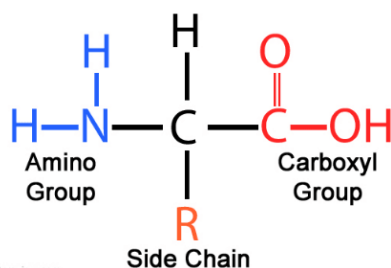


## AMINO ACIDS

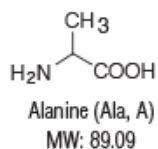
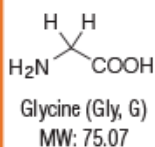
### ❖ Definition

- **Amino acids** are group of organic molecules that consist of a basic amino group ( $-\text{NH}_2$ ), an acidic carboxyl group ( $-\text{COOH}$ ), and an organic  $R$  group (or side chain) that is unique to each amino acid. The term *amino acid* is short for  $\alpha$ -amino [*alpha-amino*] carboxylic acid.
- Each molecule contains a central carbon (C) atom, called the  $\alpha$ -carbon, to which both an amino and a carboxyl group are attached. The remaining two bonds of the  $\alpha$ -carbon atom are generally satisfied by a hydrogen (H) atom and the  $R$  group.
- The amino acids differ from each other in the particular chemical structure of the  $R$  group.
- The formula of a general amino acid is:

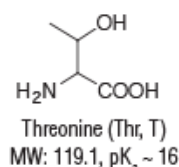
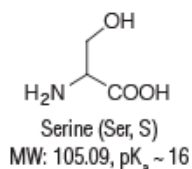


KRISHNA

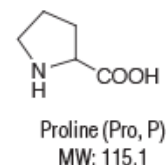
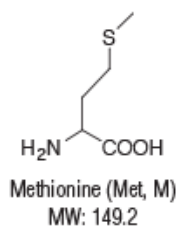
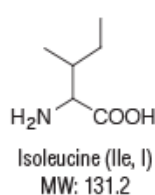
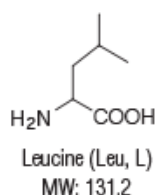
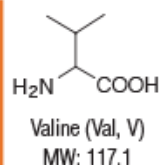
#### SMALL



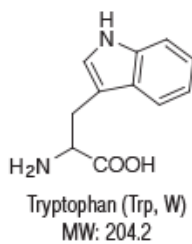
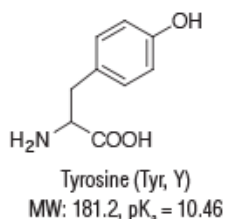
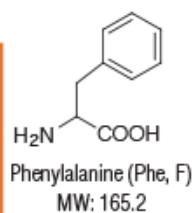
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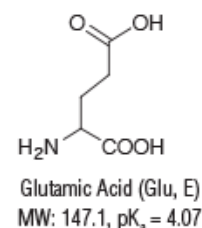
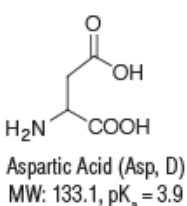
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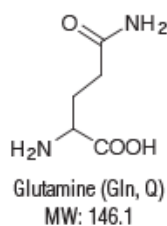
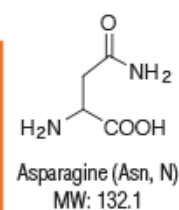
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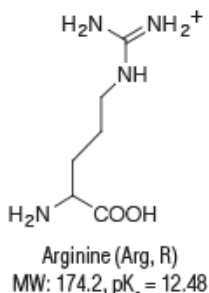
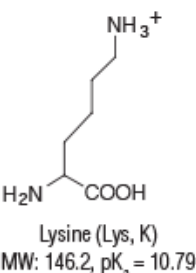
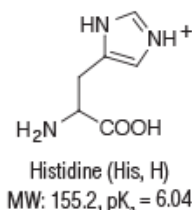
#### ACIDIC

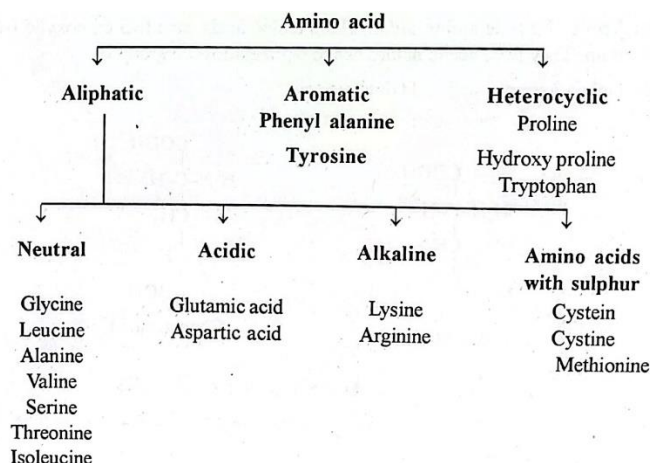


#### AMIDE



#### BASIC



❖ **Classification of amino acids based on chemical nature**❖ **Classification based on nutritional requirements**

