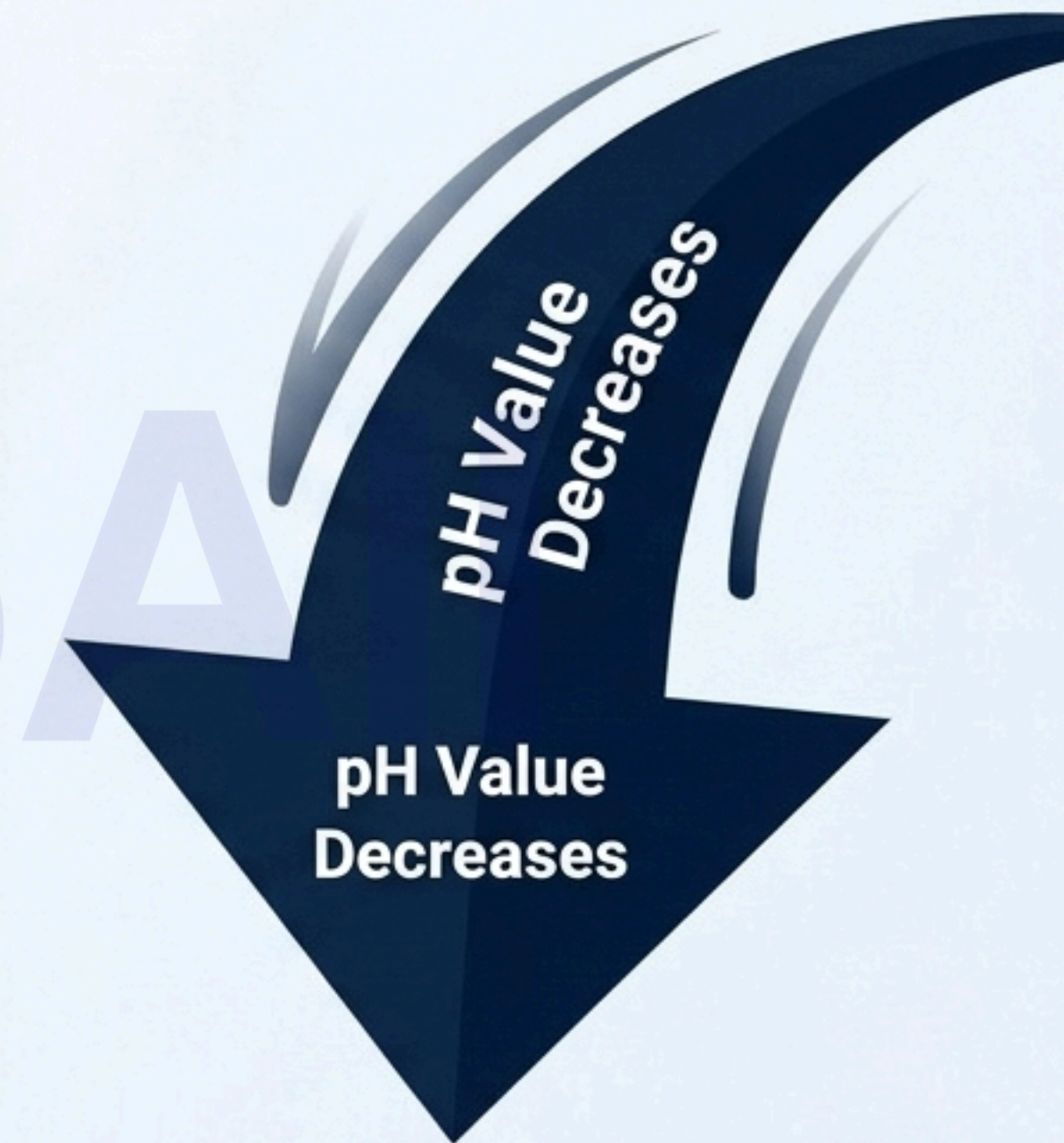
$$[H^+] > 10^{-7} \text{ M} \rightarrow \text{pH} < 7$$

Neutral:

$$[H^+] = 10^{-7} \text{ M} \rightarrow \text{pH} = 7$$

Basic:

$$[H^+] < 10^{-7} \text{ M} \rightarrow \text{pH} > 7$$



Insight: Because the formula uses a negative logarithm, higher acidity means a lower pH number.

