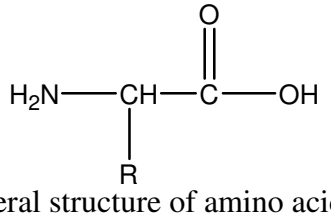
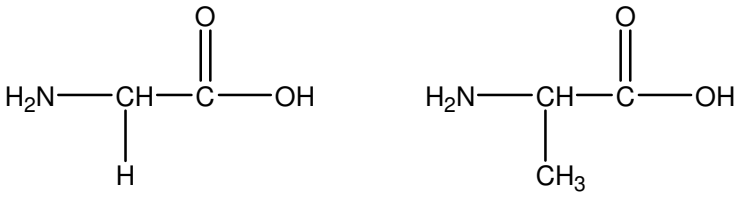
AMINO ACIDS

Amino acids are organic compounds that contain amine (-NH_2) and carboxyl (-COOH) functional groups, along with a side chain (R group) specific to each amino acid. Amino acids play central roles both as building blocks of proteins and as intermediates in metabolism. The 20 amino acids that are found within proteins convey a vast array of chemical versatility. Humans can produce 10 of the 20 amino acids. The others must be supplied in the food. Unlike fat and starch, the human body does not store excess amino acids for later use—the amino acids must be in the food every day.



General structure of amino acid

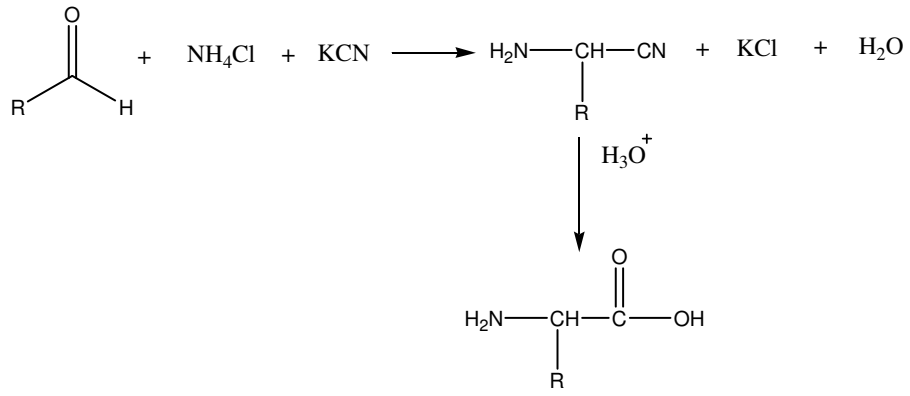


Glycine Alanine

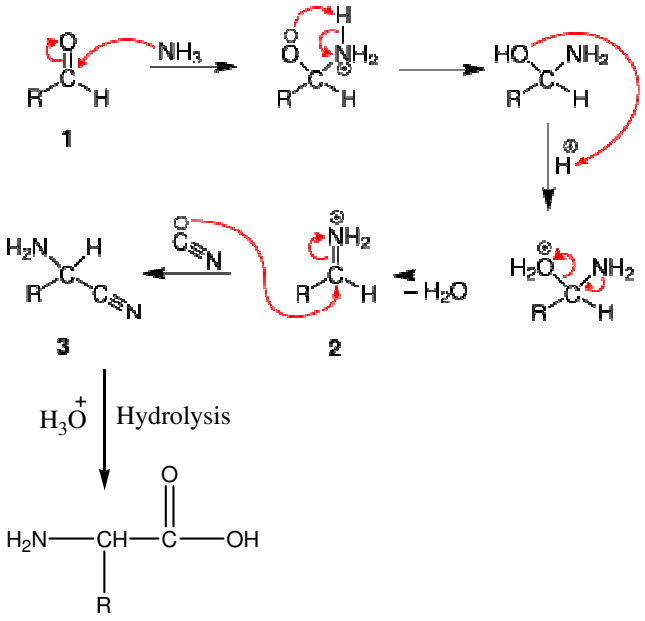
Figure: Structure of amino acids

Preparation of amino acids:

1. Strecker Synthesis: The Strecker amino acid synthesis, also known simply as the Strecker synthesis, is a method for the synthesis of amino acids by the reaction of an aldehyde with ammonium chloride in the presence of potassium cyanide.

