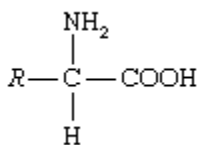


Amino Acid

DSE – 1B

3a

Amino acid, any of a group of organic molecules that consist of a basic amino group (—NH_2), an acidic carboxyl group (—COOH), and an organic R group (or side chain) that is unique to each amino acid. The term *amino acid* is short for α -amino [*alpha-amino*] *carboxylic acid*. Each molecule contains a central carbon (C) atom, called the α -carbon, to which both an amino and a carboxyl group are attached. The remaining two bonds of the α -carbon atom are generally satisfied by a hydrogen (H) atom and the R group. The formula of a general amino acid is:



The amino acids differ from each other in the particular chemical structure of the R group

Classification of Amino Acids

- Acidic amino acids:

have carboxyl group in their side chain

Eg: Aspartic and Glutamic acid

- Basic amino acids:

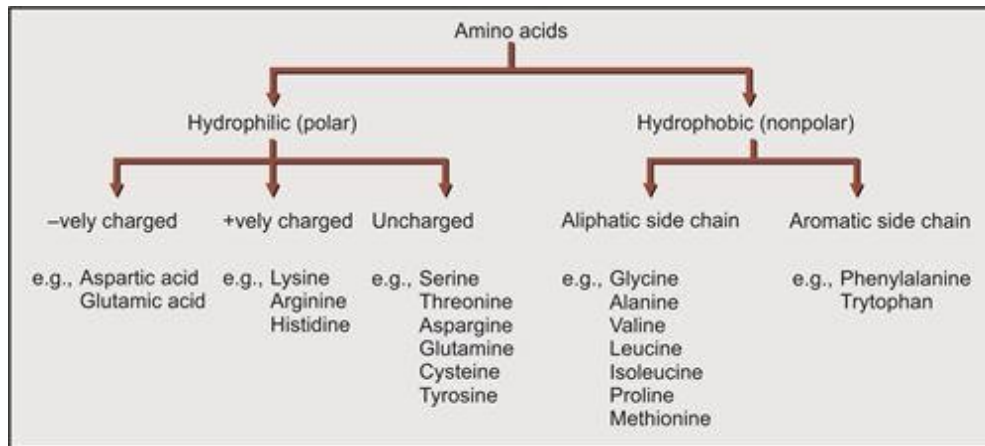
contain amino group in their side chain

Eg: Lysine, Arginine

- Imino acid:

Amino acids containing a secondary amine group

Eg: Proline



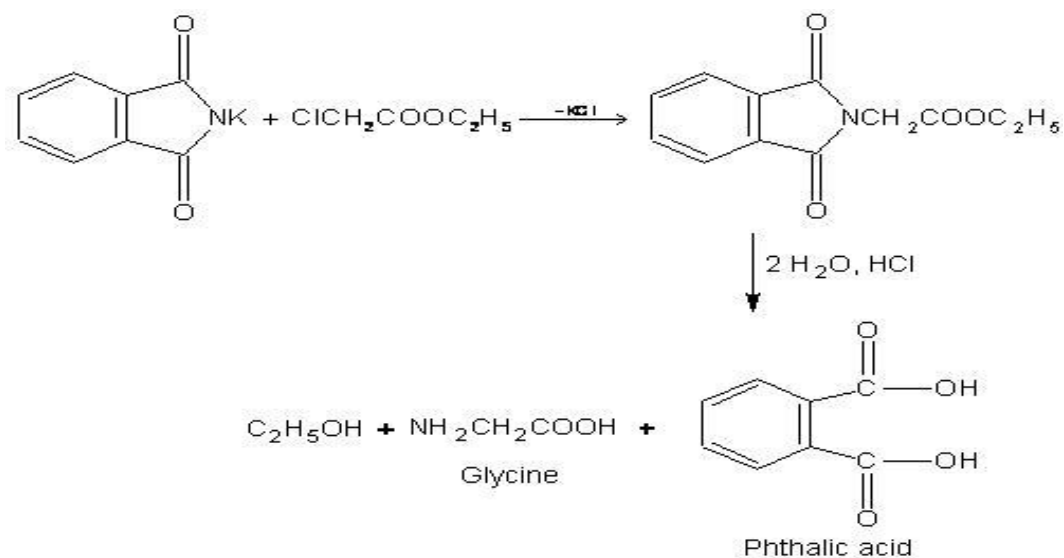
Essential amino acids

Essential amino acids cannot be made by the body but these amino acids are essential for growth of human body even absence of which death may happen. As a result, they must come from food.

