

pH and Biological Systems

pH Scale

- $\text{pH} = -\log[\text{H}^+]$
- Range: 0 (acidic) to 14 (basic)
- pH 7 is neutral
- Each unit = 10× concentration change

Buffer Systems

- Resist pH changes
- Blood pH: 7.35-7.45
- Bicarbonate buffer ($\text{H}_2\text{CO}_3/\text{HCO}_3^-$)
- Phosphate buffer in cells

Henderson-Hasselbalch Equation

- $\text{pH} = \text{pK}_a + \log\left(\frac{[\text{A}^-]}{[\text{HA}]}\right)$
- Predicts buffer behavior
- Critical for enzyme function
- Used in drug design

Enzyme pH Dependence

- Each enzyme has optimal pH
- Pepsin (stomach): pH 2
- Trypsin (intestine): pH 8
- pH affects protein charge state