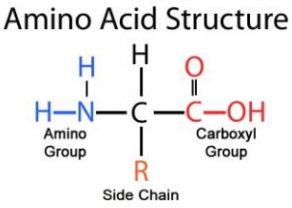
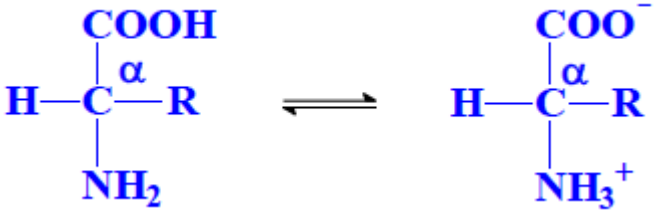
Amino acids

Amino acids: - are a group of organic compound containing two functional groups (amino and carboxyl) on the same molecules. Amino acids are considered the structural units of proteins. The amino group (–NH_2) is basic while the carboxyl group (–COOH) is acidic in nature.



- When the amino group and the carboxyl group are attached to the same carbon atom the amino acid are termed as α-amino acid.
- Side chain (R) means the alkyl groups that change according to the chemical nature of α-amino acid.

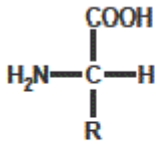


➢ Optical Properties of Amino Acid

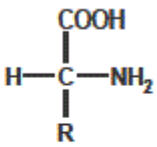
The asymmetric carbon atom which attached with four different groups and possess the optical property. Therefore all the amino acid (except Glycine where R=H) have optical properties (optical isomers and ability to rotate the polarize light).

The structure of (L- and D-amino acid) is written based on the direction of the functional group (–NH_2) in the amino acid configuration.

Amino acids



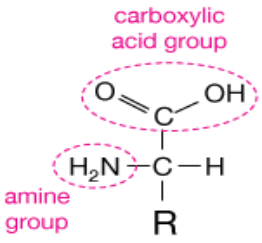
L-amino acid



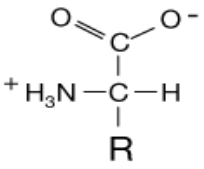
D-amino acid

➢ The Acid – Base Properties of Amino Acid

All amino acid contains an acidic carboxylic group and a basic amino group. It can form a *Zwitter ion* at pH=7. Zwitter ion forms when carboxylic group releases it proton and remains in an anionic form and NH2 group takes a proton and becomes in a cationic form. At this pH it is called *Isoelectric point (IP).*



amino acid



Zwitterion form

This behavior is called as Ampholyte

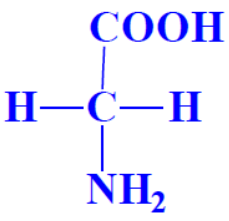
Ampholytes are amphoteric molecules that contain both acidic and basic groups and will exist mostly as zwitterions in a certain range of pH. Ampholytes are used to establish a stable pH.

➢ Classification of Amino Acid

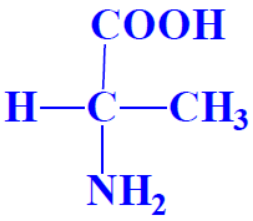
The comprehensive classification of amino acid is based on the structures of side chain (R) and chemical nature.
Each amino acid is assigned a 3 letter or 1 letter symbol. These symbols are refers to the amino acid. There are 20 α-amino acid found in proteins and divided into.

Amino acids

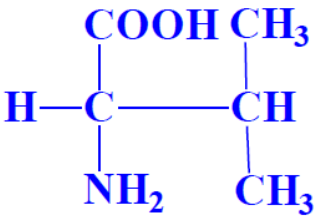
1. Aliphatic amino acids.



