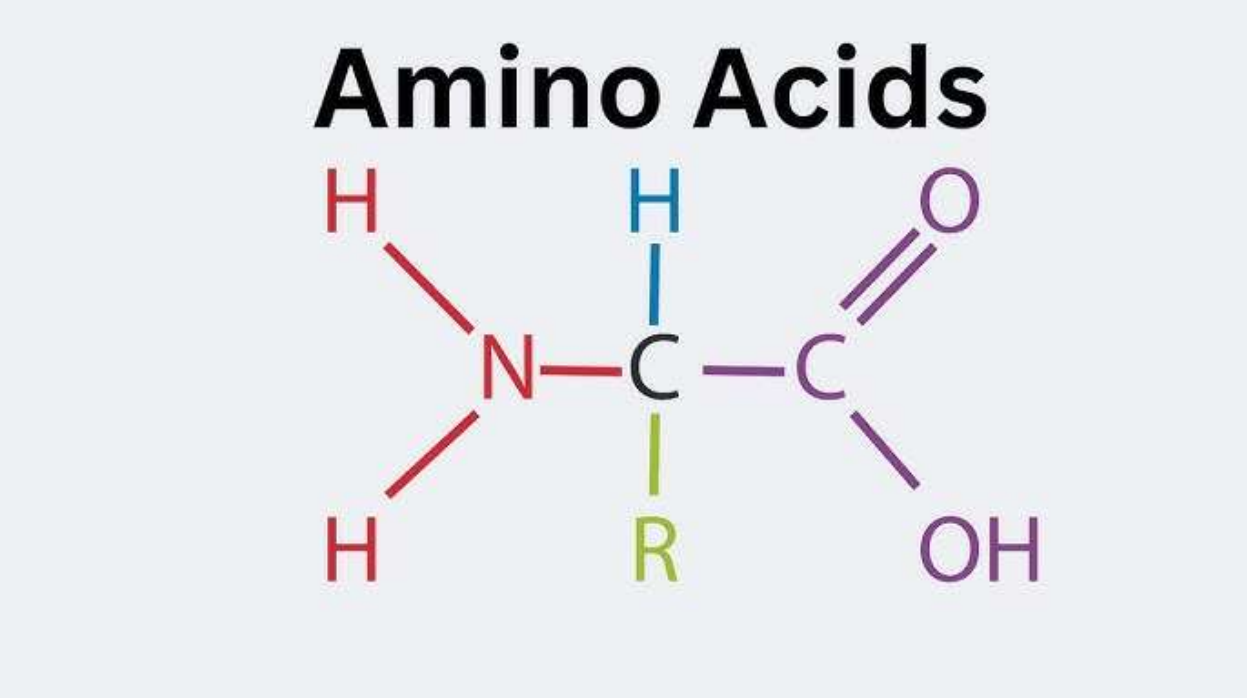
💉 Amino Acids — Survival Notes

🧱 Part 1: General Structure

Every Amino Acid (AA) has the **same basic skeleton**
(**Except Proline**. Of course it had to be special.)

If you can't draw this, the exam will eat you alive.



Components:

- **α-Carbon:** The central carbon
- **Carboxyl group (–COOH):** Acidic
- **Amino group ($–NH_2$):** Basic
- **Side chain (R):** The personality
- **Hydrogen atom**

🚨 **High-Yield Alert**

- **20 standard amino acids** enter protein structure
- **21st amino acid: Selenocysteine**
  - Encoded by a **stop codon** (UGA)
  - Examiners love this more than you love sleep
- **Proline:**
  - Only **imino acid** (–NH instead of $–NH_2$)
  - **Breaks α-helices** (structural menace)

🔗 Join the Intel: https://t.me/+NKEN38mEIKlhNTg0
🌐 Interactive questions & notes: www.resusclear.com

🍖 **Part 2: Classification (The Meat)**

Examiners adore asking:

"Enumerate essential amino acids"
"Classify amino acids chemically"

So yes, you **must** memorize this.

A. Nutritional Classification

Based on: Can your body make it?

Essential AAs

- Cannot be synthesized
- Must be eaten

🧠 **Mnemonic: TV TILL PM**

- Threonine
- Valine
- Tryptophan
- Isoleucine
- Lysine
- Leucine
- Phenylalanine
- Methionine

Semi-Essential

- Synthesized, but **not enough in growing children**
- **Arginine** (the only one)

Non-Essential

- Body synthesizes easily
- Example: Glycine, Alanine, Serine (and friends)

B. Chemical Classification

Based on: What does the R-group look like?