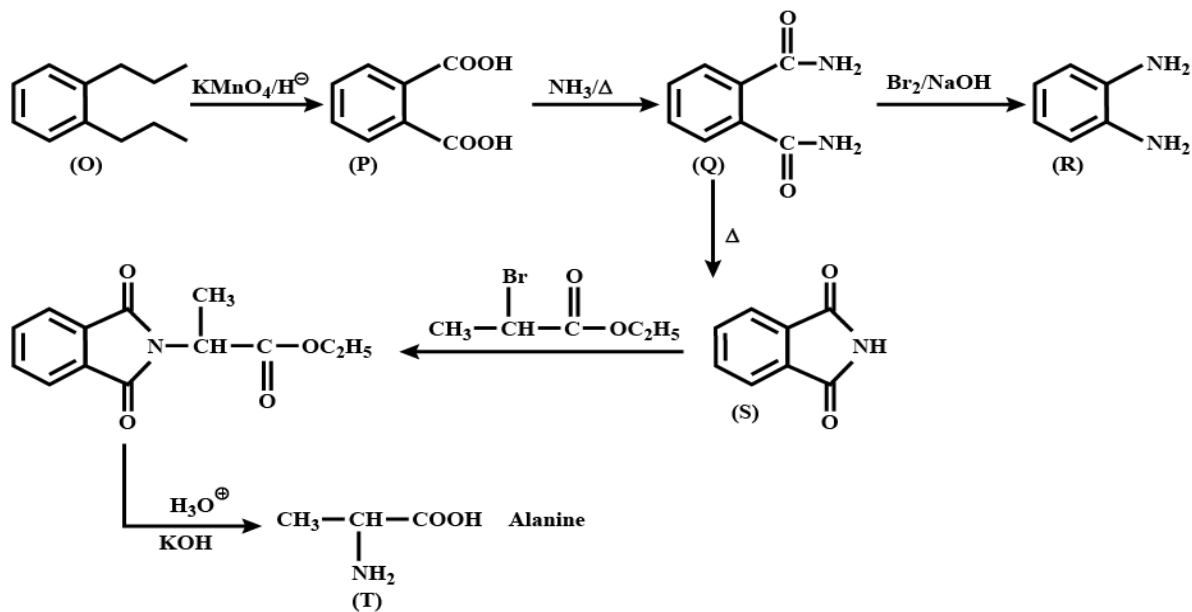
Essential AA	Nonessential AA
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Arginine	Alanine
Histidine	Asparagine
Isoleucine	Aspartate
Leucine	Glutamate
Lysine	Glycine
Methionine	Serine
Phenylalanine	Tyrosine
Threonine	
Tryptophan	
Valine	

Gabriel's Phthalimide Synthesis of Glycine

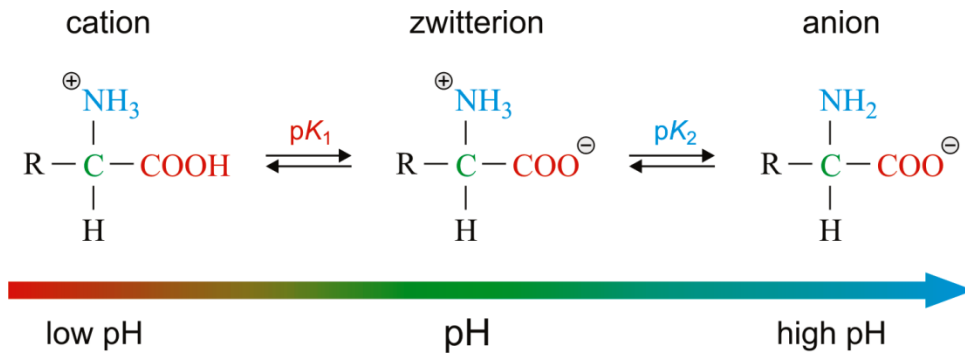
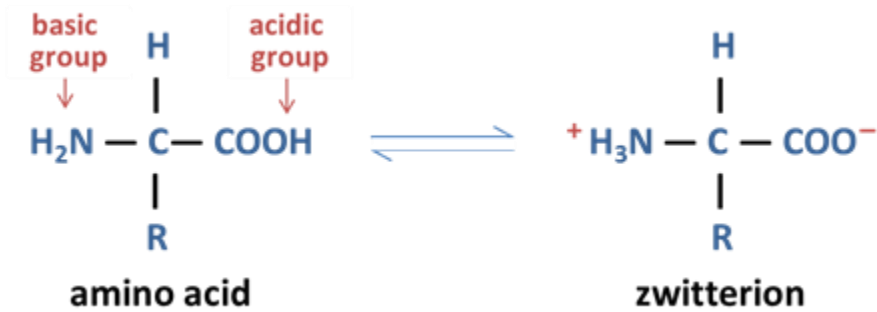


