

AMINO ACIDS

The amino acids are building blocks of protein. They are present in a particular protein in a particular sequence that can be regarded as the spelling of protein. For instance two words differ in the sequence of letters. Similarly, two proteins can be different in the sequence of amino acids. The amino acids are termed as α -amino acids as the α carbon is attached to basic amino group and acidic carboxyl group.

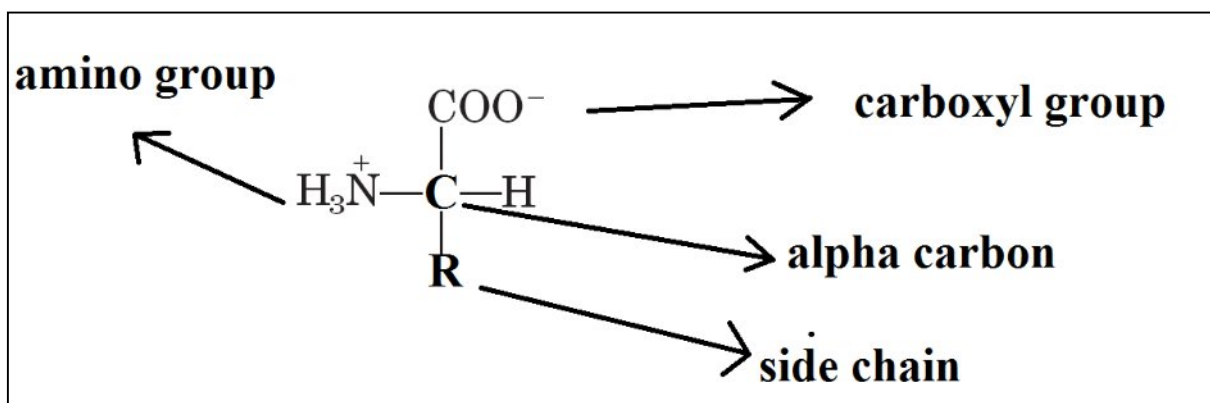
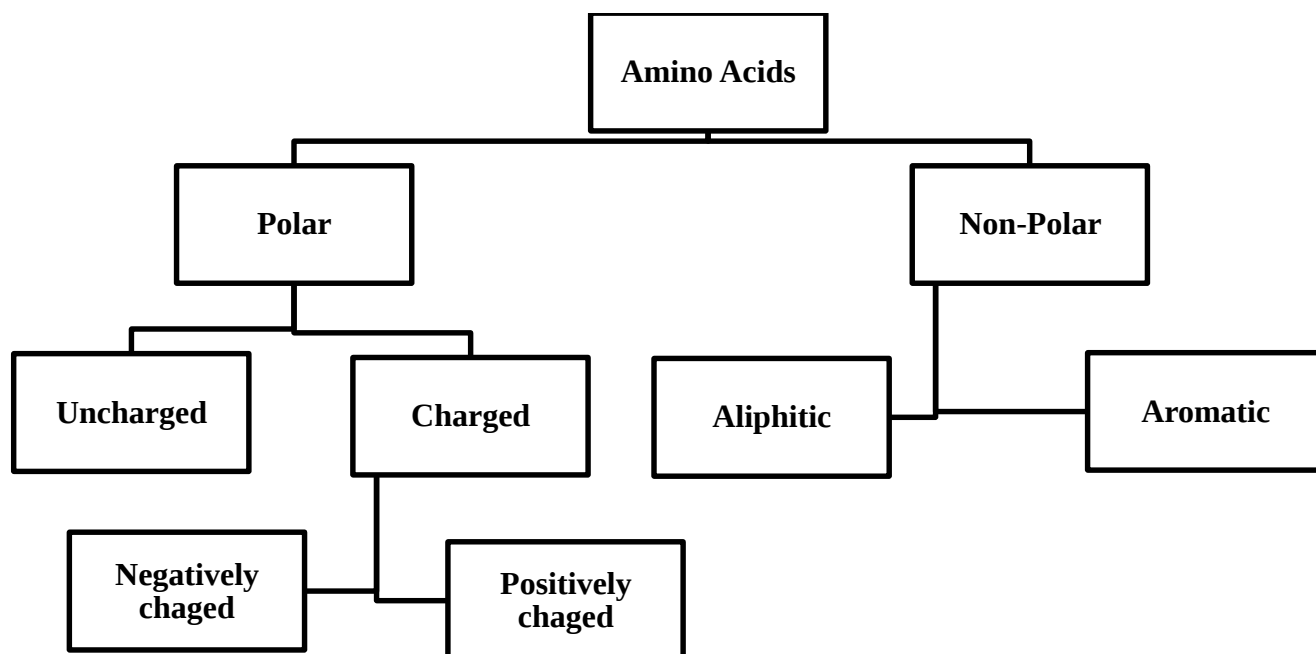


