

Q1 - Exam 2025: Classification

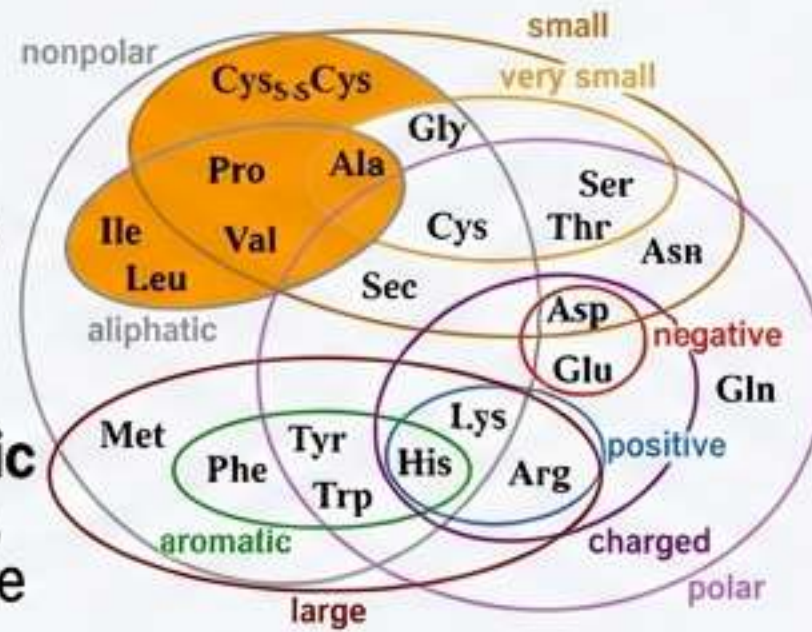
Which statement about amino acids is FALSE?

- A. Most are chiral (except Gly).
- B. L-forms are in proteins.
- C. They are amphoteric.
- D. They all have a polar character.

Correct: D

Not all amino acids are polar. A distinct class of **apolar/hydrophobic** amino acids (e.g., Gly, Ala, Val, Leu, Ile, Phe, Trp, Met, Pro) resides in the protein core.

Mnemonic: 'Pro-GAV-LIMP' = The Hydrophobic Gang.



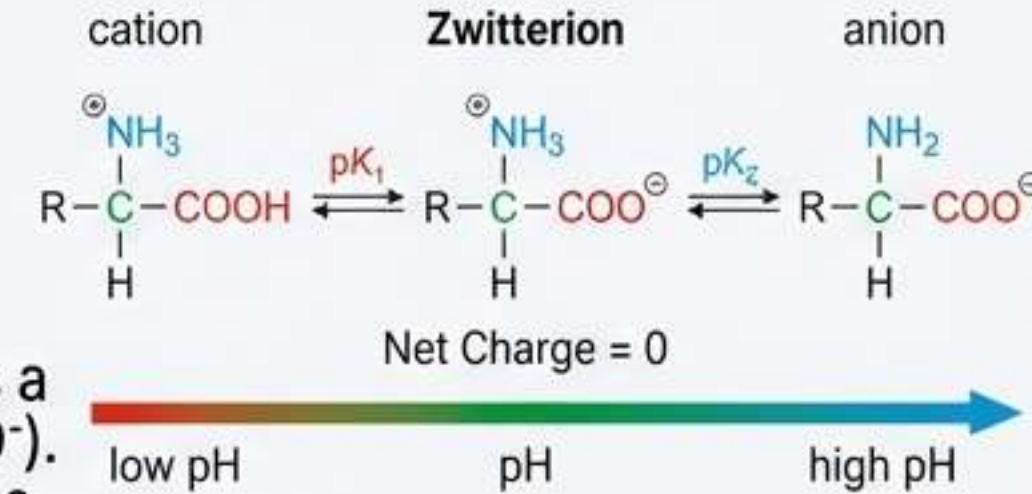
Q2 - Exam 2025: Isoelectric Point

The Isoelectric Point (pHi) is the pH at which a molecule:

- A. Is negatively charged.
- B. Is positively charged.
- C. Is neutral.
- D. Precipitates.

Correct: C

At the pHi, the amino acid is a **zwitterion** ($+H_3N-CHR-COO^-$). Net charge is zero, so it does not migrate in an electric field.



Mnemonic: pHi = pH Inert (No migration).

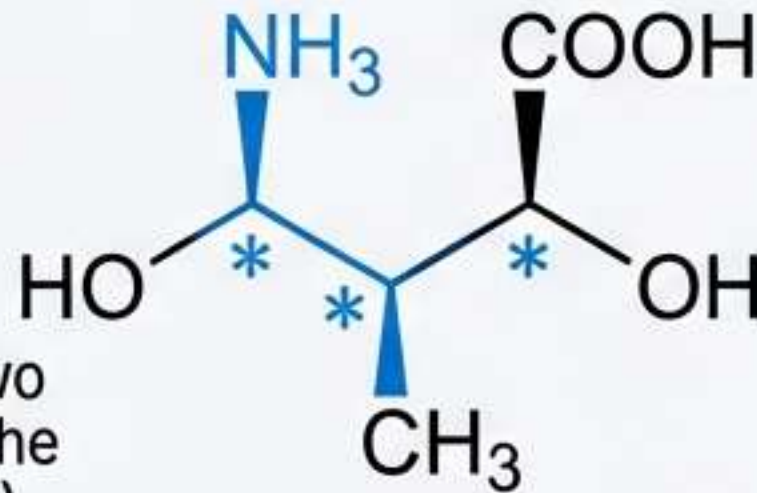
Q3 - Exam 2025: Chirality

Which amino acid possesses TWO asymmetric carbons?

- A. Lysine
- B. Leucine
- C. Threonine
- D. Alanine

Correct: C

Threonine (and Isoleucine) has two chiral centers: the α -carbon and the β -carbon (carrying the $-OH$ group).



Mnemonic: 'Thr'eonine and 'I'le have 'Two' centers.

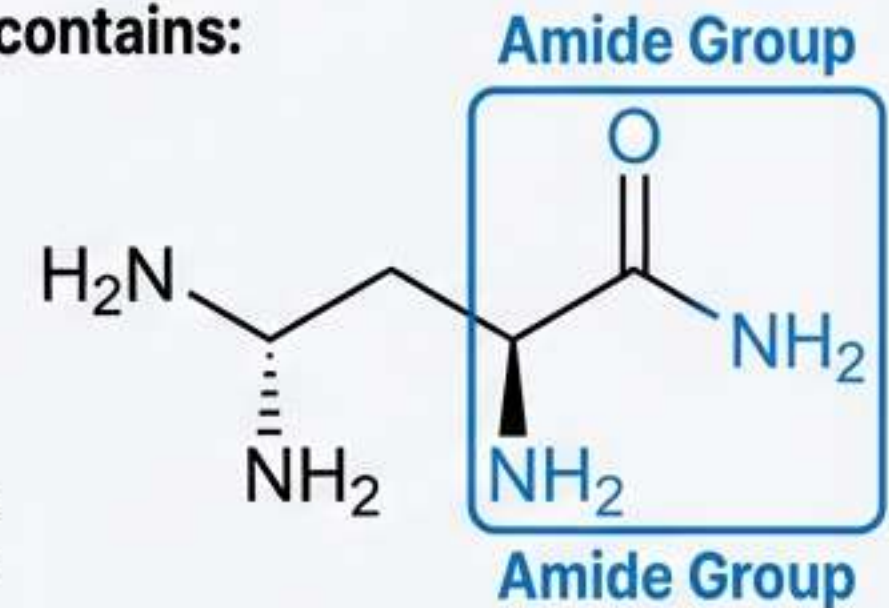
Q4 - Exam 2025: Structure

The side chain of Asparagine contains:

- A. Amine function.
- B. Amide function.
- C. Alcohol function.
- D. Acid function.

