

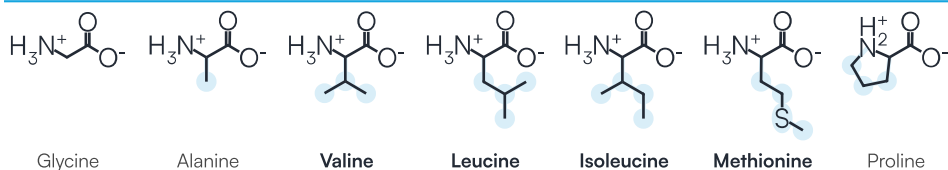
Acids and bases

- ✓ $\text{pH} = -\log[\text{H}^+]$
- ✓ $\text{pOH} = -\log[\text{OH}^-]$
- ✓ $\text{pH} + \text{pOH} = 14$ at 25°C
- ✓ $K_a = \frac{[\text{H}^+][\text{A}^-]}{[\text{HA}]}$, $\text{p}K_a = -\log K_a$
- ✓ $K_b = \frac{[\text{OH}^-][\text{HB}^+]}{[\text{B}]}$, $\text{p}K_b = -\log K_b$
- ✓ $K_a \times K_b = K_w = 1 \times 10^{-14}$
- ✓ $K_w = [\text{H}^+][\text{OH}^-] = 1 \times 10^{-14}$ at 25°C
- ✓ Henderson-Hasselbalch: $\text{pH} = \text{p}K_a + \log \frac{[\text{A}^-]}{[\text{HA}]}$

The 20 amino acids

Each amino acid has an amino group (NH_3^+), a carboxyl group (COO^-), and a side chain, shaded below. The side chain — nonpolar, polar or charged, large or small — is what gives proteins their variety of structure and function.

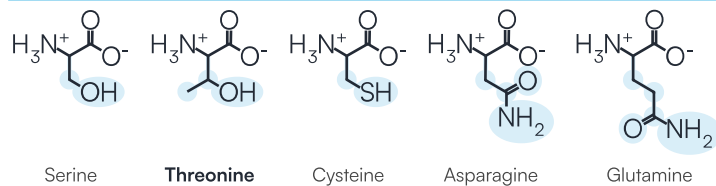
Nonpolar, aliphatic



Aromatic



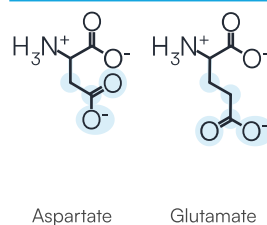
Polar, uncharged



Positively charged (basic)



Negatively charged (acidic)



- ✓ **The 9 essential amino acids**, named in bold, which the diet must supply: histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, valine