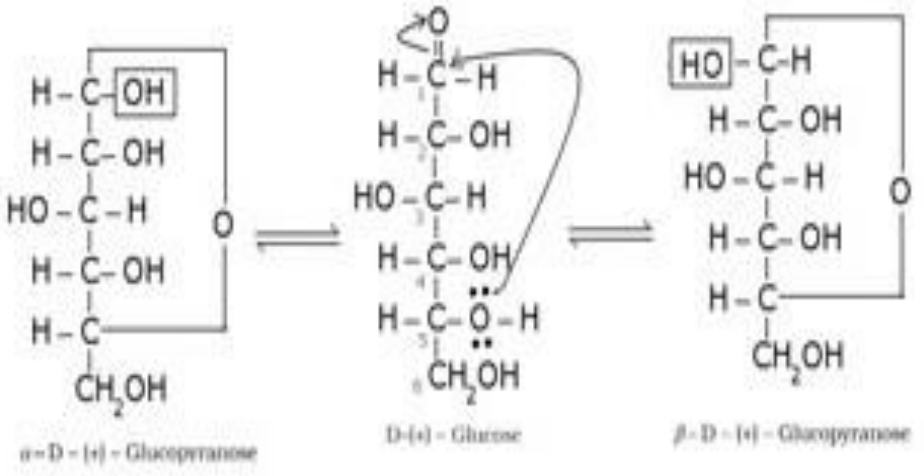
Chemistry Study Materials for Class 12
(NCERT Based Notes of Chapter -14)