Fig. The general structure of amino acid.

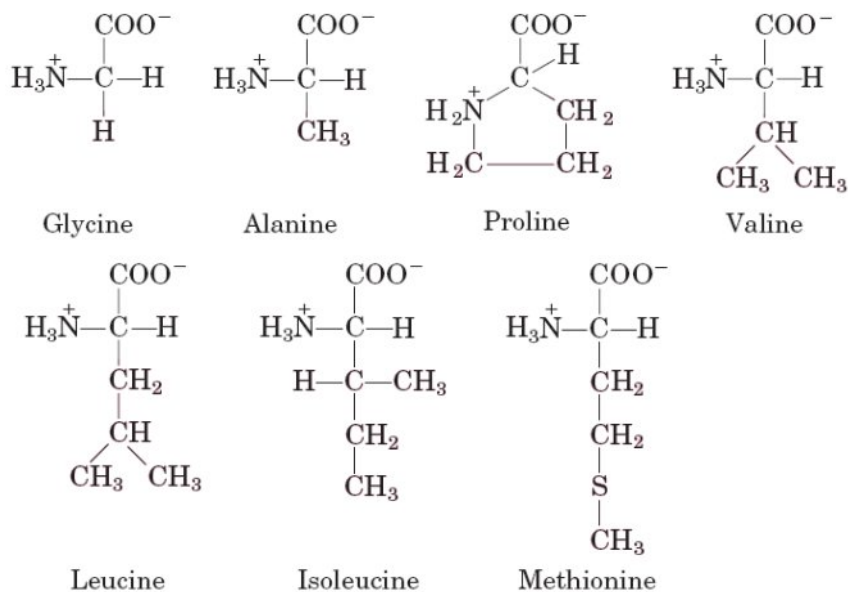
The amino acids are called so due to presence of one amino group and one carboxyl group (making a kind of carboxylic acid). All the amino acids differ in their R-group or the side chain. The R-group influences the physico-chemical properties of an amino acid.

There are 20 different α -amino acids.

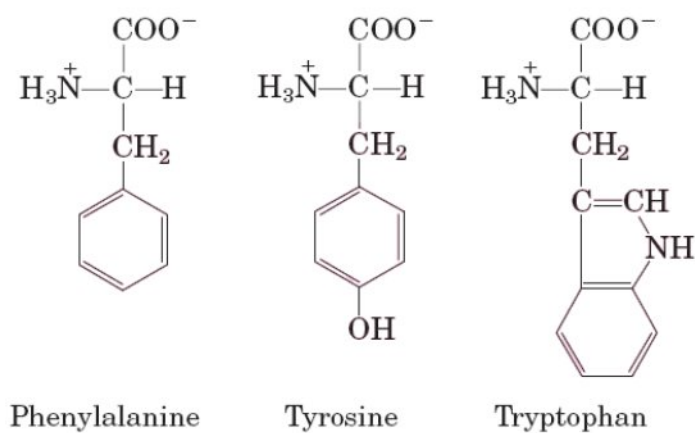
CLASSIFICATION OF AMINO ACIDS:



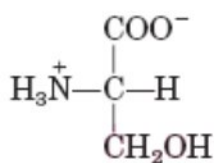
A. Amino Acids Having Non-polar side chains (Aliphatic):



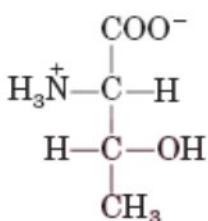
B. Amino Acids Having Non-polar side chains (Aromatic):