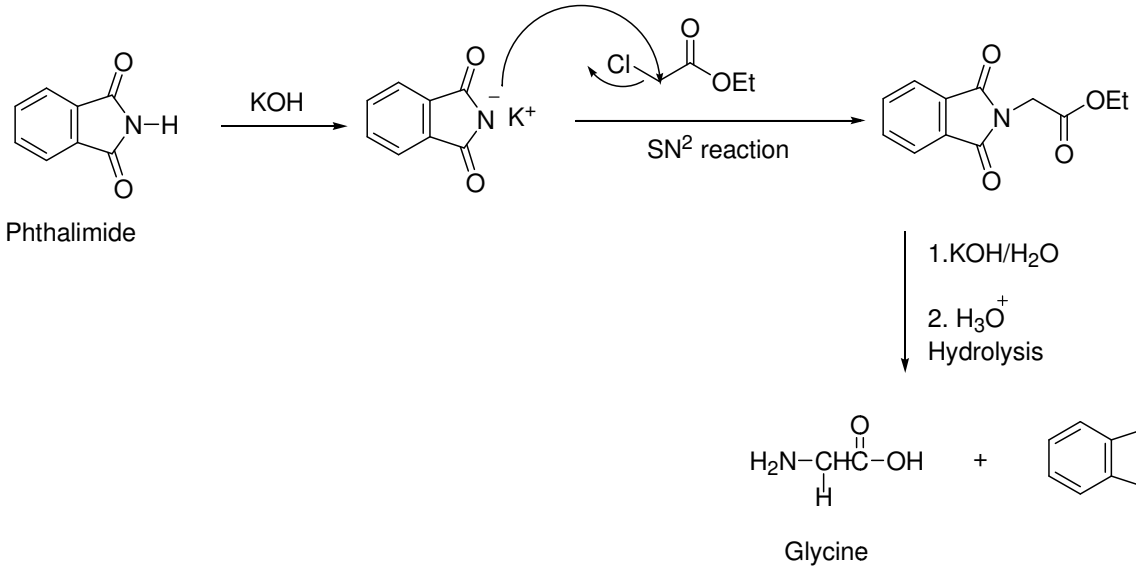


Mechanism:



If R is methyl group, i.e. if we start with acetaldehyde we will gel alanine as the product.

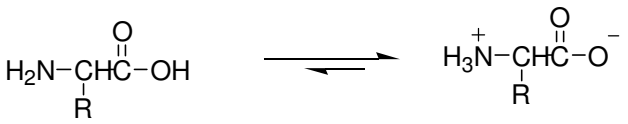
2. Gabriel Phthalimide synthesis: Potssio salt of phthalimide is treated with α-halo ester followed by hydrolysis gives the amino acid.



General properties of amino acids:

1. **Zwitterions**:

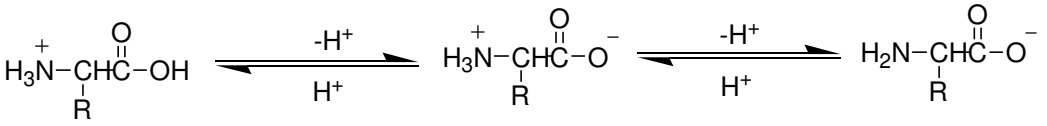
   Amino acid exists as zwitterions or dipolar ion. Every molecule of an amino acid involves two functional groups: carboxylic acid (-COOH) and amino (-NH_2) group. The –NH_2 group accepts a proton from -COOH to form the zwitterions where the acidic property of –COOH group and basic property of –NH_2 group are neutralised.



Dipolar ion or
Zwitterion

2. Amino acids are generally crystalline solid with very high melting point. This is due to strong electrostatic attractive force between the ionic molecules.
3. Amino acids are soluble in water and insoluble in organic solvent. This is also due to dipolar nature of the molecule.
4. **Isoelectric point:**

   When the pH of the solution is changed, the amino acid remains in the following equilibrium.



Conjugate acid
(In acidic pH)

Dipolar ion or
Zwitterion

Conjugate base
(In basic pH)

The position of the equilibrium depends on the pH of the solution. In acidic solution the conjugate acid predominates and in alkaline solution conjugate base predominates. For each amino acid there is a particular pH at which the concentration of dipolar ion is maximum. Since the net charge of the structure is zero, the dipolar ion is electrically neutral and consequently the amino acid does not migrate when placed in an electric field. The pH at which migration does not occur is called isoelectric point of that amino acid. E.g. the isoelectric point of alanine is 6.02.