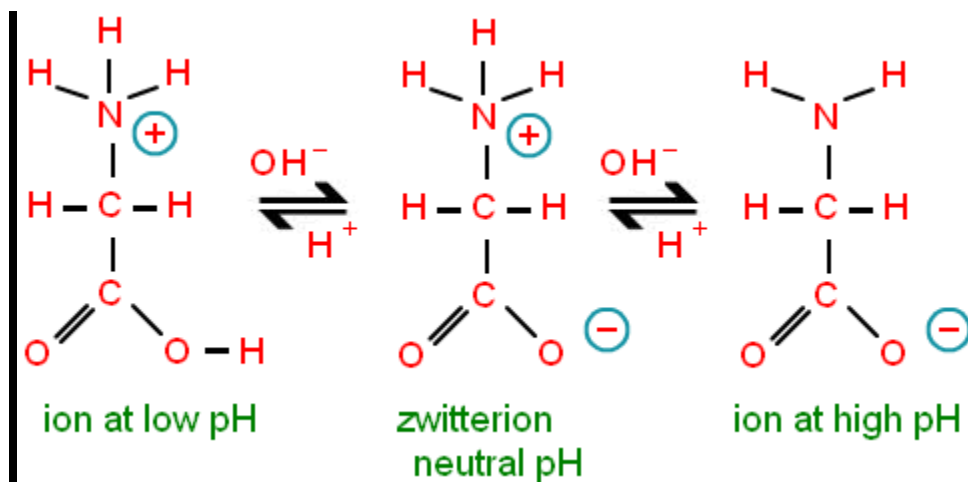
Gabriel's Phthalimide Synthesis of Alanine



zwitterion

A **zwitterion** is a molecule with functional groups, of which at least one has a positive and one has a negative electrical charge. When an **amino acid** dissolves in water, the **zwitterion** interacts with H₂O molecules – acting as both an **acid** and a base.



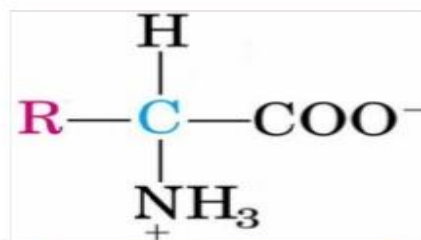


Isoelectric point

The word **isoelectric** or isoelectronic comes from 'iso,' which means the same, and 'electric,' which implies charge. The **isoelectric point** or **pI** of an **amino acid** is the pH at which an **amino acid** has a net charge of zero. ... At physiological pH, **amino acids** will exist with a net charge of zero

Isoelectric point or “pI”

- At certain pH “specific for each amino acid” the amino acid can exist in the dipolar form: fully ionized but with no net electric charge.
- The characteristic pH at which the net electric charge is zero is called the **Isoelectric point** or “pI”.
- The amino acid at the isoelectric pI is called “**Zwitter ion**” and is electrically neutral (not migrating in an electric field).



Zwitter ion

What does the isoelectric point tell you?

The **isoelectric point (pI)** is the pH value at which the molecule carries no electrical charge. The concept is particularly important for zwitterionic molecules such as amino acids, peptides, and proteins. For an amino acid, the **isoelectric point** is the average of pK_a values for the amine and the carboxyl group

What happens to an amino acid as the pH is decreased from the isoelectric point?