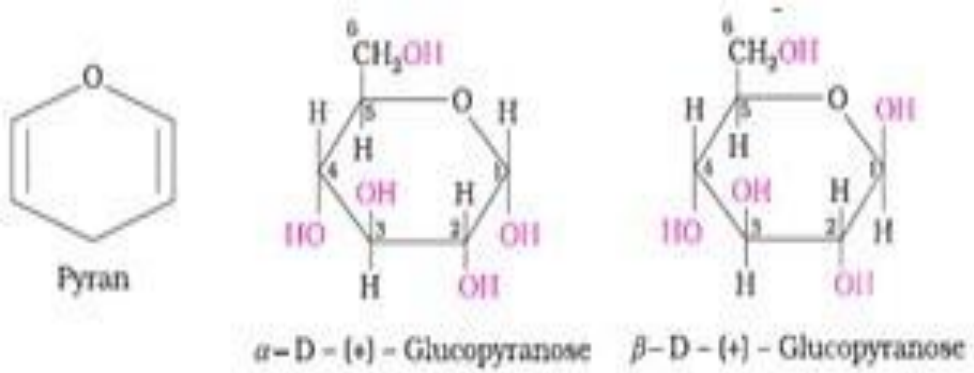
Ganesh Kumar **Date:- 24/10/2021**

Biomolecules

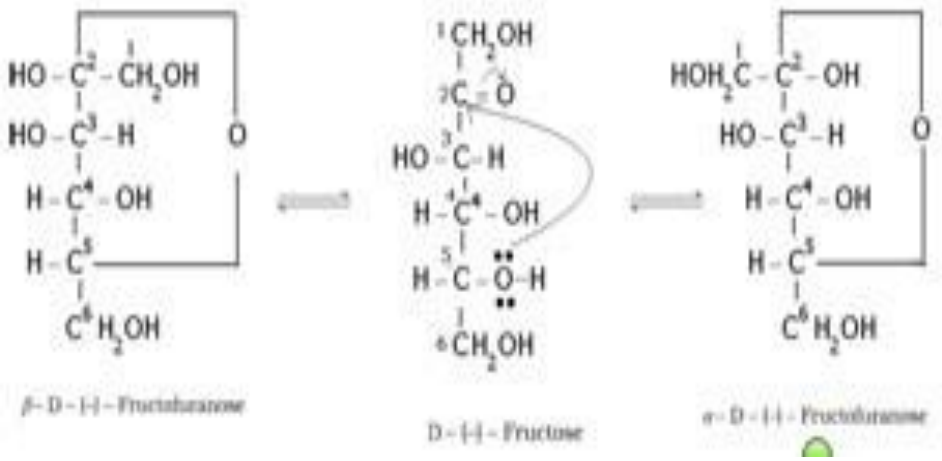
- **Cyclic structure of glucose:**



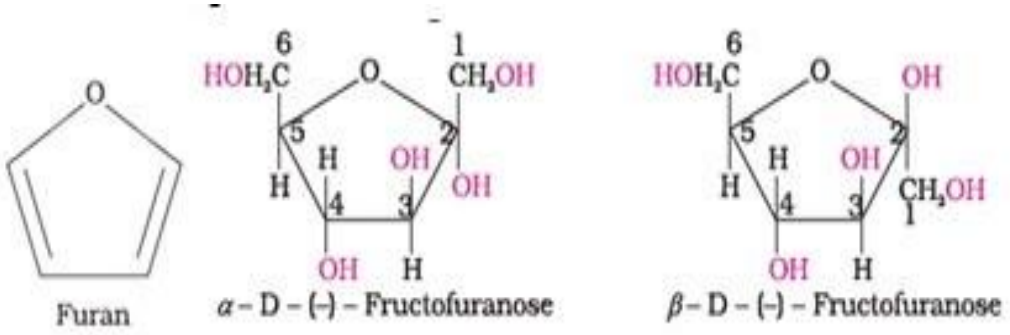
- **Haworth representation of glucose:**



- **Cyclic structure of fructose:**

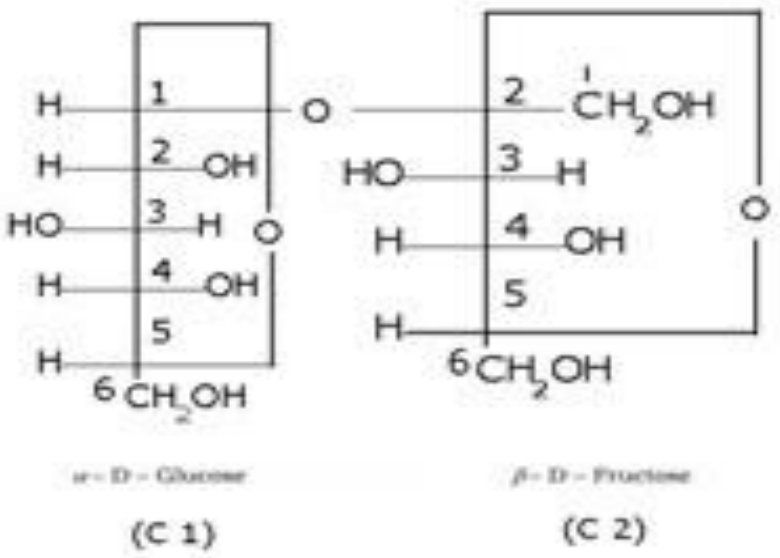


Haworth representation of fructose



- **Glycosidic linkage:** The oxide linkage formed by the loss of a water molecule when two monosaccharides are joined together through oxygen atom is called glycosidic linkage.

- **Sucrose (invert sugar):**
  Sucrose is a non-reducing sugar because the two monosaccharide units are held together by a glycosidic linkage between C1 of α-glucose and C2 of β- fructose. Since the reducing groups of glucose and fructose are involved in glycosidic bond formation, sucrose is a non- reducing sugar.

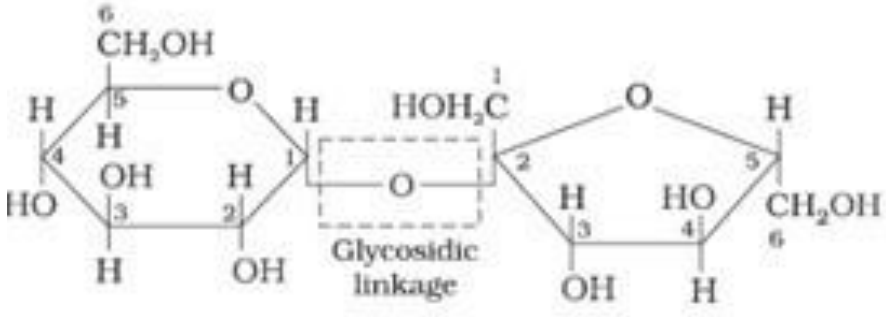


Sucrose is dextrorotatory but on hydrolysis it gives dextrorotatory & laevorotatory and the mixture is laevorotatory.

$$\underset{\text{Sucrose}}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow{H^+} \underset{\text{D-glucose}}{C_6H_{12}O_6} + \underset{\text{D-fructose}}{C_6H_{12}O_6}$$