The Other Half: pOH & Water's Constant

pH

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

pOH

$$\text{pOH} = -\log_{10}[\text{OH}^-]$$

Ionic Product of Water (K_w)

$$K_w = [\text{H}^+][\text{OH}^-] = 10^{-14}$$

$$\text{pH} + \text{pOH} = 14$$

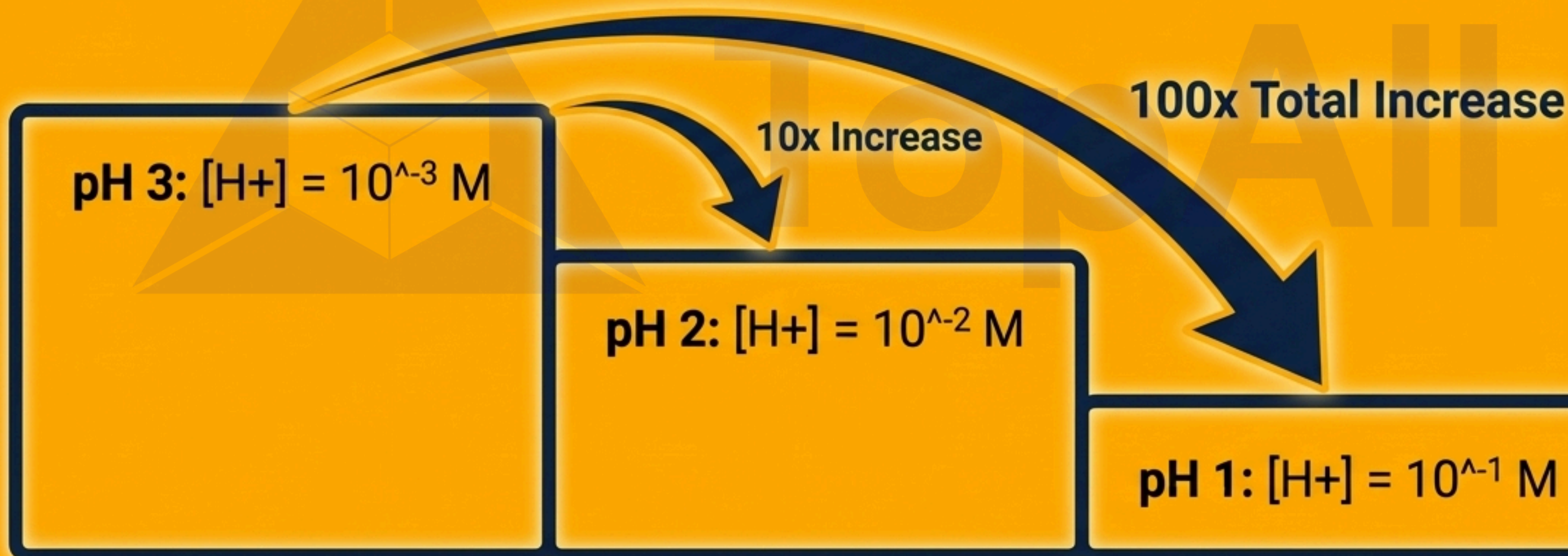
(Note: Strictly at 298 K / 25°C)

JEE Trap Alert: The Logarithmic Illusion

Bonus Trap: ΔT Matters! At higher temperatures, K_w increases, meaning neutral pure water has a $pH < 7$.

The Trap: Treating the pH scale as linear. (e.g., Thinking pH 2 is 'twice as acidic' as pH 4).

The Reality: A change of just 1 unit means a 10-fold exponential change in $[H^+]$.



Exam Snapshot

Quick Revision Matrix

Lower pH (0-6.9)

Stronger Acidity

[↑] $[H^+]$, [↓] $[OH^-]$

Neutral pH (7.0)

Pure Water (at 25°C)

$[H^+] = [OH^-]$

Higher pH (7.1-14)

Stronger Basicity

[↓] $[H^+]$, [↑] $[OH^-]$

Check the temperature first! The heuristic $pH + pOH = 14$ and neutral $pH = 7$ are strictly valid only at 298 K (25°C).



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