



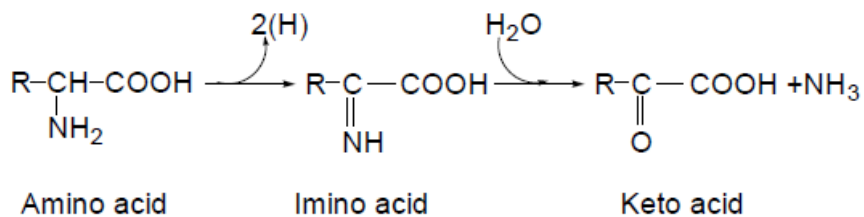
## 2- Define the following:- (8 marks)

- a) Transferases: enzymes that catalyze the transfer of groups from one molecule to another.
- b) Isomerases: enzymes that move groups within a molecule, without changing the gross composition of the substrate.
- c) Metallo enzymes: certain enzymes require a metal ion, in addition to coenzyme for their full activity. Examples of such enzymes include alcohol dehydrogenase, peroxidase, catalase and xanthine oxidase etc., which contain sites for binding metal ions. The removal of metal from these enzymes often results in partial or total loss of enzymatic activity.
- d) Enzyme inhibitors: compounds which convert the enzymes into inactive substances and then adversely affect the rate of enzyme catalysed reactions.

## 3- Compare between deamination and decarboxylation. (6 marks)

**Deamination:** means removal of the amino groups from amino acids. This is the mechanism where in the amino acids lose two hydrogen atoms (dehydrogenation) to form keto acids and ammonia. Deamination is accompanied by oxidation and is catalysed by specific amino acid oxidases or more appropriately, dehydrogenases present in liver and kidneys. The process of oxidative deamination takes place in two steps:

- a- The first step: is oxidation (dehydrogenation) of amino acid resulting in the formation of imino acid. The imino acid then undergoes the second step
- b- The second step: namely hydrolysis which results in a keto acid and ammonia.

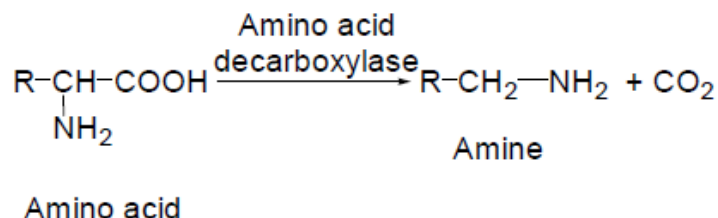


The first reaction is catalyzed by amino acid oxidase (also called dehydrogenase) and the coenzyme FAD or FMN takes up the hydrogen. There are two types of amino acid oxidases depending upon the substrate, on which they act, namely,

1. L-amino acid oxidases which act on L-amino acids (FMN acts as coenzyme).
2. D-amino acid oxidases which act on D-amino acids (FAD acts as coenzyme).

FMN occurs only in the liver and kidney and FAD occurs in all animal tissues. The major site of oxidative deamination is liver but kidney and other tissues also have a role.

**Decarboxylation:** this refers to the removal of  $\text{CO}_2$  from the carboxyl group of amino acids. The removal of  $\text{CO}_2$  needs the catalytic action of enzymes decarboxylases and the pyridoxal phosphate coenzyme. The enzymes act on amino acids resulting in the formation of the corresponding amines with the liberation of  $\text{CO}_2$ .



There are several amino acid decarboxylases found in various tissues such as liver, kidney, intestine, spleen, lung and brain. They convert the amino acids into the respective amines and liberate  $\text{CO}_2$ . For



example, histidine is converted to histamine by the action of histidine decarboxylase.

#### 4- Explain the following:- (10 marks)

a) Amphoteric properties of amino acids.

Due to the presence of their ionizable  $\alpha$ -amino and  $\alpha$ -carboxylic group can act sometimes as acids and sometimes as bases depending on the pH of their media

b) Peptide bond is rigid and plainer.

This arises from resonance interactions which characterize the peptide bond.

c) The lock and key theory cannot be applied for all the enzymatic reactions.

Because in some reactions the substrate molecules and the active site are not structurally similar to fit in with each other.

d) Many sulfa drugs act as antibiotics.

Many micro organisms like bacteria synthesize the vitamin folic acid from para-aminobenzoic acid. Sulphanilamide and other sulfa drugs are structural analogs of para-aminobenzoic acid. So, sulfa drugs act as competitive inhibitor and occupy the active site of some bacterial enzyme catalyzing this reaction. When this reaction is affected, it blocks the folic acid biosynthesis which is essential for the growth of micro organisms, ultimately results in the death of the micro organisms. Thus, many sulfa drugs act as antibiotics.

e) Peptide and protein are different.

Amino acid polymers (polypeptides) with molecular weight greater than 10000 daltons are termed proteins while those with molecular weight less than 10000 daltons are called peptide.