$[\alpha]_D = +66.5^0 \qquad [\alpha]_D = +52.5^0 \qquad [\alpha]_D = -92.4^0$

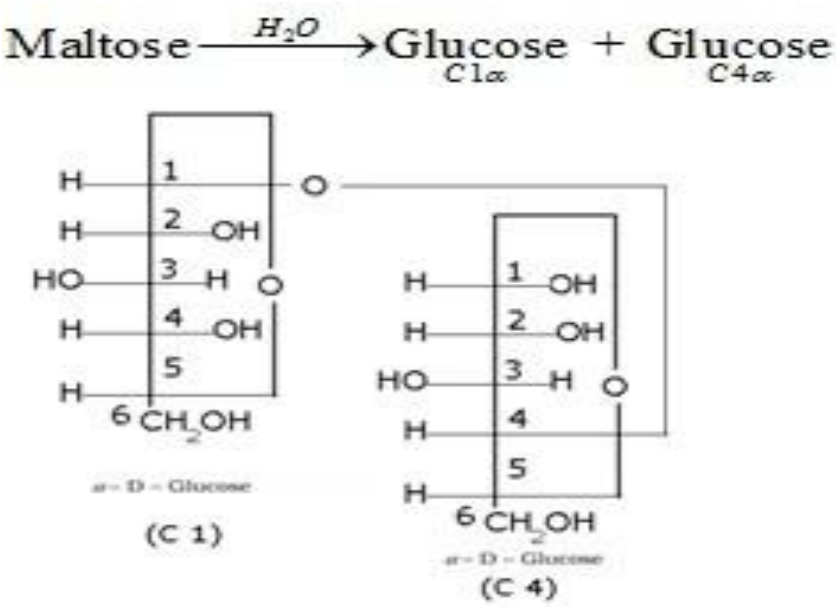
- **Haworth Projection of Sucrose:**



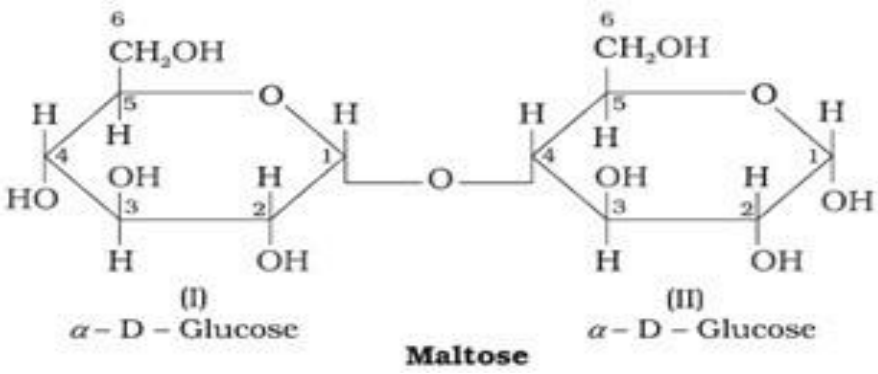
Sucrose

- **Maltose:**

1. Maltose is composed of two α-D-glucose units in which C1 of one glucose (I) is linked to C4 of another glucose unit (II).
2. The free aldehyde group can be produced at C1 of second glucose in solution and it shows reducing properties so it is a reducing sugar.