Correct: B

Asparagine (Asn) is the **amide** derivative of Aspartic Acid. Its side chain contains a carboxamide group ($-CONH_2$).



Mnemonic: Aspara'gine' has an 'Amine' on the acid = 'Amide'.

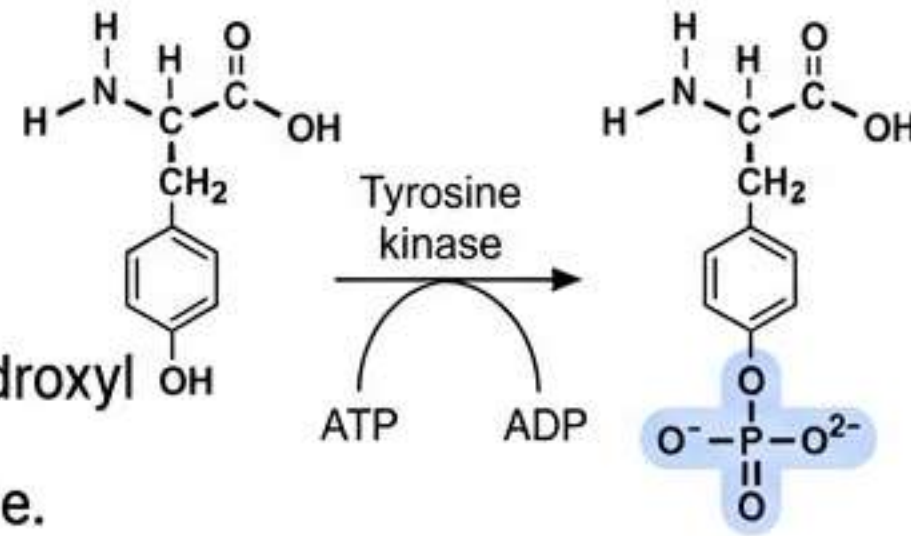
Q5 - Exam 2025: Modification

Which amino acid can be phosphorylated?

- A. Methionine
- B. Leucine
- C. Tyrosine
- D. Valine

Correct: C

Phosphorylation occurs on hydroxyl (-OH) groups. The targets are Serine, Threonine, and Tyrosine.



Mnemonic: "STY"le points for Phosphorylation (Ser, Thr, Tyr).

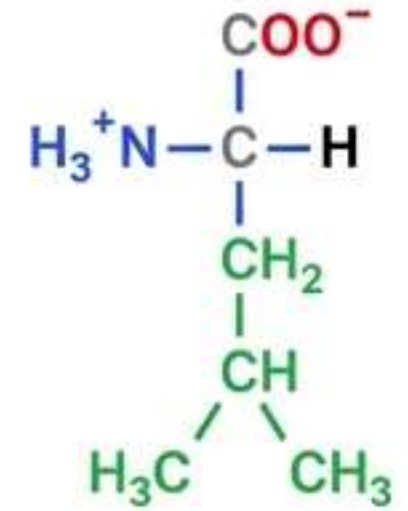
Q6 - Exam 2025: Leucine Properties

Which statement about Leucine is FALSE?

- A. It is linear aliphatic
- B. It is essential
- C. It is branched
- D. It is non-polar

Correct: A

Leucine is aliphatic but branched-chain (BCAA), not linear. It is a hydrophobic, essential amino acid.



Mnemonic: "L'eucine is "L'ike a branch (Branched chain).

Q7 - Exam 2025: Primary Structure

The primary structure of a protein:

- A. Is stabilized by non-covalent bonds
- B. Is temperature dependent
- C. Is determined by side chains
- D. Is formed by amino acids linked by covalent bonds

Correct: D

Primary structure is the linear sequence of amino acids linked by peptide bonds (covalent amide bonds). It is the genetic code made.

Mnemonic: Primary = Peptide bond sequence.



Q8 - Exam 2025: Tertiary Structure

The tertiary structure of proteins:

- A. Is random
- B. Is only due to H-bonds
- C. Only exists in fibrous proteins
- D. Ensures the 3D conformation essential for activity

Correct: D

Tertiary structure is the overall 3D folding driven by hydrophobic interactions, ionic bonds, and disulfides. It creates active sites.

Mnemonic: Tertiary = Three-Dimensional (3D).



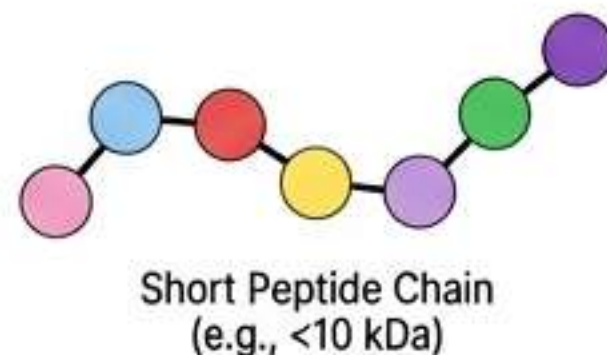
Q9 - Exam 2025: Peptide Definition

Which statement about peptides is TRUE?

- A. Mass > 100 kDa.
- B. > 50 amino acids.
- C. Always single chain.
- D. All answers are false.

Correct: D

Peptides are generally small (<10kDa, <50 AA). They can be multi-chain (e.g., Insulin). The listed constraints are incorrect.



Mnemonic: Peptides are 'Petite' proteins.

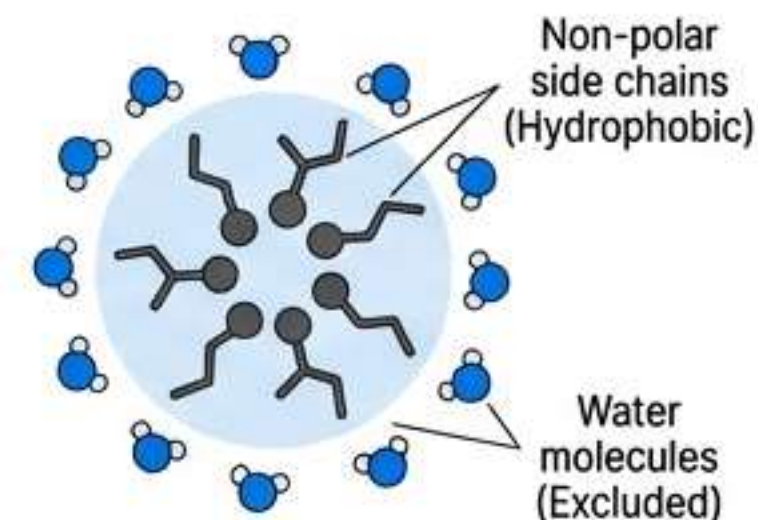
Q10 - Exam 2025: Bonding Types

Which bond type is NOT correctly described?

- A. Hydrogen bonds.
- B. Disulfide bonds.
- C. Hydrophobic bonds.
- D. Hydrophobic bonds form between polar side chains.

Correct: D

Hydrophobic interactions occur between **non-polar** side chains clustering to exclude water, never between polar chains.



Mnemonic: Phobics fear water, they stick together.

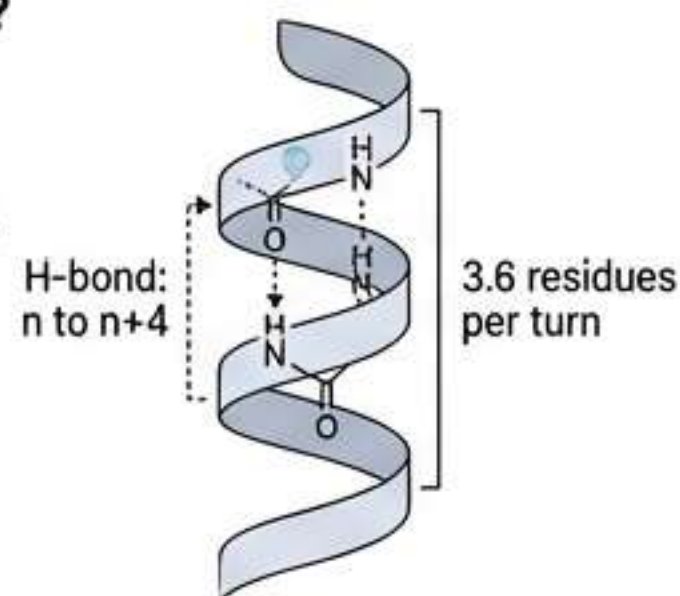
Q11 - Exam 2025: Alpha-Helix

Which statement about the α -helix is FALSE?