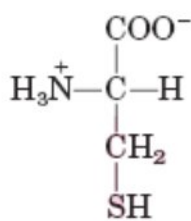
C. Polar Amino Acids (Uncharged):



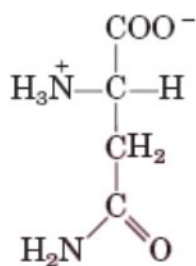
Serine



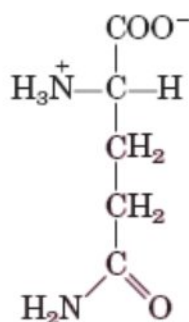
Threonine



Cysteine

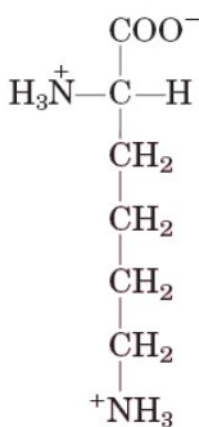


Asparagine

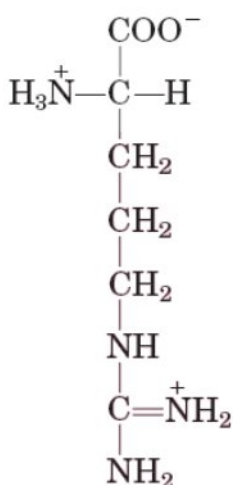


Glutamine

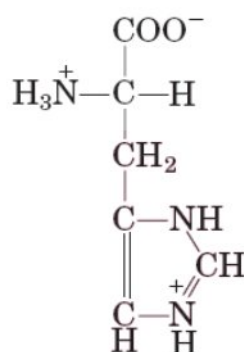
D. Positively Charged Polar Amino Acids.



Lysine

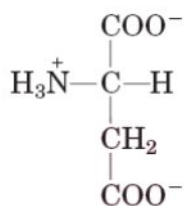


Arginine

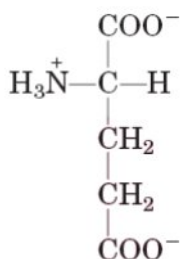


Histidine

E. Negatively Charged Polar Amino Acids



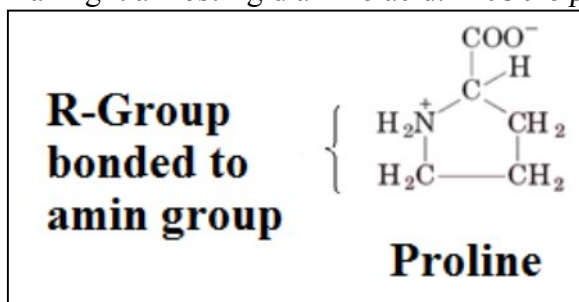
Aspartate



Glutamate

Physical Properties of amino acids:

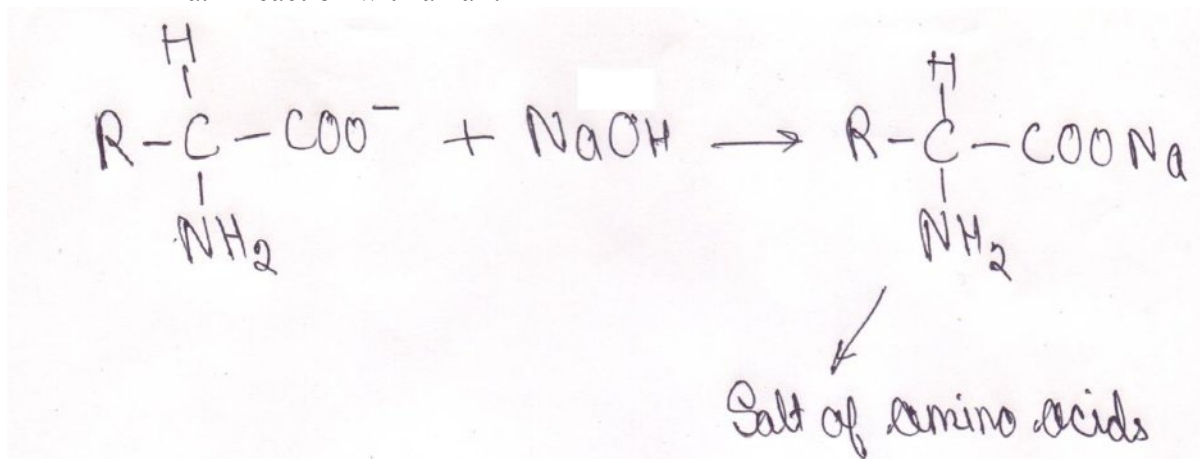
1. High melting point.
2. Do not absorb visible light thus are colourless. The tyrosine, tryptophan and phenylalanine absorb UV light in the range of 250-290 nm.
3. The R-group of amino acids determine the location of amino acids in the protein. E.g. the hydrophobic amino acids (Non-polar) reside in the core of the protein and polar (hydrophilic) amino acids reside on the surface of cytosolic or other soluble proteins.
4. Taste: Glycine, Alanine and Valine are sweet tasting amino acids. Arginine and isoleucine are bitter tasting amino acids.
5. All amino acids except glycine are optically active having at least one asymmetric carbon. *The isoleucine and threonine have two asymmetric carbon.*
6. The glycine is the simplest amino acid and the proline is the most rigid amino acid. In all amino acids, except proline, the R-group does not form any bond with amino or carboxyl group. In proline, the R-group is bonded to amino group making it a most rigid amino acid. *Thus the proline is also called imino acid.*



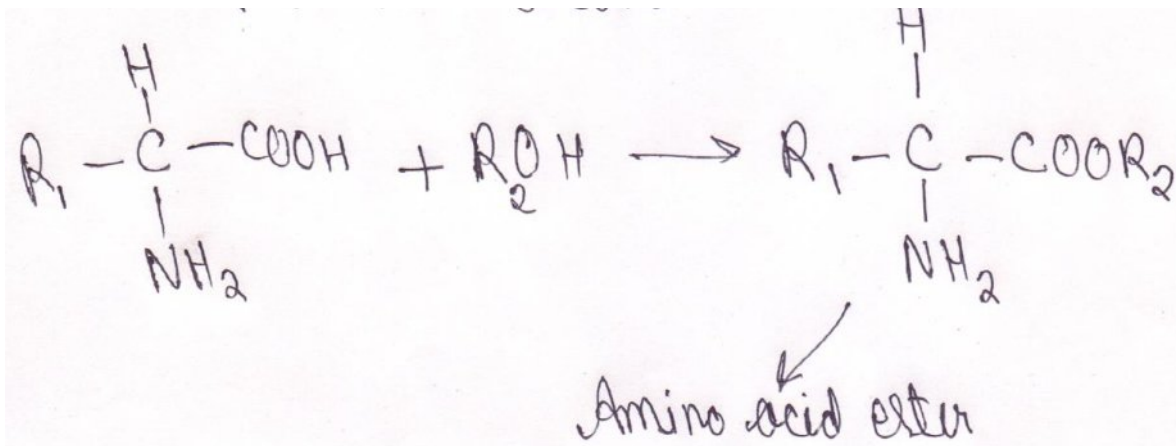
Chemical properties of amino acids:

1. Reactions involving COOH Groups:

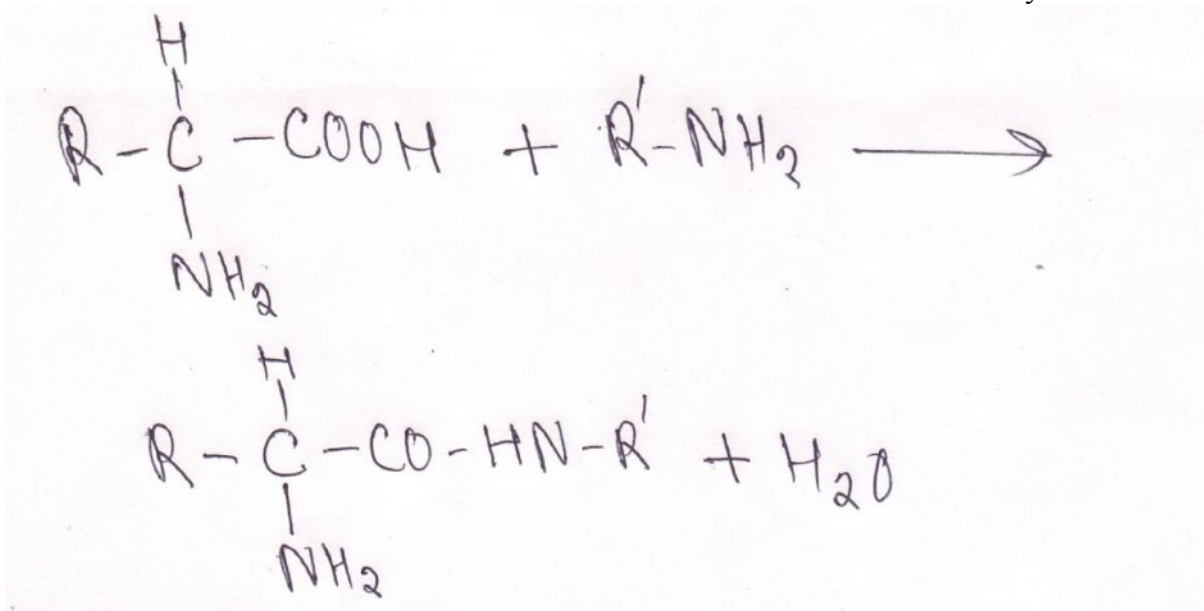
a. Reaction with alkali:



- b. Reactions with alcohols: causes esterification

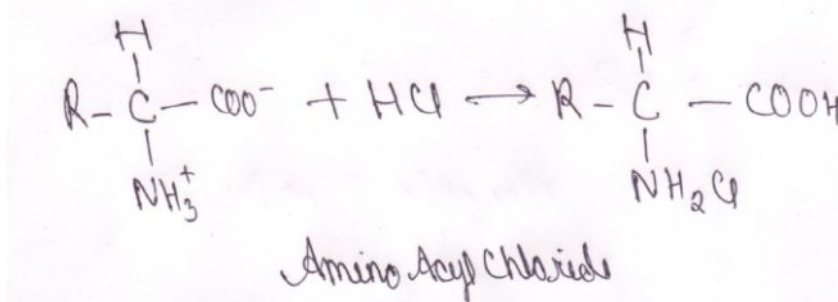


c. Reaction with amines: amino acids reacts with amines to yield amides

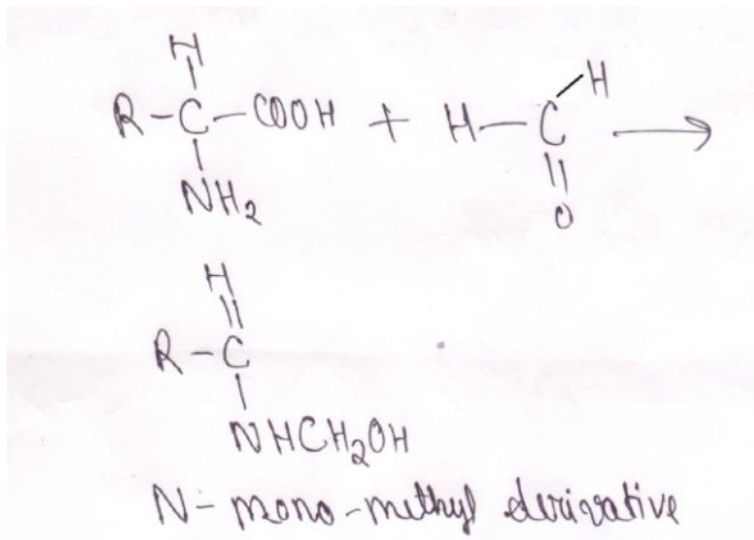


2. Reactions involving NH_2 group:

a. Reaction with mineral acids: This leads to formation of salt called *amino acid salt*.