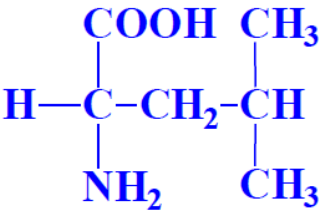
glycine (Gly)



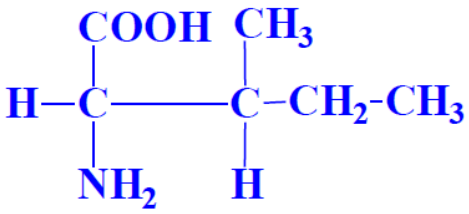
alanine (Ala)



valine (Val)



leucine (Leu)



isoleucine (Ile)

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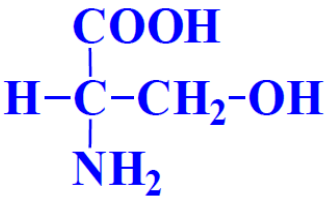
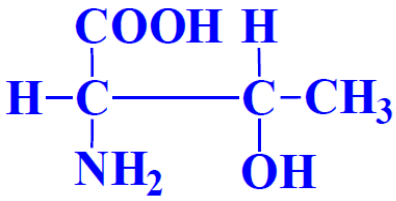
2. Hydroxyl amino acids.



serine (Ser)



threonine (Thr)

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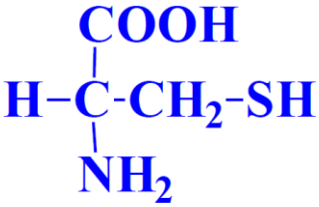
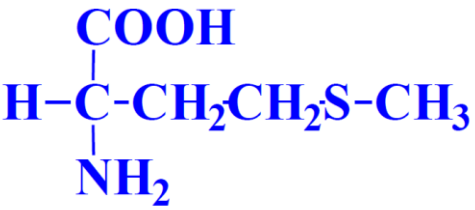
3. Sulfuric amino acids.



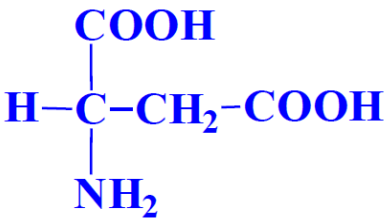
cysteine (Cys)



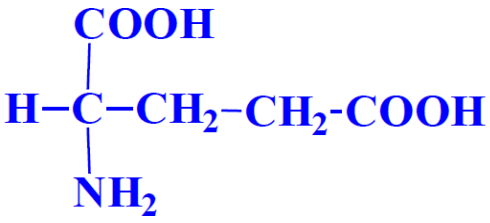
methionine (Met)

Amino acids

4. Acidic amino acids and their amides.

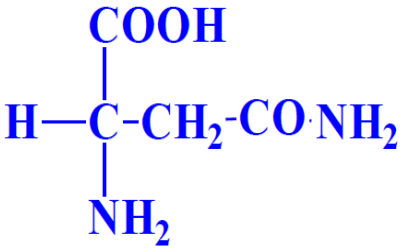


aspartic acid (Asp)

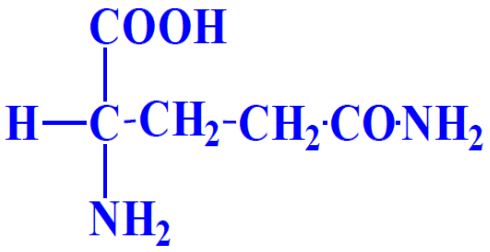


glutamic acid (Glu)

Their monoamides (with carboxamide group in the side chain)



asparagine (Asn)



glutamine (Gln)

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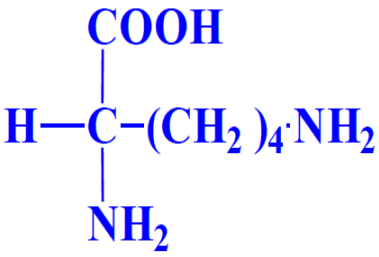
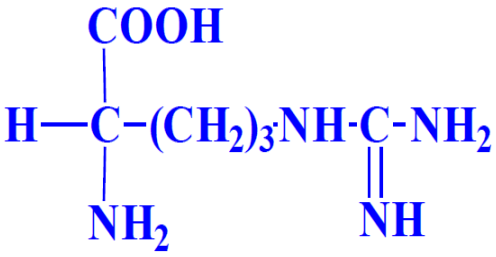
5. Basic amino acids.

