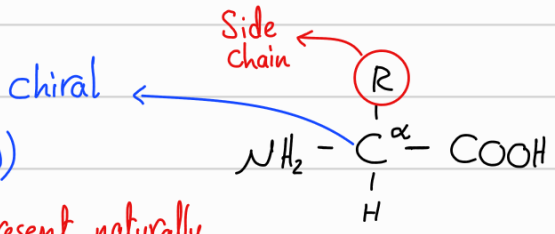
Amino Acids



L, D ⇝ Amino group on Left (L) or Right (D)

proteins contain only (L) ↳ Can present naturally

☆ We have 20 amino acids

such as Bacterial cell wall and antibiotics

Types of amino acids

1) Non-polar

Glycine ⇝ (R = H)
- Simplest, Achiral
- Derived from acetic acid and aminoethane

Alanine ⇝ (R = CH_3)

Valine (R = 2C + 1β)

Leucine (R = 3C + 1Y)

IsoLeucine (Ile) (R = 3C + 1β)

Branched, essential

Methionine (R = C-C-S-C)
- Thioether
- It is the precursor of SAM

Proline (R = C-C-C)
- Secondary amine

Phenylalanine (F)
- phenyl, Benzene

Tryptophan (Trp, W)
- R = indole (2 rings)
- largest A.A

2) Polar, uncharged

Serine (R = C-OH)

Threonine (R = C-C-OH)

Tyrosine (Y) (R = ○-OH)
- benzene + OH

Asparagine (Asn, N) (R = C-C(=O)-NH_2) — amide group

Glutamine (Gln, Q) (R = C-C-C(=O)-NH_2)

Cysteine (R = C-SH) — Sulfedryl, thiol

3) Polar, acidic ⊖

Aspartic acid (D) (R = C-C(=O)-O^-)

Glutamic acid (E) (R = C-C-C(=O)-O^-)

4) Polar, Basic ⊕

Lysine (K) (R = C-C-C-C-NH_3^+)

Arginine (R) (R = C-N, C(NH_3^+), N)
- Guanidinium

Histidine (R: imidazole ring)
- Imidazole

Derivatives of amino acids

Tyrosine: 1) Catecholamines → Epinephrine, Norepinephrine, Dopamine

2) Melanin → Eu ⇝ brownish; pheo ⇝ Redish-yellow

3) Thyroxine

4) Tyramine (Tyr ⇝ XCOOH) ⇝ cheese
- similar to epinephrine

Histidine: Histamine (His ⇝ XCOOH)
- Neurotransmitter
- Allergic mediator, inflammation
- asthma

Glutamate 1) GABA
- Synthesized in brain
- Can't cross BBB
- Inhibitory NT ⇝ anti-anxiety, anti-convulsive, Relaxing

2) Gla ⇝ clotting

Glu —(vit. K)→ Gla attract Ca^{+2}

3) MSG (mono-sodium Glutamate)
- Asian food
- Chills, headache, dizziness
- Chinese resturant syndrome

Tryptophan
1) Melatonin: Day-nigh cycle (sleeping)
2) Serotonin (5-hydroxytryptamine): Sedative

Arginine: Arg —(NADPH)→ NO

NO
- Vasodilation
- ↓ clotting, ↓ leukocyte
- Scavenging superoxide anion

Start codon (AUG) encodes Met

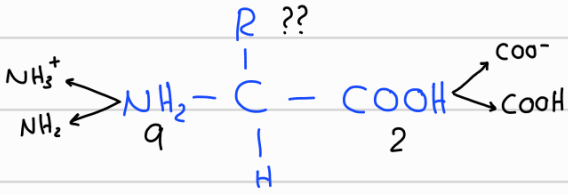
Lysine & Proline:

Hydroxylysine, Hydroxyproline ⇝ strenghthen Collagen

Zwitterion, Isoelectric point (PI): pH where the net charge of amino acid is Zero

Non-Ionizable ⇝ non-polar A.A , only 2 pka

Ionizable ⇝ polar A.A , 3 pka



What is the charge of Phenylalanine at:

1) pH = 5 2) pH = 13

3) pH = 1 4) pH = 9

what is the charge of Glutamate at: (pka = 4.1)

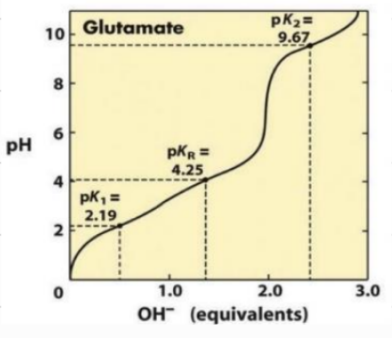
1) pH = 7 2) pH = 4

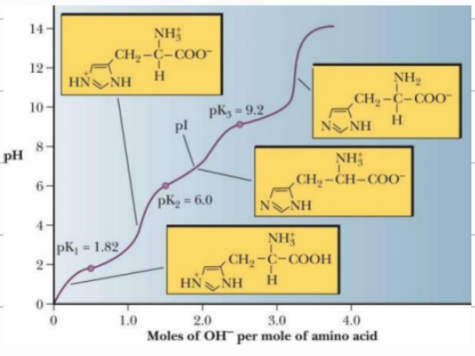
Find out the Zwitterion point for:

A) Arginine (pka = 12.5)

B) Methionine

C) Glutamate D) Histidine





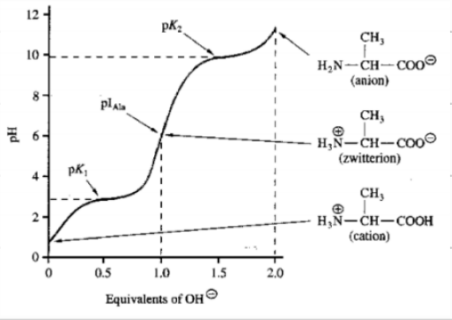
Which of the following amino acids could have the this curve:

A) Threonine

B) Glycine

C) Arginine

D) Aspartate



* Elements ⇝ Major → Primary (O, N, H, C)
  → Ca, P
  → lesser, minor (metals)

* Bonds 1) Covalent
  Share of electrons < Equal ⇝ Non polar
  Unequal ⇝ Polar dipole (δ^-, δ^+)

2) Non Covalent
A) Charged-charged (Electrostatic, Ionic)
B) Hydrogen bonds
  → H between 2 electronegative
C) Van Der Waals ⇝ weakest, transient
  → unequal distribution of electrons
D) Hydrophobic interactions
  → Between Non-polar

Polar Bonds ⇝ difference in the electronegative
Non-polar bonds ⇝ similar electronegative

→ inversely related
Bond length ⇝ distance
Bond strength ⇝ energy required to break bonds
Bond orientation ⇝ angles

Carbon can form 4 bonds (single, double, triple)
→ pure carbon is water insoluble