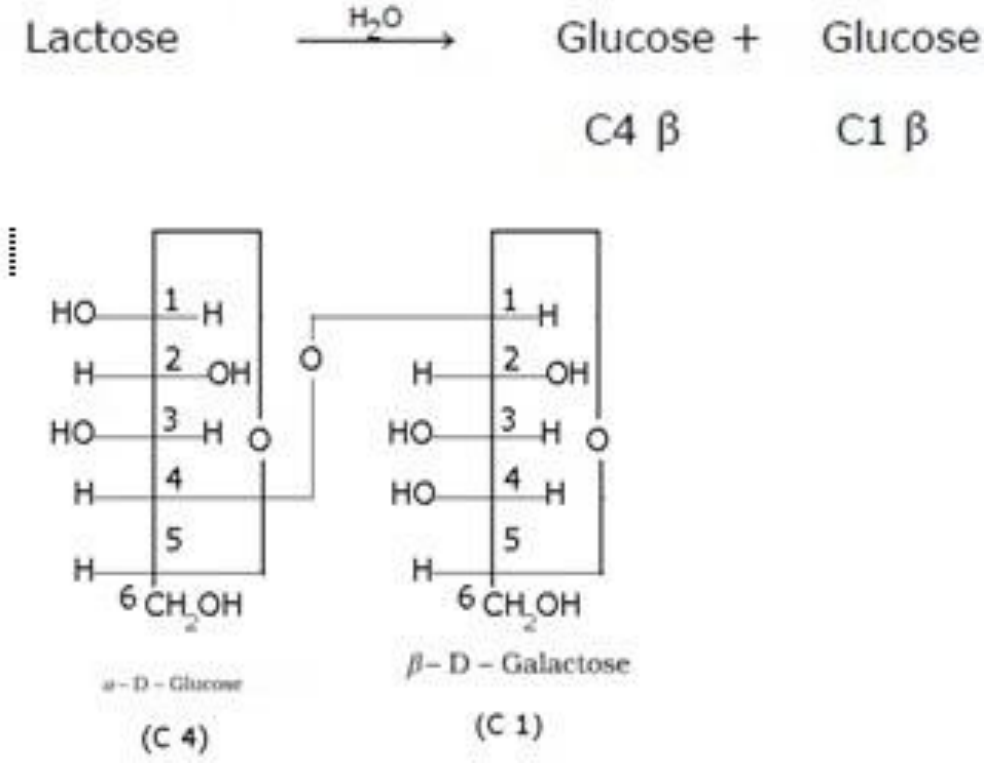


- **Haworth projection of maltose:**

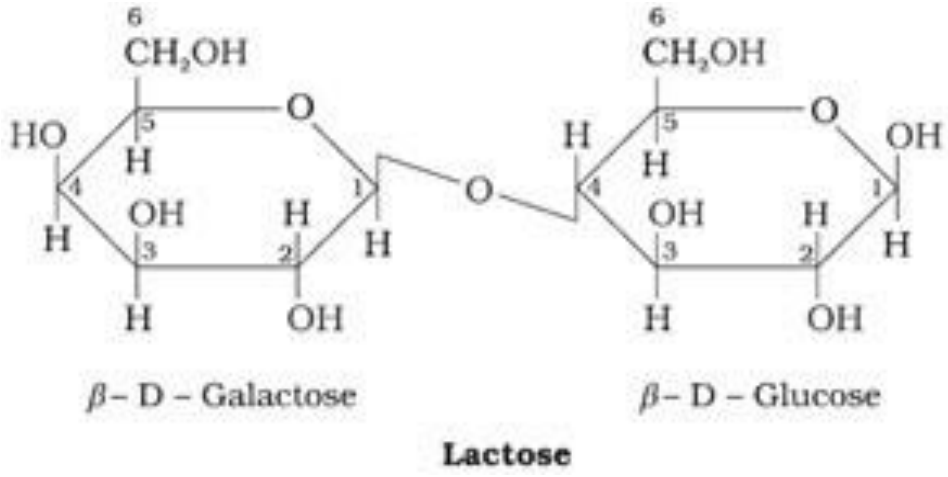


Maltose

- **Lactose (Milk sugar):** It is composed of β-D-galactose and β-D-glucose. The linkage is between C1 of galactose and C4 of glucose. Hence it is also a reducing sugar.



- **Haworth projection of lactose:**



Lactose

- **Starch:** It is a polymer of -glucose and consists of two components — Amylose and Amylopectin.

- **Amylose:**

1. It is a water soluble component
2. It is a long unbranched chain polymer
3. It contains 200 – 1000 -D-(+)- glucose units held by - glycosidic linkages involving C1 – C4glycosidic linkage
4. It constitutes about 15-20% of starch

- **Amylopectin**

1. It is a water insoluble component
2. It is branched chain polymer
3. It forms chain by C1 – C4glycosidic linkage whereas branching occurs by C1 – C6glycosidic linkage
4. It constitutes about 80-85% of starch

- **Cellulose:**

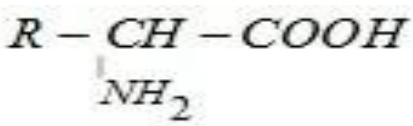
1. It occurs exclusively in plants.
2. It is a straight chain polysaccharide composed only of β-D-glucose units which are joined by glycosidic linkage between C1 of one glucose unit and C4 of the next glucose unit.

- **Glycogen:**

1. The carbohydrates are stored in animal body as glycogen.
2. It is also known as animal starch because its structure is similar to Amylopectin.
3. It is present in liver, muscles and brain.
4. When the body needs glucose, enzymes break the glycogen down to glucose.