- A. It is a regular structure.
- B. Stabilized by intra-chain H-bonds.
- C. H-bonds form between residue n and $n+3$.
- D. 3.6 residues per turn.

Correct: C

In an α -helix, the Hydrogen bond forms between residue n and residue $n+4$. The $n+3$ pattern is for 3_{10} helices.



Mnemonic: 'n+4' fits the 'Floor' (Helix stability)

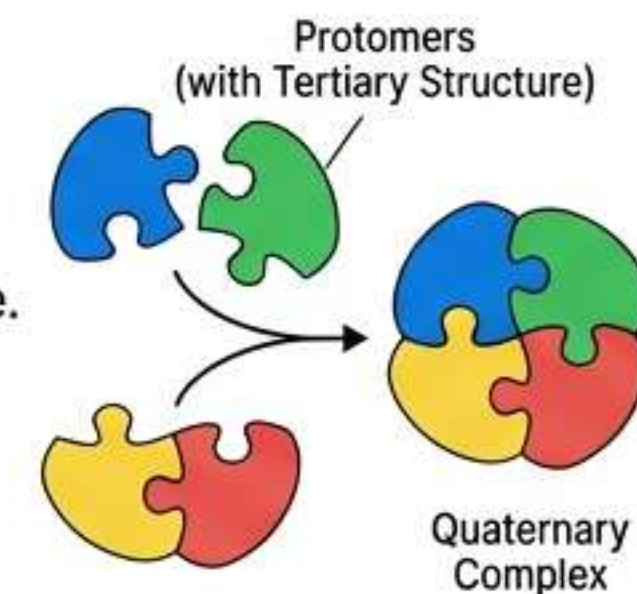
Q12 - Exam 2025: Quaternary Structure

The quaternary structure of proteins:

- A. Consists of multiple chains.
- B. Stabilized by non-covalent bonds.
- C. Each chain has tertiary structure.
- D. Protomers have only secondary structure.

Correct: D (False Statement)

Quaternary structure is the assembly of subunits (protomers). Each protomer **must** already possess a tertiary structure to assemble.



Mnemonic: Quaternary = Quantity (Multiple chains)

Q13 - Exam 2025: Assay Reagents

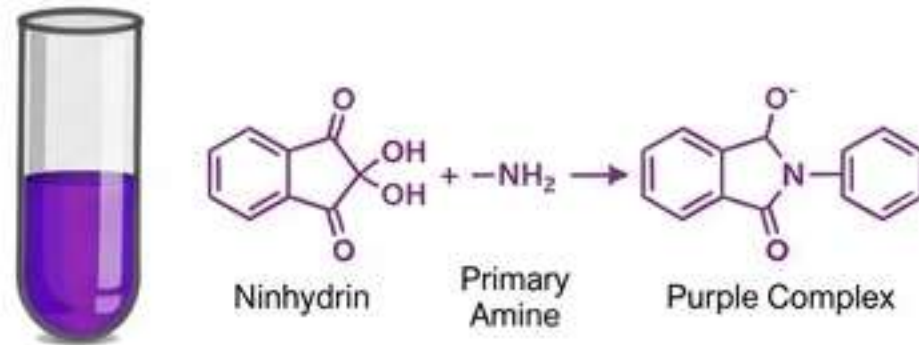
Which reagent is used to assay amino acids?

- A. Ninhydrin.
- B. Phenylisothiocyanate.
- C. Dansyl chloride.
- D. Biuret reagent.

Correct: A

Ninhydrin reacts with primary amines to produce a purple color (Ruhemann's purple), allowing quantitative analysis.

Mnemonic: "Nin'hydrin turns 'Nin'ja purple."



Q14 - Exam 2025: Solubility

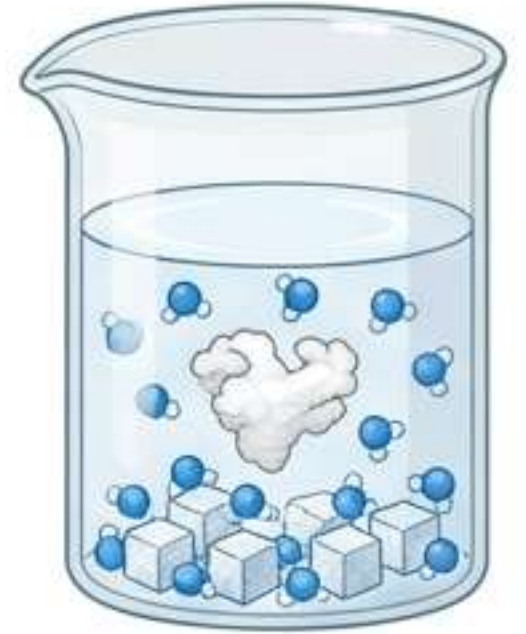
Protein solubility is minimal:

- A. At very acidic pH.
- B. At very basic pH.
- C. In salt-poor medium.
- D. In the presence of high salt concentration.

Correct: D

High salt concentrations compete for water, stripping the solvation shell and causing precipitation. This is '**Salting Out**'.

Mnemonic: "Salting Out = Spitting Out (Precipitation)."



Q15 - Exam 2025: SDS-PAGE

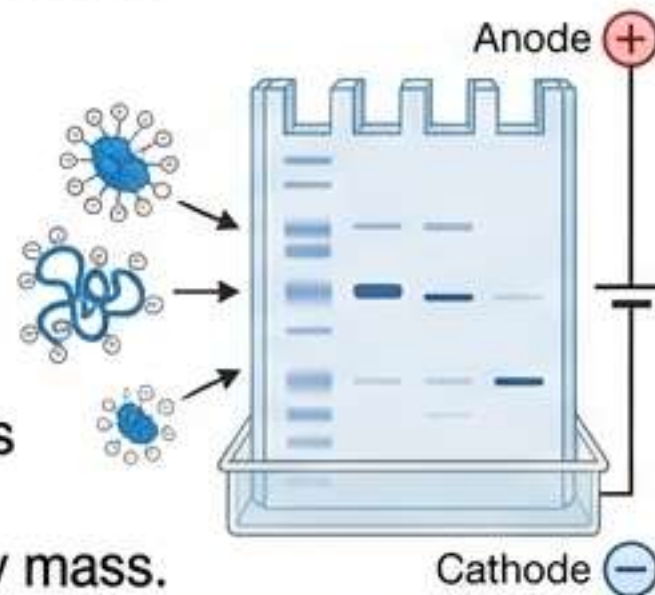
Which statement about SDS-PAGE is FALSE?

- A. SDS confers uniform negative charge.
- B. SDS breaks peptide bonds.
- C. Separation depends on mass.
- D. Used on polyacrylamide gel.

Correct: B

SDS is a detergent that denatures proteins and masks charge, but it **does not break covalent peptide bonds**. Separation is by mass.

Mnemonic: "SDS = Shape Destroying Stuff (Not Bond Breaker)."