- i) **Essential amino acids:** These amino acids cannot be synthesized in the body and have to be present essentially in the diet. Examples-Valine, Isoleucine, Leucine, Lysine, Methionine, Threonine, Tryptophan and Phenylalanine.
- ii) **Semi-essential amino acids:** These amino acids can be synthesized in the body but the rate of synthesis is lesser than the requirement(e.g. during growth, repair or pregnancy) Examples-Arginine and Histidine.
- iii) **Non-essential amino acids:** These amino acids are synthesized in the body, thus their absence in the diet does not adversely affect the growth. Examples- Glycine, Alanine, and the other remaining amino acids

S. no	Essential amino acids	S. no	Nonessential amino acids
01	Arginine	01	Alanine
02	Histidine	02	Asparagine
03	Isoleucine	03	Aspartate
04	Leucine	04	Cysteine
05	Lysine	05	Glutamate
06	Methionine	06	Glutamine
07	Phenylalanine	07	Glycine
08	Threonine	08	Proline
09	Tryptophan	09	Serine
10	Valine	10	Tyrosine

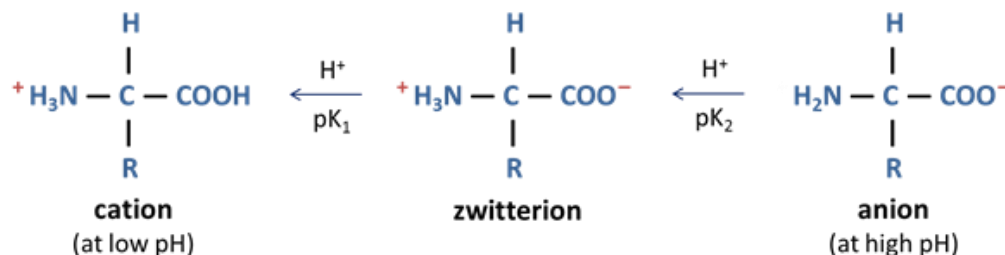
❖ **Chirality**

- All the amino acids except glycine are chiral molecules. That is, they exist in two optically active asymmetric forms (called enantiomers) that are the mirror images of each other.
- One enantiomer is designated d and the other l.
- It is important to note that the amino acids found in proteins almost always possess only the l-configuration.

❖ **Acid-base properties**

- Another important feature of free amino acids is the existence of both a basic and an acidic group at the  $\alpha$ -carbon.
- Compounds such as amino acids that can act as either an acid or a base are called amphoteric.
- The basic amino group typically has a pKa between 9 and 10, while the acidic  $\alpha$ -carboxyl group has a pKa that is usually close to 2.
- The pKa of a group is the pH value at which the concentration of the protonated group equals that of the unprotonated group. Thus, at physiological pH (about 7–7.4), the free amino acids exist largely as dipolar ions or “zwitterions” (German for “hybrid ions”; a zwitterion carries an equal number of positively and negatively charged groups).

- The pH at which Zwitterion exist is called isoelectric point because at this pH it is electrically neutral.



#### ❖ Biological role of Amino acids

- Amino acids serve as building blocks of proteins. Some amino acids are found in free form in human blood.
- They also serve as precursors of hormones, purines, pyrimidines, porphyrins, vitamins and biologically important amines like histamine.
- Peptides have many important biological functions. Some of them are hormones. They are used as anti-biotics and antitumor agents.
- Some peptides are required for detoxification reactions. Some peptides serve as neurotransmitters.
- Amino acid proline protects living organisms against free radical induced damage.
- Some peptides are involved in regulation of cell cycle and apoptosis.

Amino acid	Role
Isoleucine	Formation of hemoglobin; prevents muscle wasting in debilitated individuals
Leucine	Promotes healing of skin and broken bones; reduces muscle protein breakdown
Valine	Influences brain uptake of other neurotransmitter precursors (tryptophan, phenylalanine and tyrosine)
Histidine	Production of red and white blood cells; treatment of anemia
Lysine	Inhibits viruses; treatment of herpes simplex, Lysine and Vitamin C together form L-carnitine, a biochemical that enables muscle tissue to use oxygen more efficiently, delaying fatigue
Methionine	Increases the antioxidant levels (glutathione); reduces blood cholesterol levels
Phenylalanine	Production of collagen, precursor of tyrosine; enhances learning, memory, mood and alertness
Threonine	Prevents fatty build up in the liver; amino detoxifiers
Tryptophan	Prevents fatty buildup in the liver; precursor of key neurotransmitter serotonin, which exerts a calming effect

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