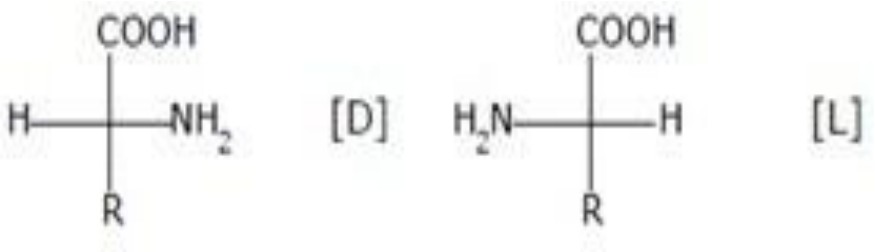
- **Amino acids:**

Amino acids contain amino (–NH2) and carboxyl (–COOH) functional groups.



Where R – Any side chain

Most naturally occurring amino acids have L – Configuration



- **Types of amino acids:**

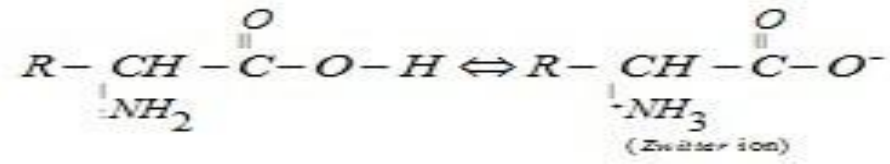
a). **Essential amino acids:** The amino acids which cannot be synthesized in the body and must be obtained through diet are known as essential amino acids.

Examples: Valine, Leucine

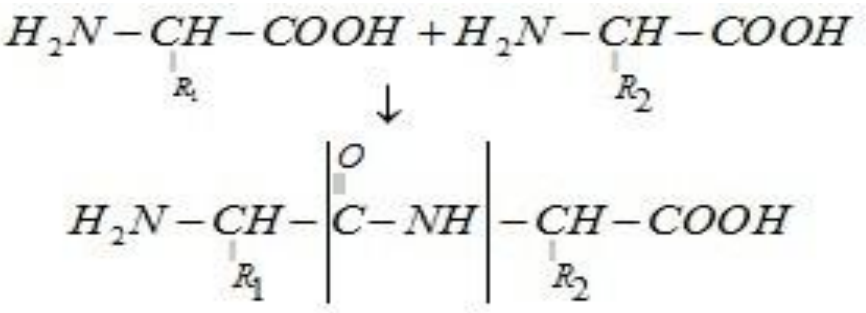
b). **Non-essential amino acids:** The amino acids, which can be synthesized in the body, are known as non-essential amino acids. Examples: Glycine, Alanine

- **Zwitter ion form of amino acids:**

1. Amino acids behave like salts rather than simple amines or carboxylic acids. This behaviour is due to the presence of both acidic (carboxyl group) and basic (amino group) groups in the same molecule. In aqueous solution, the carboxyl group can lose a proton and amino group can accept a proton, giving rise to a dipolar ion known as zwitter ion. This is neutral but contains both positive and negative charges.
2. In zwitter ionic form, amino acids show amphoteric behaviour as they react both with acids and bases.



- **Isoelectronic point:** The pH at which the dipolar ion exists as neutral ion and does not migrate to either electrode cathode or anode is called isoelectronic point.
- **Proteins:** Proteins are the polymers of α -amino acids and they are connected to each other by peptide bond or peptide linkage. A polypeptide with more than hundred amino acid residues, having molecular mass higher than 10,000u is called a protein.
- **Peptide linkage:** Peptide linkage is an amide linkage formed by condensation reaction between –COOH group of one amino acid and –NH2 group of another amino acid.



Peptide link age

- **Primary structure of proteins:** The sequence of amino acids is said to be the primary structure of a protein.
- **Secondary structure of proteins:** It refers to the shape in which long polypeptide chain can exist. Two different types of structures: α – Helix:

1. It was given by Linus Pauling in 1951
2. It exists when R- group is large.
3. Right handed screw with the NH group of each amino acid residue H – bonded to – C = O of adjacent turn of the helix.
4. Also known as 3.613 helix since each turn of the helix has approximately 3.6 amino acids and a 13 – membered ring is formed by H – bonding.
5. C = O and N – H group of the peptide bonds are Trans to each other.
6. Ramchandran angles (ΦandΨ) - Φangle which $C_\alpha$makes with N – H and Ψangle which $C_\alpha$makes with C = O.

β– pleated sheet:

1. It exists when R group is small.
2. In this conformation, all peptide chains are stretched out to nearly maximum extension and then laid side by side which are held together by hydrogen bonds.

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