Q16 - Case Study: Identification

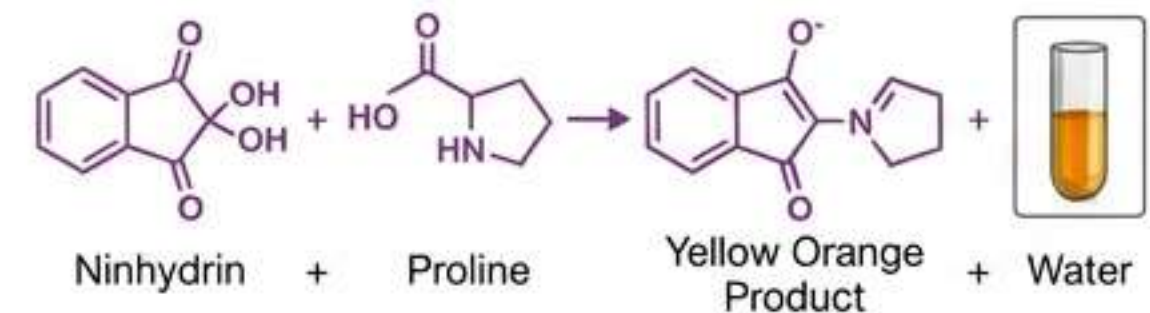
Mixture: Asp, Pro, Phe, Arg, Cys. Which gives a yellow color with Ninhydrin?

- A. Asp
- B. Pro
- C. Phe
- D. Arg

Correct: B

Proline is an imino acid (secondary amine). Unlike primary amines (purple), Proline yields a specific **yellow product**.

Mnemonic: "Proline = Yellow (like a pro jersey)."



Q17 - Exam 2025: Glutamine Synthesis

α -ketoglutarate \rightarrow glutamate \rightarrow glutamine is catalyzed by:

- A. Glutaminase.
- B. Carboxylase.
- C. Glutamate DH and Glutamine Synthetase.
- D. Transaminase.

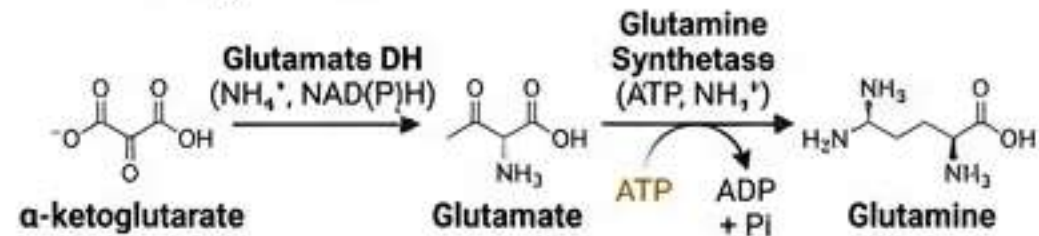
Correct: C

Explanation:

Step 1: Reductive amination by **Glutamate Dehydrogenase**.

Step 2: Amidation by **Glutamine Synthetase** (consumes ATP).

Mnemonic: 'Synth'etase 'Synth'esizes (Builds Gln).



Q18 - Exam 2025: Ammoniogenesis

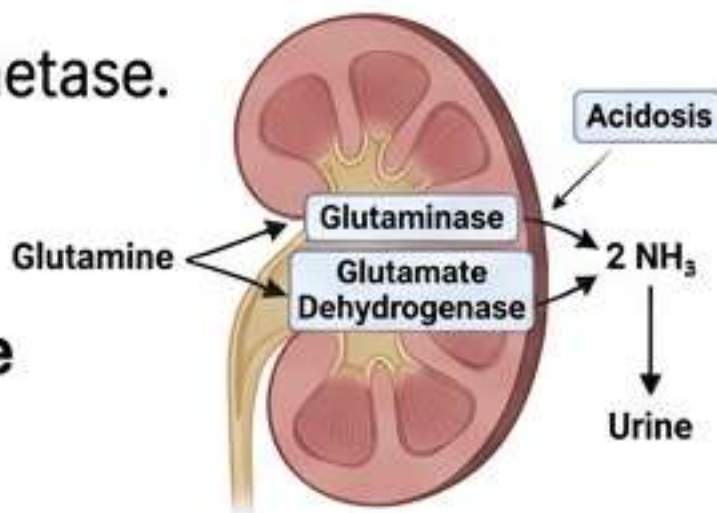
Regarding Renal Ammoniogenesis: Which is **FALSE**?

- A. Ammonia comes from Glutamine.
- B. Stimulated by acidosis.
- C. 2 NH_3 released by Glutamine Synthetase.
- D. Glutaminase is a key enzyme.

Correct: C

False. NH_3 is released by **Glutaminase** and **Glutamate Dehydrogenase**. Synthetase *consumes* ammonia.

Mnemonic: Genesis (creation) of ammonia releases it.



Q19 - Exam 2025: Urea Cycle

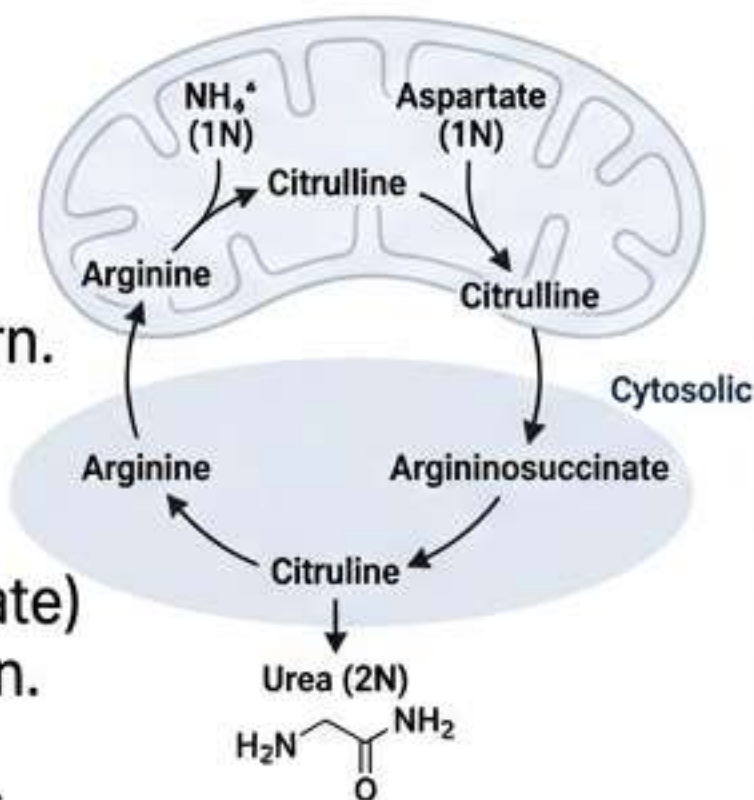
The Urea Cycle:

- A. Is entirely mitochondrial.
- B. Occurs in kidney.
- C. Consumes no ATP.
- D. Eliminates 2 Nitrogen atoms per turn.

Correct: D

The cycle converts 2 Nitrogen atoms (one from free NH_4^+ , one from Aspartate) into one molecule of **Urea** for excretion.

Mnemonic: Urea = Unload 2 Nitrogens.



Q20 - Exam 2025: Transamination

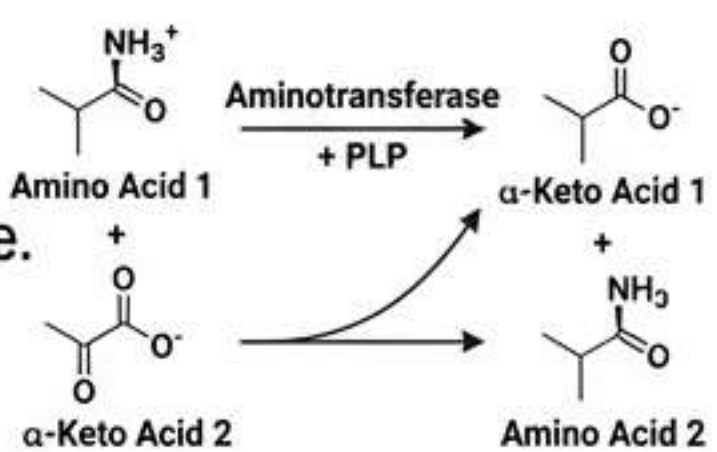
Transamination:

- A. Transforms ammonia to urea.
- B. Needs no cofactor.
- C. Produces CO_2 .
- D. Is catalyzed by an Aminotransferase.

