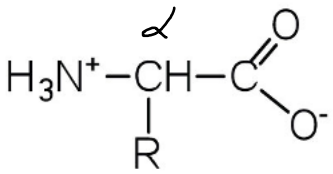
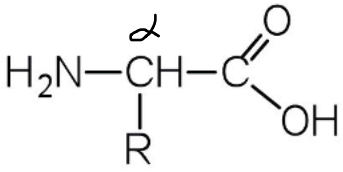
Chemistry 2, HW 24

Every amino acid has a central carbon atom (alpha carbon) bonded to a carboxylate group ($-COO^-$), an ammonium group ($-NH_3^+$), a hydrogen atom, and a side chain group (R group). The differences in the amino acids are due to the differences in the R groups. The proper form of amino acid is ionized structure called zwitterion, where COOH group lose proton and NH_2 group accept proton.



α-Amino acid drawn as a zwitterion

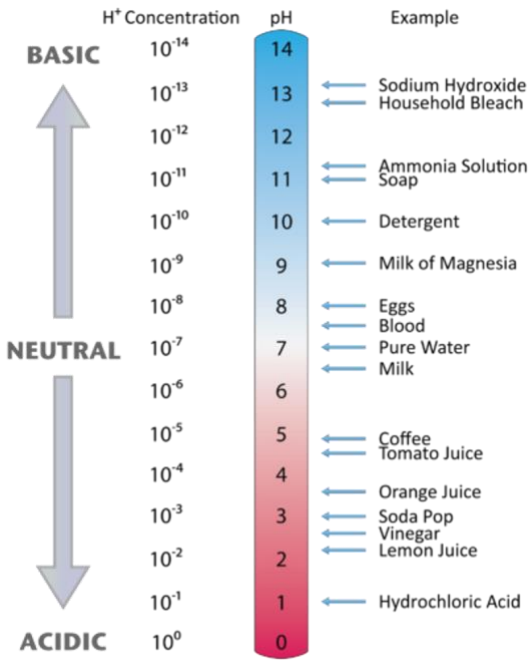


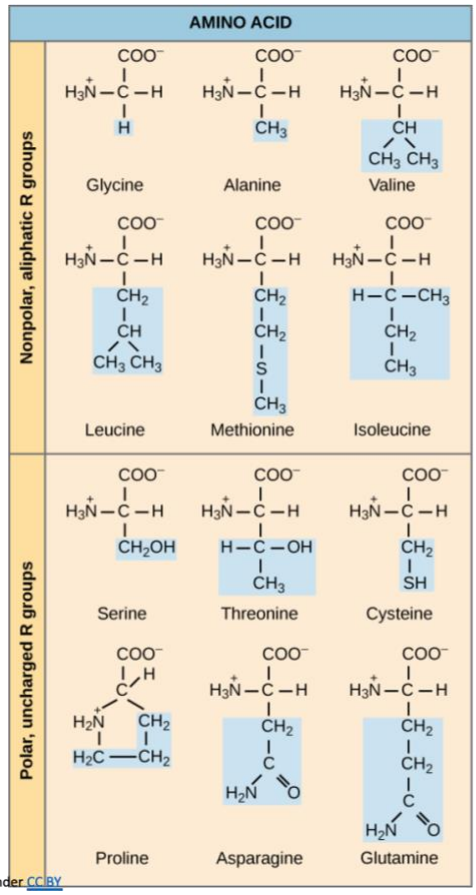
α-Amino acid drawn as an uncharged molecule; not an accurate respresentation of amino acid structure

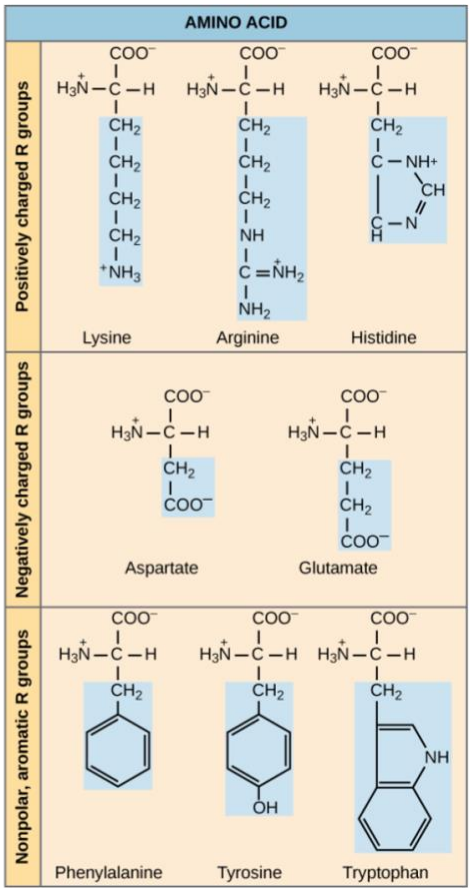
Classification of amino acids

1. Nonpolar amino acids: R group is alkyl or aromatic group, which make amino acid hydrophobic ("water fearing")
2. Polar amino acids contain polar R groups such as -OH, -SH, -CONH2, they are hydrophilic, they interact with water.
3. Acidic amino acids where R groups have $-COO^-$ group.
4. Basic amino acids contain R group that have NH_3^+ group.

At a specific pH known as the isoelectric point (pI), the positive and negative charges of an ionized amino acid are equal. Glycine has pI = 6. If we put it into more acidic solution (pH lower than 6), COO^- group will accept the proton to form COOH, because NH_3^+ group still has the positive charge, the overall charge of glycine molecule will be positive.
If we put the same amino acid in more basic solution (higher pH), NH_3^+ group will donate the proton, the overall charge on the amino acid will be negative.







Questions:

1. Compare valine, threonine, lysine and glutamate. What type of atoms and group of atoms they have in their R group, are they polar or not, are they acidic or basic and why?
2. pI of cysteine equals 5.1. What dies it mean? At pH 3.0 how does the zwitterion change? At pH 8.5 how does the zwitterion change?