Amino acids

BSc. Part III

Organic chemistry

Paper VII

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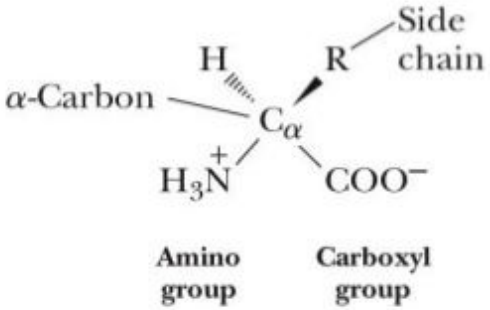
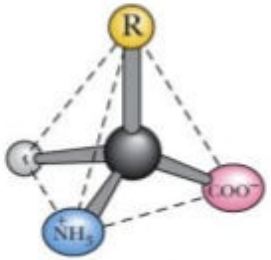
Introduction

Amino Acids

- **Amino acid:** a compound that contains an amino group, a carboxyl group and a side-chain that is specific to each amino acid.
- **□-Amino acid:** an amino acid in which the amino group is on the carbon adjacent to the carboxyl group
- The are 20 common α-amino acids used by the ribosomes to make proteins. These 20 have L chirality at the α-carbon.

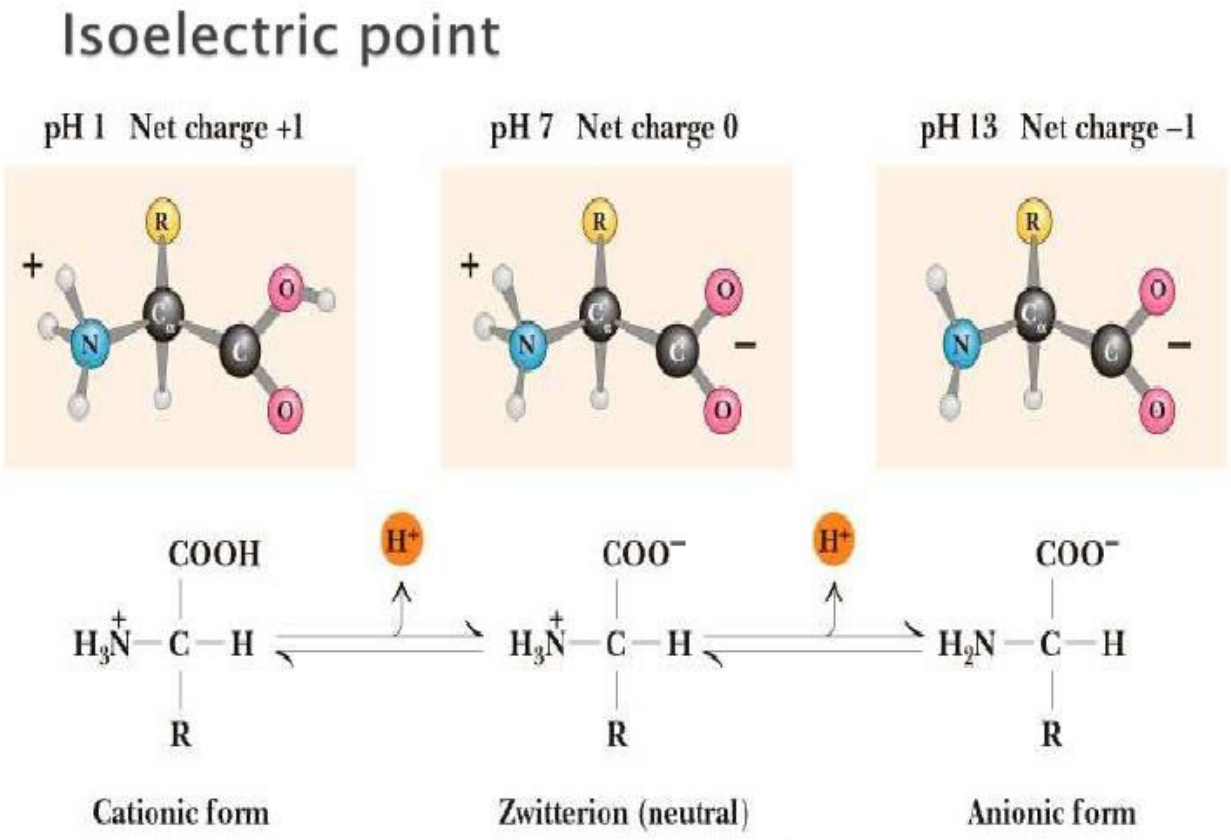


Ball-and-stick model



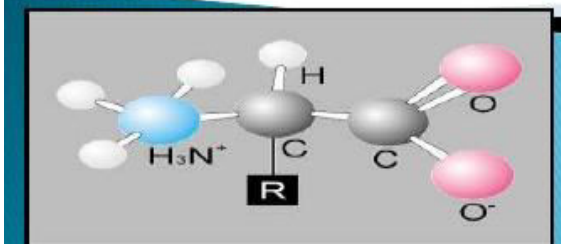
Amino acids are tetrahedral structures

Amino acids in the zwitterion form are amphoteric.That is , theyreact readly with acids or bases.