Correct: D

Transamination transfers an amino group from an AA to a keto-acid. It requires **Aminotransferases** and cofactor **PLP** (Vit B6).

Mnemonic: Transferase = Transfer amino group.



Q21 - Exam 2025: Carbon Fate

Fate of Carbon Skeletons:

- A. Valine is ketogenic.
- B. Lysine forms Succinyl-CoA.
- C. Proline is ketogenic.
- D. Ile and Thr form Succinyl-CoA (glucogenic).

Correct: D

Isoleucine and **"Threonine"** are amphibolic. They feed into the Krebs cycle via **"Succinyl-CoA,"** enabling gluconeogenesis.



Mnemonic: 'I'le and 'T'hr are 'IT' (Do both).

Q23 - Exam 2025: Valine

Valine is:

- A. Polar.
- B. Hydroxylated.
- C. An essential amino acid.
- D. Phosphorylatable.

Correct: C

Valine is a branched-chain, non-polar amino acid. It is "essential," meaning the human body cannot synthesize it.

Mnemonic: 'V'aline is 'V'ital (Essential).

ESSENTIAL AMINO ACIDS

Histidine	Lysine
Isoleucine	Phenylalanine
Leucine	Threonine
Lysine	Tryptophan
Methionine	Valine
Phenylalanine	Arginine

Q22 - Exam 2025: Charge Properties

Which statement about amino acids is FALSE?

- A. Asp, Glu are polar ionizable.
- B. Phe, Tyr, Trp are aromatic.
- C. Ile and Leu are branched.
- D. All amino acids have zero charge at pH 7.

Correct: D

At pH 7, acidic AAs (Asp, Glu) are negative, and basic AAs (Lys, Arg) are positive. Only neutral AAs are uncharged.

Amino acid	pI
Asp	2.77
Glu	3.22
Lys	9.74
Arg	10.76

Mnemonic: pH 7 is Neutral ground, but Acids/Bases still fight.

Q24 - Exam 2025: pHi Calculation

Calc pHi of Glutamic Acid ($pK_{a1}=2.1$, $pK_{a2}=9.5$, $pK_R=4.1$):

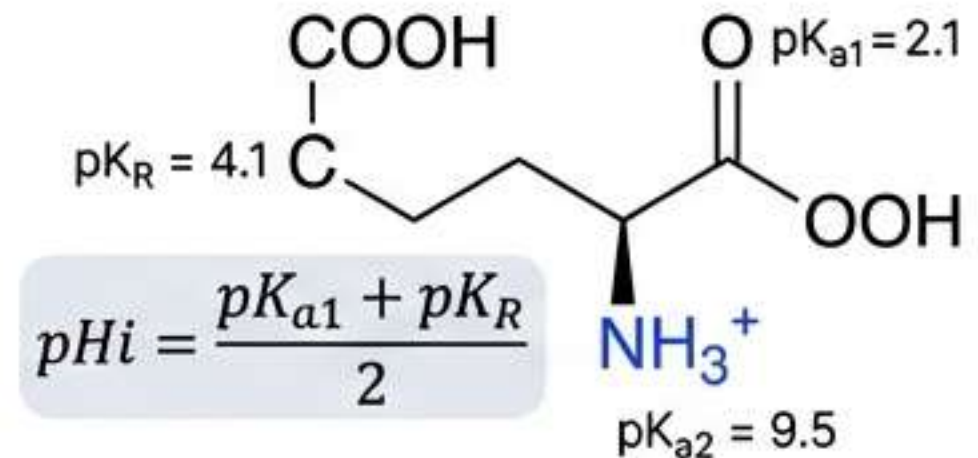
- A. 7.8
- B. 3.1
- C. 5.8
- D. 6.8

Correct: B

For acidic amino acids,
 $pHi = (pK_{a1} + pK_R) / 2$.

Calculation: $(2.1 + 4.1) / 2 = 3.1$.

Mnemonic: Acidic pHi? Average the 'low' numbers.



Q25 - Exam 2025: Electrophoresis

Electrophoresis of Lys, Leu, Asp at pH 6. Order?

- A. Lys → Cathode, Leu → Origin, Asp → Anode
- B. Lys → Anode
- C. Leu → Cathode
- D. All migrate same way.

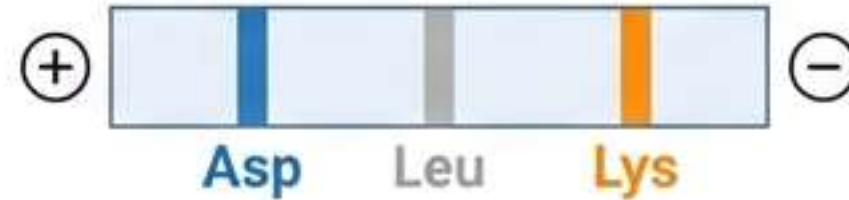
Correct: A

pH 6: **Asp** (pHi 2.8) is (-), goes Anode.

Lys (pHi 9.7) is (+), goes Cathode.

Leu (pHi 6.0) is neutral, stays at origin.

Mnemonic: 'A'sp → 'A'node.



Q26 - Exam 2025: Detection

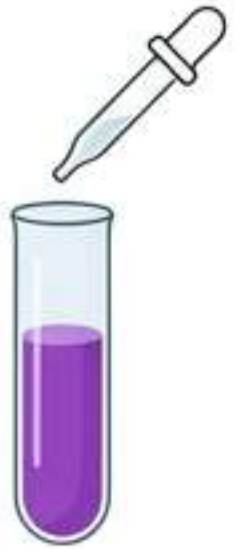
Which reagent produces a purple compound?

- A. Phenylisothiocyanate
- B. Acyl halide
- C. FDNB
- D. Ninhydrin

Correct: D

Ninhydrin reacts with primary amines to form Ruhemann's purple. It detects amino acids quantitatively.

Mnemonic: Purple = Protein + Ninhydrin.



Q27 - Exam 2025: Isoelectric Focusing

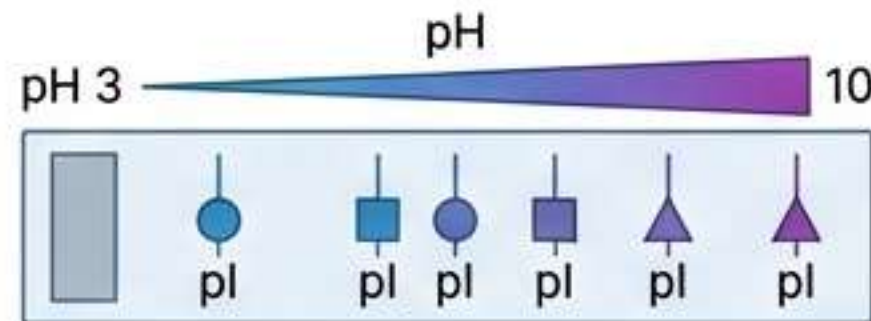
Isoelectric focusing separates proteins based on:

- A. Size.
- B. Molecular Weight.
- C. Density.
- D. Their pHi.

Correct: D

Proteins migrate in a pH gradient until they reach the pH equal to their **pHi**. At this point, net charge is zero and migration stops.

Mnemonic: Focus on the pHi-oint.



Q28 - Exam 2025: Cation Exchange

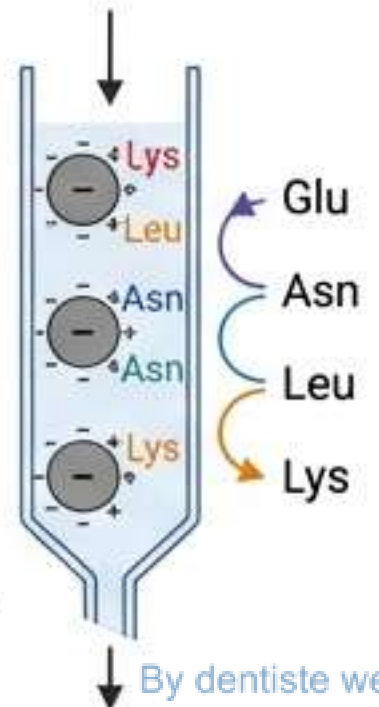
Cation Exchange (pH 2 → 10). Elution order: Glu, Asn, Leu, Lys?

