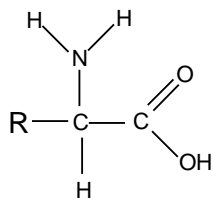


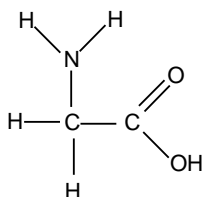
STRUCTURE OF AMINO ACIDS

Amino acids are molecules containing an amine group and a carboxylic acid group. Naturally occurring amino acids have the following general formula:

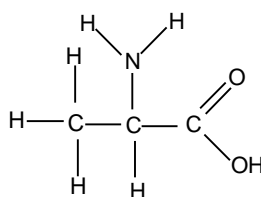


There is a central carbon atom attached to a hydrogen, a carboxylic acid group, an amine group and an alkyl group. Amino acids are thus all chiral except for glycine, in which the R is another H atom.

Amino acids occur widely in nature and have a number of uses in the human body. Some simple examples are:



glycine
aminoethanoic acid



alanine
2-aminopropanoic acid

ACID-BASE PROPERTIES OF AMINO ACIDS

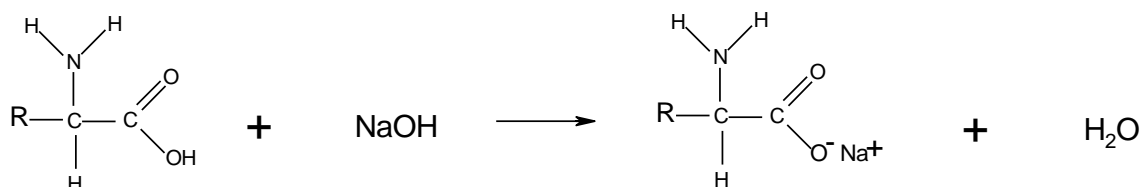
Carboxylic acids have acidic properties and react with bases.

Amines have basic properties and react with acids.

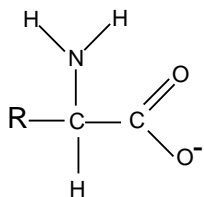
It therefore follows that amino acids have both acidic and basic properties.

i) reaction with bases

Amino acids react with strong bases such as sodium hydroxide:

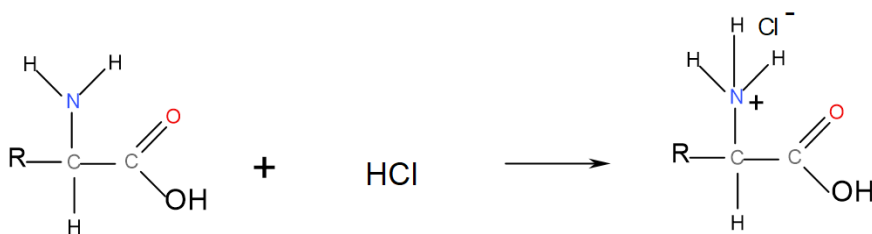


In **high pH**, therefore, amino acids exist in anionic form:

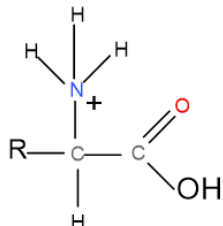


ii) reaction with acids

Amino acids react with strong acids such as hydrochloric acid:

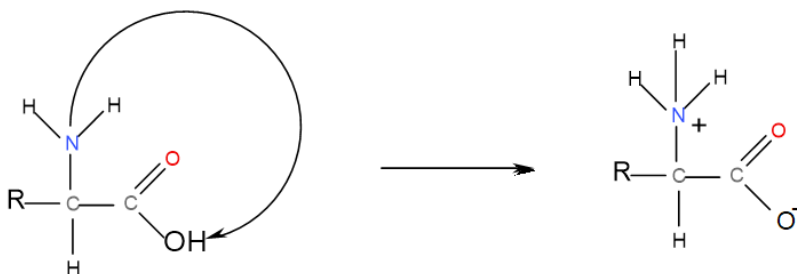


In **low pH**, therefore, amino acids exist in cationic form:



iii) reaction with itself

Since amino acids have a proton donating group and a proton accepting group on the same molecule, it follows that each molecule can undergo an acid-base reaction with itself:

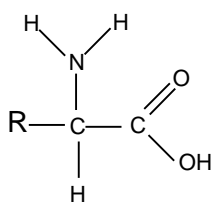


The double ion that is formed as a result of this reaction is called a **Zwitterion**. This reaction happens in the solid state.

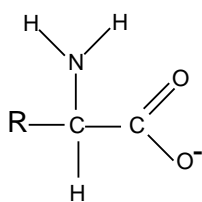
In the solid state, therefore, amino acids are ionic. This explains why they are solids with a high melting point.

iv) summary

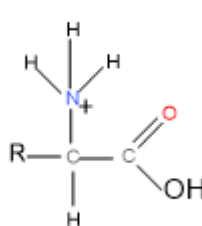
Amino acids can exist in molecular form, in cationic form, in anionic form or in Zwitterion form depending on the environment:



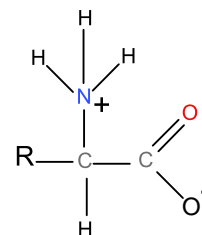
in neutral solution



in alkaline solution



in acidic solution



in the solid state

Since amino acids can react with acids and alkalis, they make very effective **buffer solutions**.