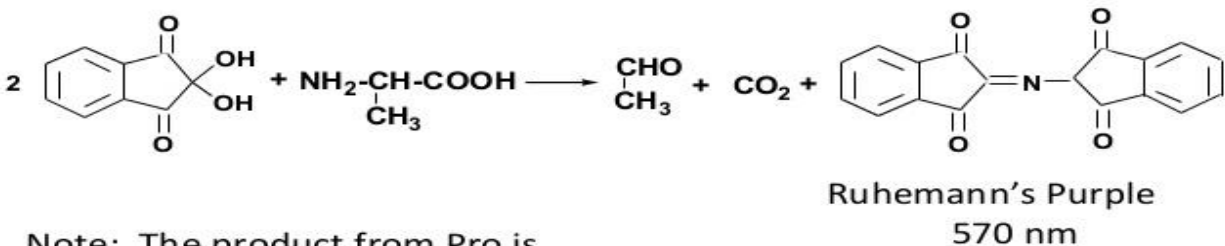
If you **decrease** the **pH** by adding an **acid** to a solution of an **amino acid**, the -COO⁻ part of the zwitterion picks up a hydrogen ion. This time, during electrophoresis, the **amino acid** would move towards the cathode (the negative electrode).

Ninhydrin Reaction

Detecting Amino Acids

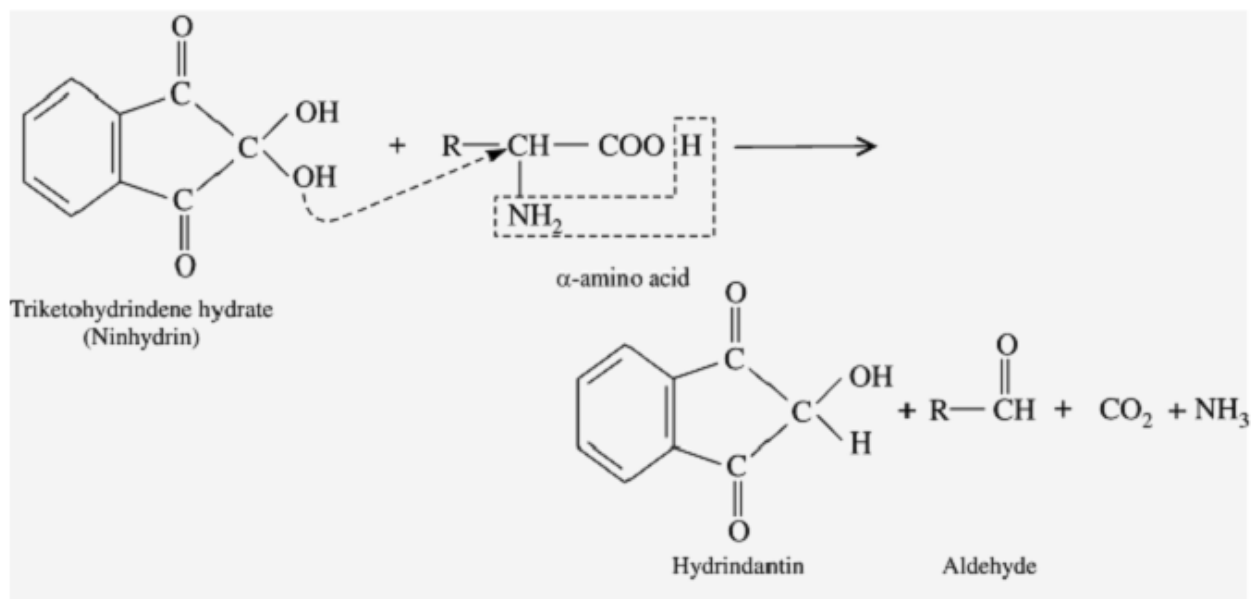
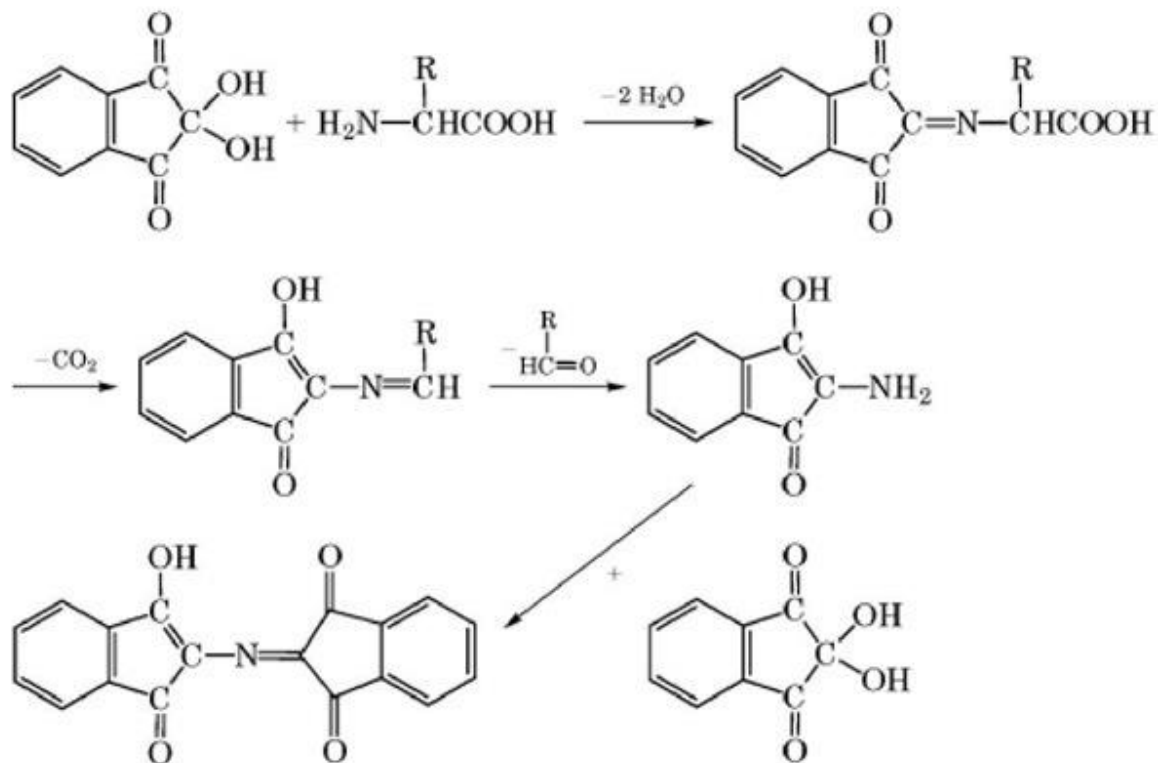