- A. Lys, Leu...
- B. Glu, Asn, Leu, Lys.
- C. Leu...
- D. Asn...

Correct: B

Cation exchange holds (+) charges. Increasing pH elutes the most acidic first. Order = Increasing pHi: **Glu → Asn → Leu → Lys**.

Mnemonic: Lowest pHi leaves First.



Q29 - Exam 2025: Acid Hydrolysis

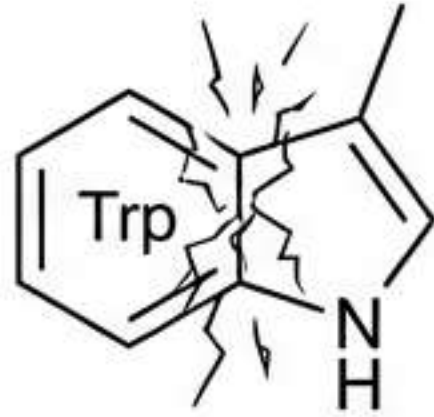
Total acid hydrolysis destroys which amino acid?

- A. Alanine
- B. Tryptophan
- C. Tyrosine
- D. Serine

Correct: B

Strong acid hydrolysis (HCl at $110^{\circ}C$) completely destroys the fragile indole ring of **Tryptophan**.

Mnemonic: Acid trips up Tryptophan.



Q30 - Exam 2025: pI Definition

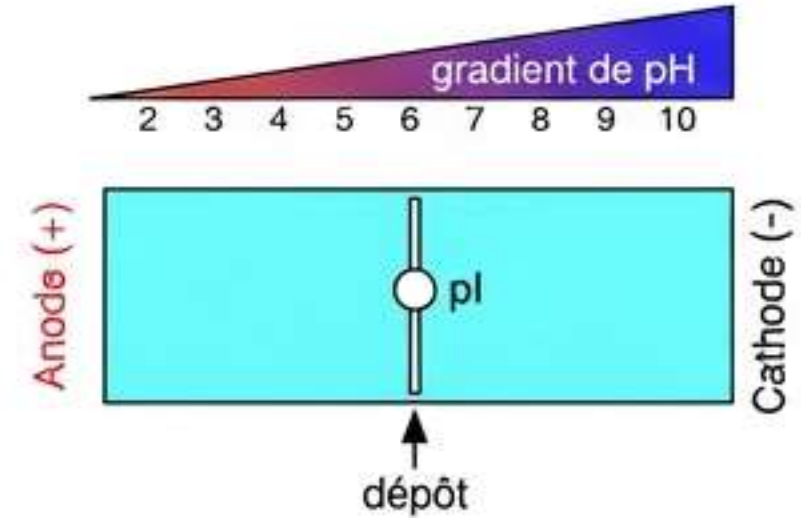
At the Isoelectric Point (pI):

- A. Equals $(pK_a + pK_b)/2$ for all.
- B. Positive charge.
- C. Depends only on side chain.
- D. Compound does not migrate.

Correct: D

At pI, net charge is **zero**. With no net charge, there is no attraction to electrodes, so **no migration** occurs.

Mnemonic: Zero charge = Zero movement.



Q31 - Exam 2025: Disulfide Bridges

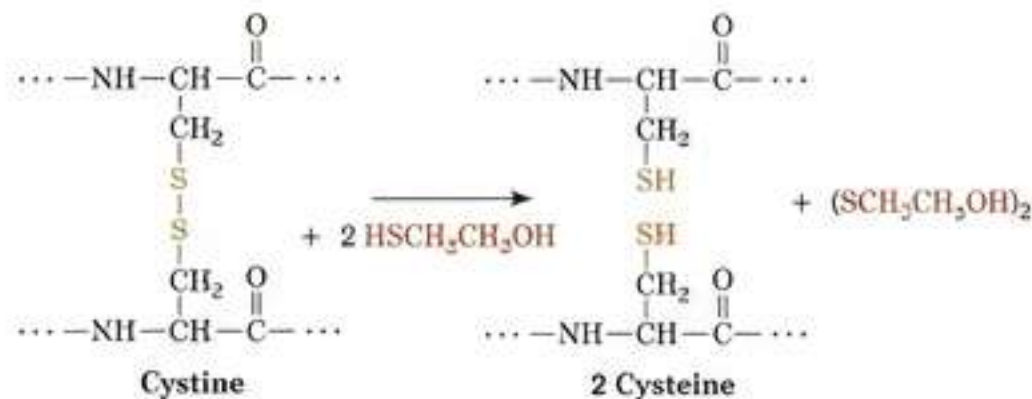
Rupture of disulfide bridges is done by:

- A. 2-mercaptoethanol.
- B. HCl.
- C. NaOH.
- D. Ninhydrin.

Correct: A

Disulfides (S – S) are reduced to thiols ($-SH$) by reducing agents like **β -mercaptoethanol**.

Mnemonic: Mercapto cuts the Map.



Q32 - Exam 2025: C-Terminal

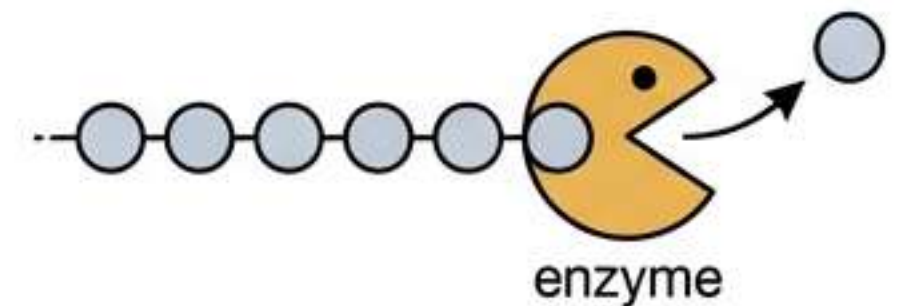
The C-terminal of a peptide is identified by:

- A. Ninhydrin.
- B. Endoproteases.
- C. Carboxypeptidase.
- D. Dansyl chloride.

Correct: C

Carboxypeptidases are exopeptidases that specifically cleave amino acids from the **C-terminal** end.

Mnemonic: 'C'arboxy for 'C'-terminal.



Q33 - Exam 2025: Biological Peptides

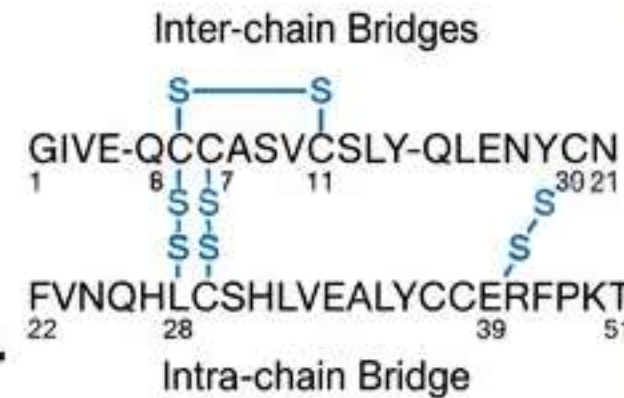
Which statement is **FALSE**?

- A. Insulin has two chains.
- B. Oxytocin has an internal loop.
- C. Vasopressin regulates BP.
- D. Insulin contains 3 inter-chain bridges.

Correct: D

Insulin has 3 disulfide bridges total, but **only two are inter-chain** (linking A and B). The third is **intra-chain** (within A).