1. Aliphatic (No rings)

- **Simple:**
  - Glycine (smallest, R = H)
  - Alanine (R = CH_3)
- **Branched-chain (BCAA):**
  - Valine, Leucine, Isoleucine
  - 📌 Metabolized in **muscle**, not liver

- **Hydroxy (–OH):**
  - Serine, Threonine
  - 📌 Sites of phosphorylation
- **Sulfur-containing:**
  - Cysteine (–SH)
  - Methionine (–S–CH_3)

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2. Aromatic (Ring structures)

- **Phenylalanine:** Benzene ring
- **Tyrosine:** Phenol ring (benzene + OH)
- **Tryptophan:** Indole ring

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3. Heterocyclic (Ring contains Nitrogen)

- **Histidine:** Imidazole ring (buffering king 👑)
- **Proline:** Pyrrolidine ring
- **Tryptophan:** Indole ring
  - Yes, it's **both aromatic and heterocyclic**
  - Overachiever.

C. Polarity Classification

Based on: Does it like water?

1. Non-Polar (Hydrophobic)

- Hide inside proteins
- Leucine, Valine, Proline, Phenylalanine

2. Polar Uncharged

- Water-loving, soluble
- Serine, Threonine, Cysteine, Glutamine

3. Polar Charged (Ionic)

- **Acidic (−):** Aspartic acid, Glutamic acid
- **Basic (+):** Lysine, Arginine, Histidine

🧪 Part 3: Properties of Amino Acids

This section screams **written exam**.

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1. Amphoteric Property

Amino acids can act as **acids or bases**, depending on pH.

- **Low pH (acidic):**
  - AA acts as a **base**, accepts H^+ → **cation**
- **High pH (alkaline):**
  - AA acts as an **acid**, donates H^+ → **anion**

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2. Zwitterion (Dipolar Ion)

- Carries **both +ve and −ve charges**
- **Net charge = 0**
- Does **not migrate** in an electric field
- Most AAs exist as zwitterions at **physiological pH (7.4)**

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3. Isoelectric Point (pI)

- The **pH at which net charge = 0**
- 📌 **Clinical link:**
  - Proteins are **least soluble** at their pI
  - They precipitate

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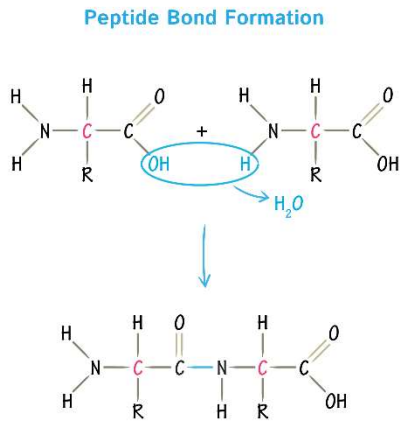
4. Peptide Bond Formation

- **Type:** Covalent amide bond
- **Reaction:** Condensation (H_2O removed)
- **Between:**
  - α-COOH of one AA
  - α-NH_2 of the next
- **Characteristics:**
  - Rigid
  - Planar
  - Partial double-bond character
  - No rotation



🚨 Part 4: Exam Traps (Q&A Style)

Straight from the department book. No mercy.

Q1: Amino acids with hydroxyl (–OH) group?

- **Serine, Threonine, Tyrosine**
  📌 Sites of phosphorylation

Q2: Sulfur-containing amino acids?

- **Cysteine, Methionine, Homocysteine**
  ⚠️ Trap:
- **Cystine = 2 cysteines + disulfide bond**

Q3: Which AA forms disulfide bonds?

- **Cysteine**

Q4: Modified amino acids (post-translational)?

- **Hydroxyproline & Hydroxylysine**
  - Collagen
  - Requires **Vitamin C**
- **γ-Carboxyglutamate**
  - Prothrombin (clotting factors)
  - Requires **Vitamin K**

Q5: Match the ring

- Indole → **Tryptophan**
- Imidazole → **Histidine**
- Guanidino group → **Arginine**
- Phenol ring → **Tyrosine**

🧠 **Student-to-Student Reality Check**

Don't memorize the full chemical formula of tryptophan unless you enjoy suffering.
For **guaranteed marks**, focus on:

- **Classifications (Part 2)**
- **Amphoteric definition (Part 3)**

Those come up. Every. Single. Time.