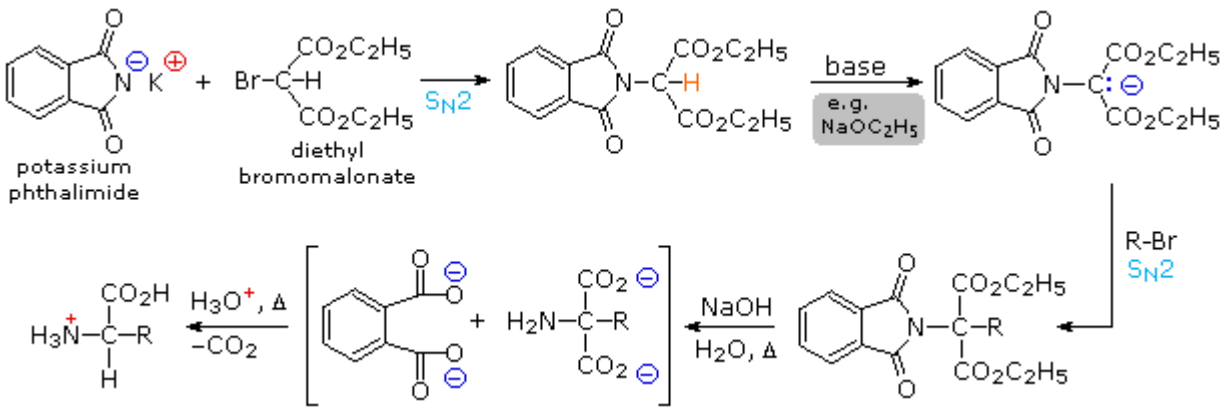
Isoelectric point

- Amino acids can exist as **ampholytes** or **zwitterions** in solution, depending upon pH of the medium.
- The pH at which the amino acids exist as zwitterions, with no net charge on them is called Isoelectric pH or Isoelectric point.
- In acidic medium, the amino acids exist as cations
- In alkaline medium , they exist as anions.



Due to no net charge, there is no electrophoretic mobility at Isoelectric pH.
Solubility and buffering capacity is also minimum at Isoelectric pH

Synthesis of α amino acids
By Gabriel synthesis :



Properties of amino acids

Physical properties-

- Colorless
- Crystalline
- May be sweet(Glycine, Alanine, Valine), tasteless(Leucine) or bitter(Arginine, Isoleucine). **Aspartame- An artificial sweetener contains Aspartic acid and Phenyl alanine.**
- Soluble in water, acids, alkalis but insoluble in organic solvents
- High melting point(More than 200^0c)

B. CHEMICAL PROPERTIES

1. **Reaction with ammonia**: The carboxyl group of dicarboxylic amino acids reacts with NH_3 to form amide

Aspartic acid + NH^+_3 ------> Aspargine

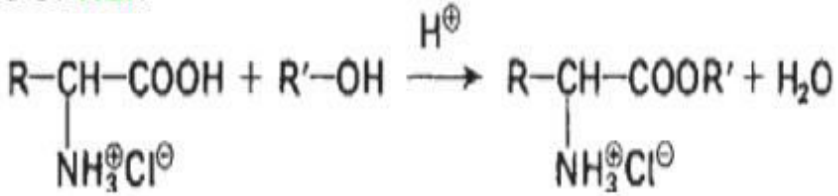
Glutamic acid + NH^+_3 -----> Glutamine

2. The amino acid behave as bases and combines with acids (e.g. HCL) to form salts (-NH^+_3 Cl^-).

1- Esterification of Carboxyl Groups

-Amino acids are readily esterified by acid-catalyzed reactions.

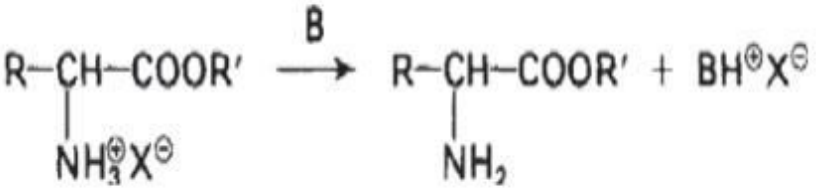
-An ethyl ester hydrochloride is obtained in ethanol in the presence of HCl:



-The free ester is released from its salt by the action of alkali.

-A mixture of free esters can then be separated by distillation without decomposition.

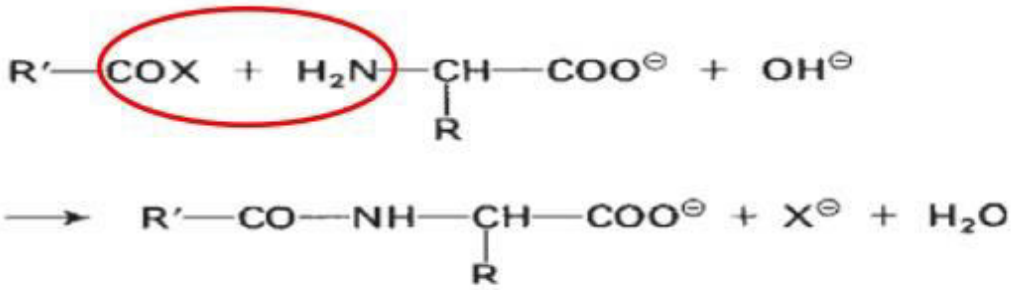
Fractional distillation of esters is the basis of a method introduced by *Emil Fischer* for the separation of amino acids



2- Reactions of Amino Groups

A- Acylation

-Activated acid derivatives, e. g., acid halogenides or anhydrides, are used as acylating agents



B- Alkylation and Arylation

-N-methyl amino acids are obtained by reaction of the N-tosyl derivative of the amino acid with methyl iodide, followed by removal of the tosyl substituent with HBr