Mnemonic: Insulin bridges: 2 across, 1 inside.



Q34 - Exam 2025: Hemoglobin

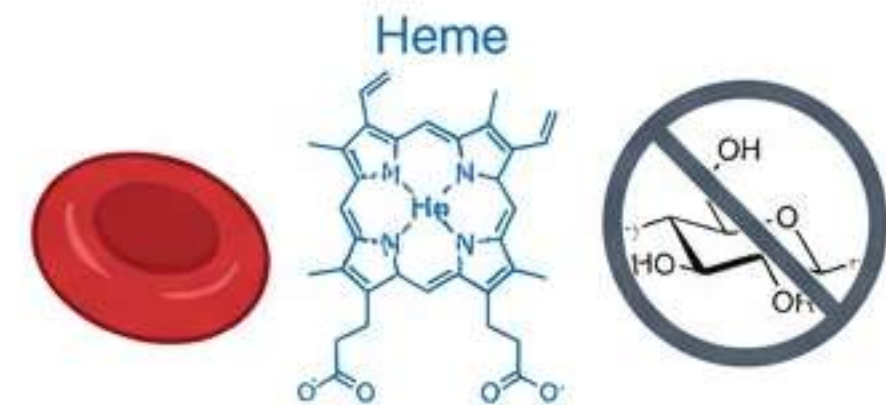
Hemoglobin:

- A. Has 4 polypeptide chains.
- B. Contains heme.
- C. Found in RBCs.
- D. Is a glycoprotein.

Correct: D

Hemoglobin is a **chromoprotein** (contains pigment heme). It is **not** a glycoprotein (no sugar attached).

Mnemonic: Hemoglobin = Heme + Globin (No Glyco).



Q35 - Exam 2025: Helix Bonding

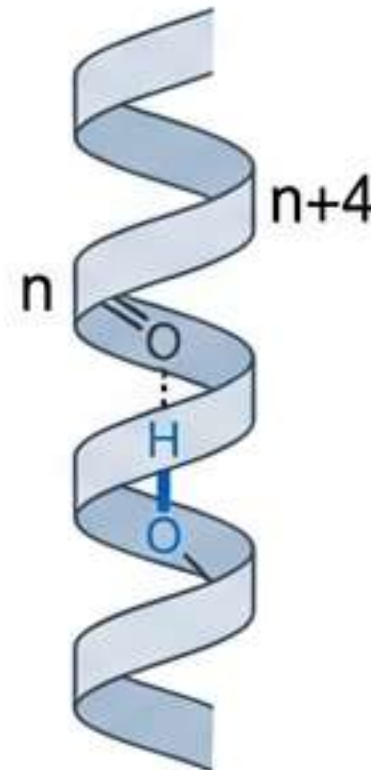
α -helix (**FALSE** statement):

- A. Regular structure.
- B. Stabilized by intra-chain H-bonds.
- C. H-bonds form between residue n and $n+3$.
- D. Side chains are outside.

Correct: C

In an α -helix, the Hydrogen bond is strictly between **n and $n+4$** . (n to $n+3$ is a rare 3_{10} helix).

Mnemonic: Alpha is Four ($n+4$).



Q36 - Exam 2025: Urea Cycle Output

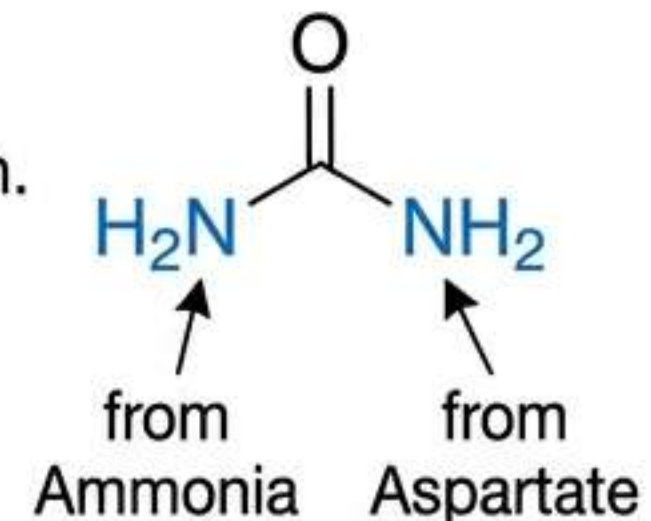
The Urea Cycle:

- A. Contains 3 mitochondrial reactions.
- B. Occurs only in kidney.
- C. Eliminates 2 Nitrogen atoms per turn.
- D. Involves no enzymes.

Correct: C

The cycle eliminates 2 nitrogens: one from free **ammonia**, the other from **Aspartate**, excreting them as Urea.

Mnemonic: Bi-cycle removes Bi-Nitrogens.



Q37 - Exam 2025: Transaminases

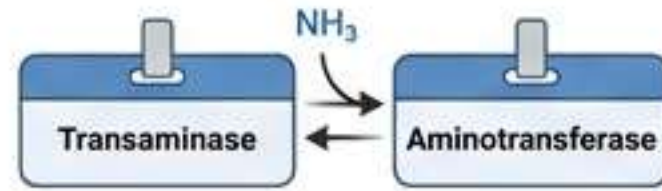
Transaminases:

- A. Convert amines to ammonia.
- B. Transfer a carboxyl group.
- C. Use NAD⁺ as cofactor.
- D. Are catalyzed by an Aminotransferase.

Correct: D

'Transaminase' is synonymous with **Aminotransferase**. They transfer amino groups using **PLP** (B6), not NAD⁺.

Mnemonic: Same enzyme, different name.



Q38 - Exam 2025: Carbon Fate 2

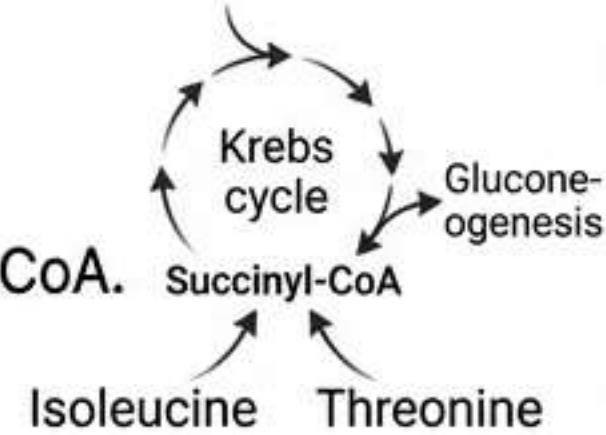
Fate of carbon skeleton:

- A. Lysine forms Fumarate.
- B. Proline is ketogenic.
- C. Isoleucine and Threonine form Succinyl-CoA.
- D. Tryptophan yields Glycine.

Correct: C

Isoleucine and **Threonine** feed into the Krebs cycle via **Succinyl-CoA**, allowing for gluconeogenesis.

Mnemonic: Success for Ile and Thr.



Q39 - Exam 2025: Protein Bonds

Bonds in protein structure (**FALSE**):

- A. Hydrogen bonds.
- B. Ionic bonds.
- C. Hydrophobic interactions.
- D. Hydrogen bonds between acid and base groups.

Correct: D

Interactions between fully charged acid (COO^-) and base (NH_3^+) groups are **ionic bonds** (Salt bridges), not Hydrogen bonds.

Mnemonic: Charges make Salt, not Water (H-bond).



Q40 - Exam 2025: Precipitation

Which protein property is **CORRECT**?

- A. Solubility max at pl.
- B. Precipitate in low salt.
- C. Precipitate with Trichloroacetic Acid (TCA).
- D. Resist proteases.

Correct: C

TCA is a strong acid used to denature and **precipitate** proteins out of solution for analysis or purification.

Mnemonic: TCA = Totally Coagulates All.