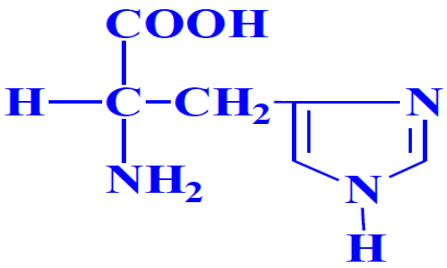


lysine (Lys)



arginine (Arg)

Amino acids



histidine (His)

- The side chain of histidine is (an imidazole ring which consider as aromatic heterocyclic)
  But the histidine consider as basic amino acid.Because the non-protonated nitrogen in the ring has a lone pair that it actively donates in several biochemical reactions Lone pair donator = Lewis base.

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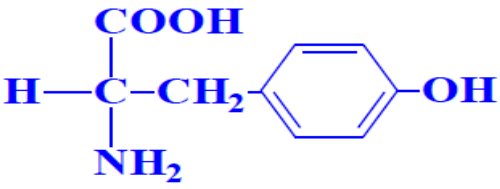
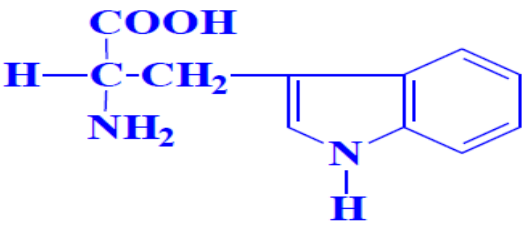
6. Aromatic amino acids.



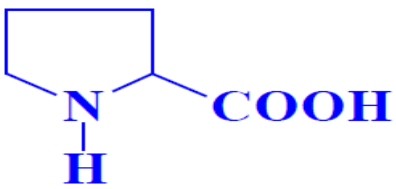
phenylalanine (Phe)



tyrosine (Tyr)



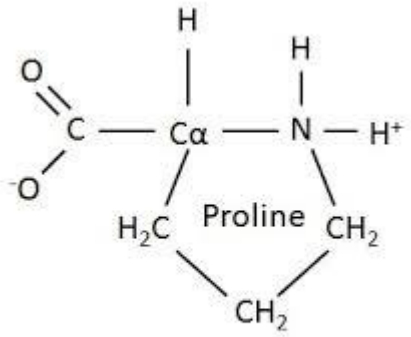
tryptophan (Trp)



proline (Pro)

Amino acids

- Proline is the only amino acid with a secondary amine, in that the alpha-amino group is attached directly to the main chain, making the α carbon a direct substituent of the side chain.



➢ **Essential and Non Essential Amino Acid**

- **Essential amino acids :-** the amino acids which cannot be synthesized by the body and have to provided in the diet.the essential amino acid are leucine (Leu) , isoleucine (Ile) , threonine(Thr) , tryptophan (Trp) , phenylalanine (Phe) , valine (Val) , methionine (Met) and lysine (Lys) . some amino acid such as histidine (His) and arginine (Arg) are syntheized in tissues but not adequate amount for normal growth of small childreny these two amino acids are often classified into *semi-essential amino acid* .
- **Non Essential amino acids:-** the amino acids which can synthesized by the body. the nonessential amino acid are alanine(Ala) , aspartic acid (Asp) , asparagine (Asn) , cysteine (Sys) , glutamic acid (Glu) , glutamine (Gln) , glycine (Gly) , proline (Pro) , serine (Ser) and tyrosine (Tyr).