Ninhydrin is the classical reagent for detecting amino acids. Reaction requires 2-5 min at 100°C and is sensitive at the nanomole level.



Note: The product from Pro is Yellow and absorbs at 440 nm.

Mechanism of Ninhydrin Reaction



Amino Acids Quiz

1. Which of the following is most found in protein molecule?
 - a. Carbon
 - b. Hydrogen
 - c. Oxygen
 - d. Nitrogen
2. No of naturally occurring amino acids is :
 - a. 10
 - b. 20
 - c. 30
 - d. 40
3. All of the following are aliphatic amino acids except :
 - a. Glycine
 - b. Alanine
 - c. Proline
 - d. Lysine
4. One of the following is neutral amino acid :
 - a. Arginine
 - b. Lysine
 - c. Glutamine
 - d. Valine
5. All of the following are hydroxy containing amino acids except :
 - a. Serine
 - b. Threonine
 - c. Valine
 - d. Tyrosine
6. One of the following is optically non active amino acid
 - a. Valine
 - b. Tyrosine
 - c. Glycine
 - d. Threonine
7. All of the following are polar amino acids except.
 - a. Serine
 - b. Glutamate
 - c. Arginine
 - d. Alanine
8. All of the following are essential amino acids except :
 - a. Lysine
 - b. Aspartate
 - c. Tryptophan
 - d. Histidine
9. Lysine :
 - a. Basic Only ketogenic
 - b. Ketogenic glucogenic
 - c. Acidic glucogenic
 - d. Non essential
10. All of the following are primary amino acids except :
 - a. Cysteine
 - b. Cystine
 - c. Alanine
 - d. Arginine