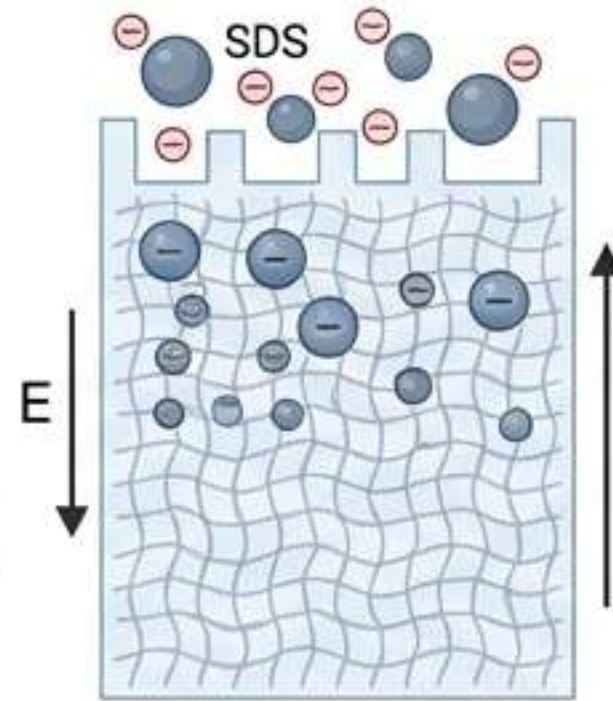
Q41 - Exam 2025: SDS-PAGE Mechanism

SDS-PAGE (**FALSE** statement):

- A. Proteins get negative charge.
- B. Separation depends on mass.
- C. Uses polyacrylamide gel.
- D. Separation is due to negative charge provided by SDS.

Correct: D

Separation is **NOT** due to charge differences (charge/mass ratio is constant). Separation is due to **sieving** (mass/size) through the gel.



Mnemonic: Size matters in PAGE, not charge.

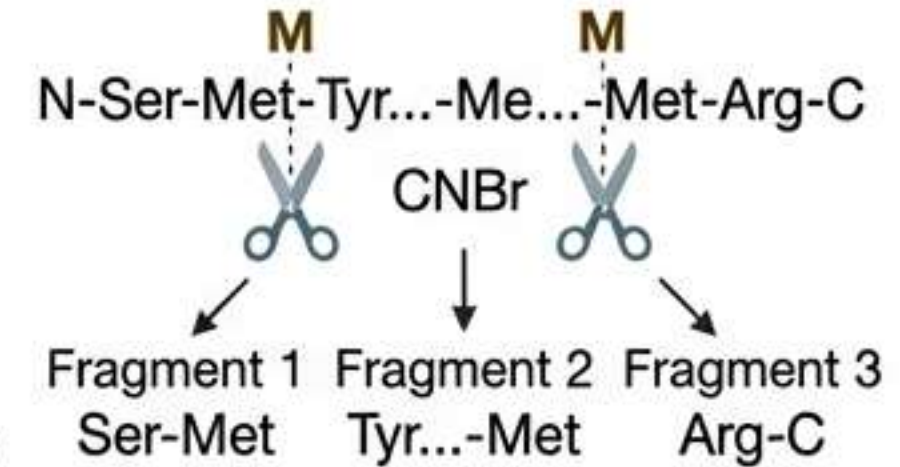
Q42 - Exam 2025: Peptide Mapping

BrCN cleaves after Met. How many fragments for:
N-Ser-Met-Tyr...-Met-Arg-C?

- A. 1
- B. 2
- C. 3
- D. 4

Correct: C (3 Fragments)

CNBr cleaves after **Methionine**. The peptide has 2 Mets. Cleavage occurs after Met #2 and Met #14, creating **3 fragments**.



Mnemonic: Methionine = Middle cut (CNBr).

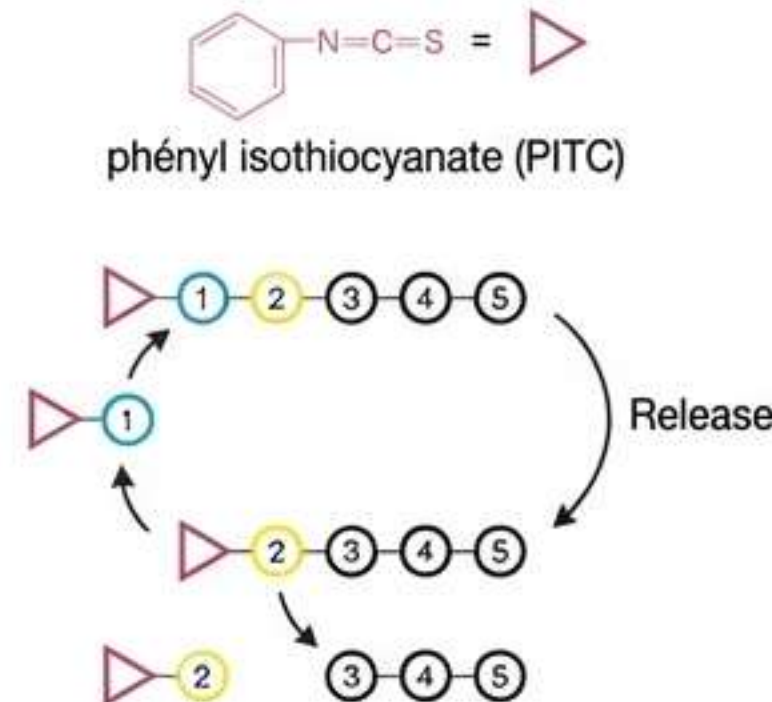
Q43 - Course Concept: Edman

Edman Degradation determines:

- A. C-terminal amino acid.
- B. N-terminal amino acid.
- C. Internal sequence.
- D. Total hydrolysis.

Correct: B

Edman degradation (using PITC) specifically labels and removes the **N-terminal** amino acid, allowing cyclic sequencing.



Mnemonic: Edman starts at the End-man (N-terminus).

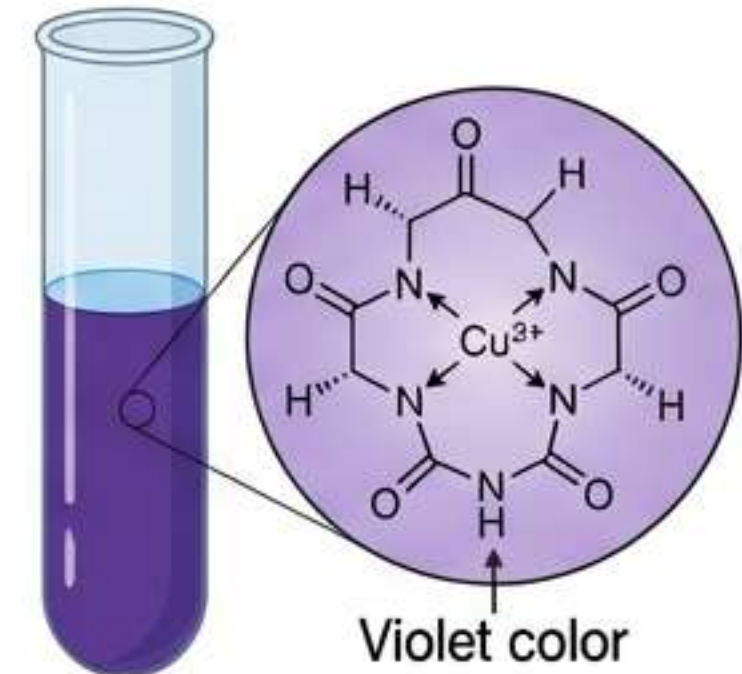
Q44 - Course Concept: Biuret

The **Biuret** reaction detects:

- A. Free amino acids.
- B. Peptide bonds.
- C. Aromatic rings.
- D. Reducing sugars.

Correct: B

The Biuret reagent (Copper) reacts with **peptide bonds** (requires >2 bonds) to form a violet complex. It measures protein concentration.



Mnemonic: Biuret = Bond (Peptide).