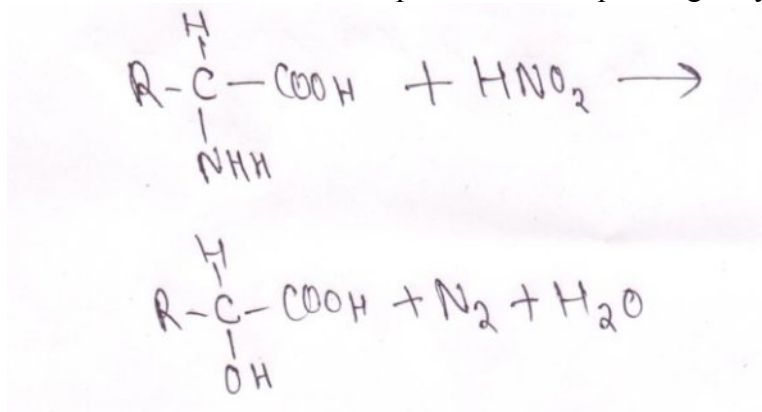


b. Reaction with formaldehyde:



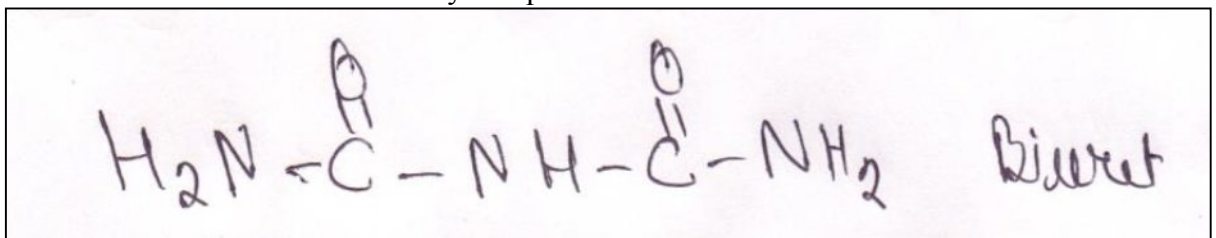
This method is basis of Sorenson method of titration for determining purity of individual amino acids.

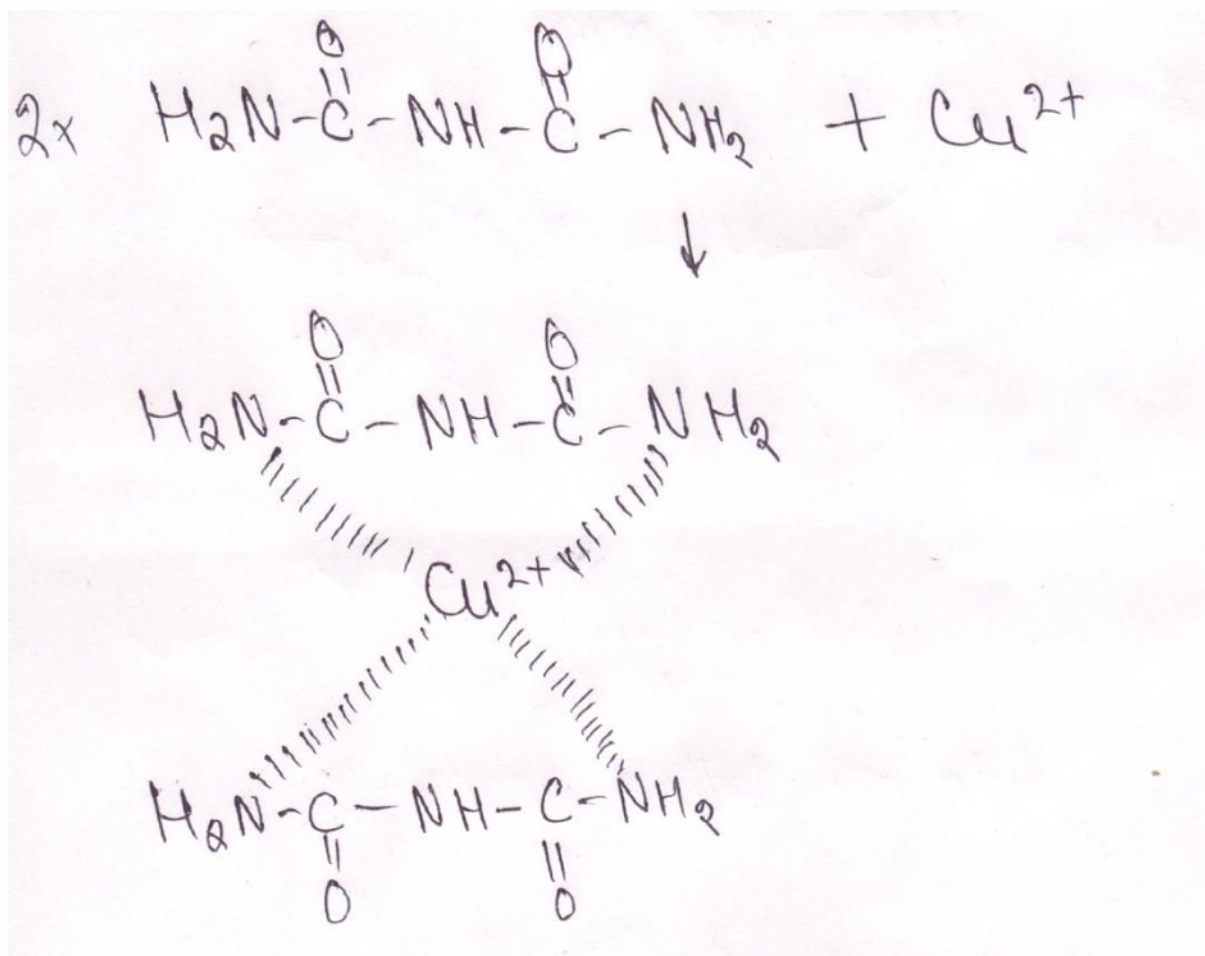
c. Reaction with nitrous acid produces corresponding α -hydroxyl acid:



Other reactions:

1. Biuret reaction: compound containing peptide bond produces a characteristic purple colour with copper sulphate solution. This reaction is called biuret reaction. The similar kind of reaction is shown by compound called biuret.





Copper ion reacting with the compound biuret.

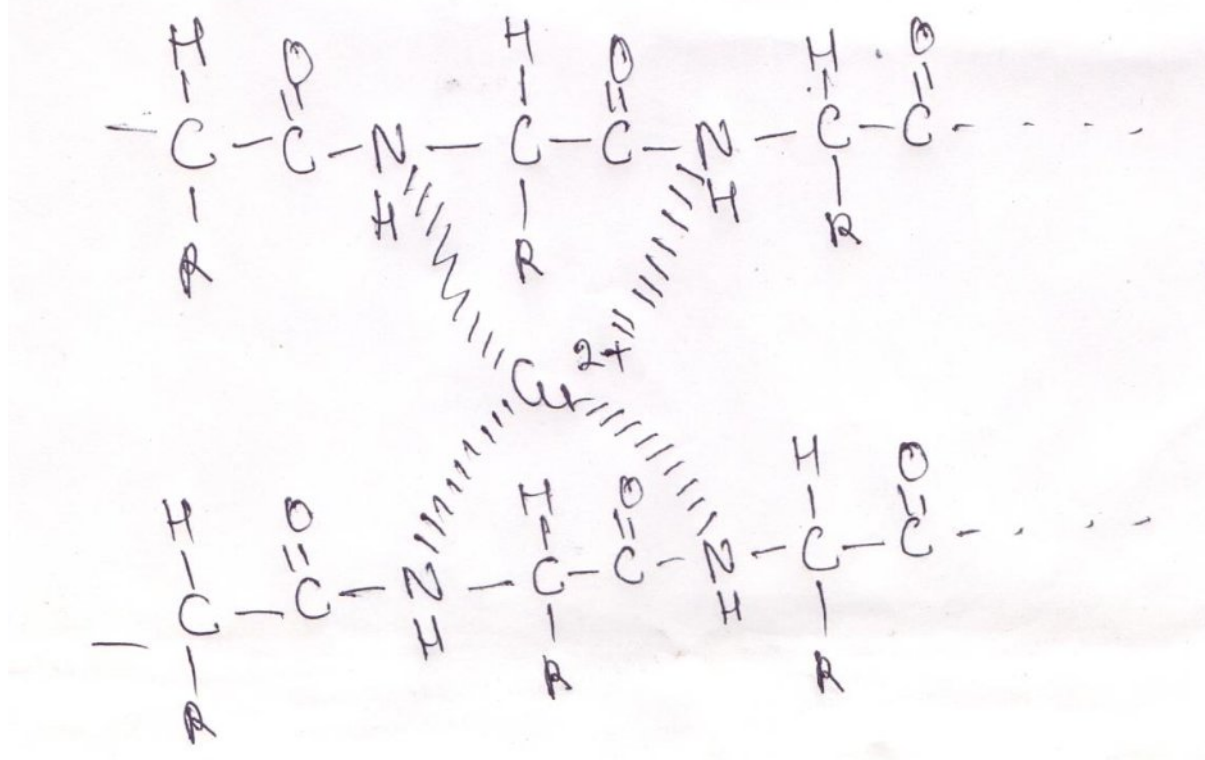
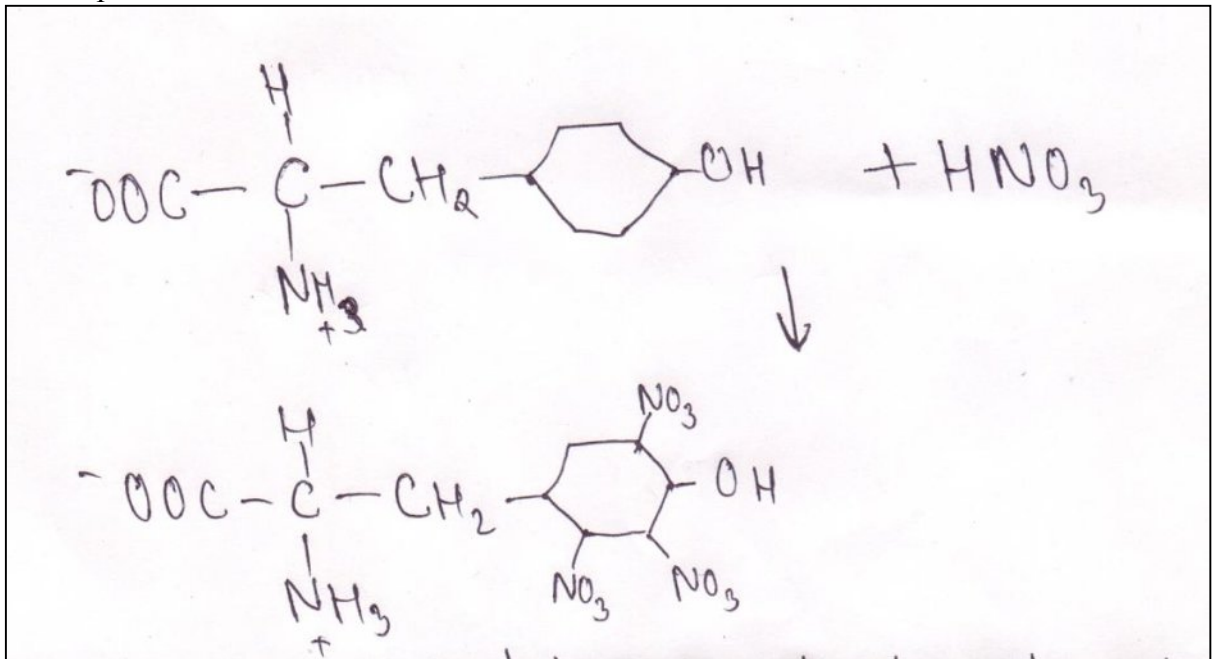


Fig: Copper ion forming hydrogen bond with peptide bonds.

2. Xanthoproteic reaction:



Tyrosine reacts with HNO_3 giving Tri-nitro phenolic amino acid.

3. Millon's Reaction: when mercuric or mercurous nitrates are heated with tyrosine it gives red colour complex.
4. Nitroprusside reaction: When the sodium nitroprusside reacts with cystein produces red colour.