CARBOHYDRATES

Carbohydrates are most abundant organic molecules in nature. They are primarily composed of the elements carbon, hydrogen and oxygen. The name Carbohydrate means ' Hydrates of Carbon'. Soluble in water and sweet in taste.

DEFINITION-

Carbohydrates are defined as polyhydroxy aldehydes or ketones or compounds which produce them on hydrolysis.

CLASSIFICATION-

Classified into 4 classes based on the number of monomeric units-

I. Monosaccharides: single sugar unit

II. Disaccharides: 2 monosaccharide units

III. Oligosaccharide: 3-10 monosaccharide units

IV. Polysaccharides: more than 10 units

FUNCTION-

Carbohydrates participate in a wide range of functions-

i. Source of energy.

ii. Precursors for many organic compounds(fats, amino acids).

iii. Participate in the structure of cell membrane and cell growth, adhesion and fertilization.

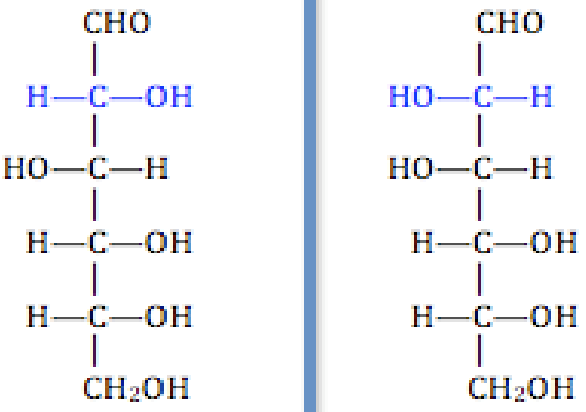
iv. Structural component of fiber (cellulose) of plants, exoskeleton of insects and cell wall of microorganisms.

v. Serve as storage form of energy (glycogen).

STRUCTURAL PROPERTIES-

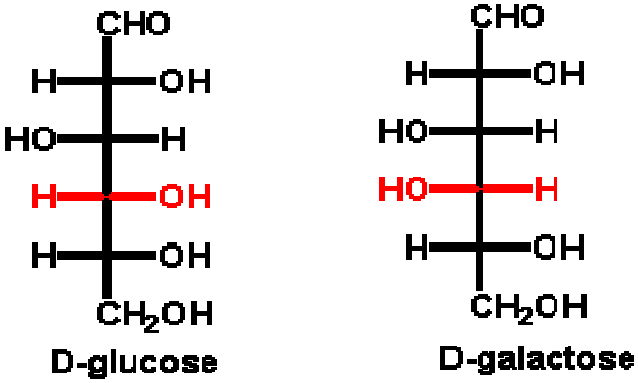
1. STEREOISOMERISM

Stereoisomers are isomeric molecules that have the same molecular formula and sequence of bonded atoms (constitution), but differ in the three-dimensional orientations of their atoms in space.



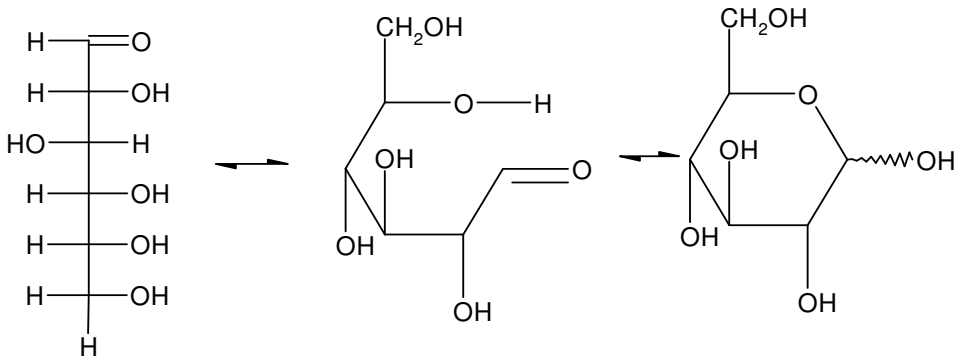
2.OPTICAL ACTIVITY-

Optical activity is a characteristic feature of compounds with asymmetric carbon atom. When a beam of polarized light is passed through a solution of an optical isomer, it will be rotated either to the right or left. The term dextrorotatory (+) and Levorotatory (-) are used to compounds respectively.



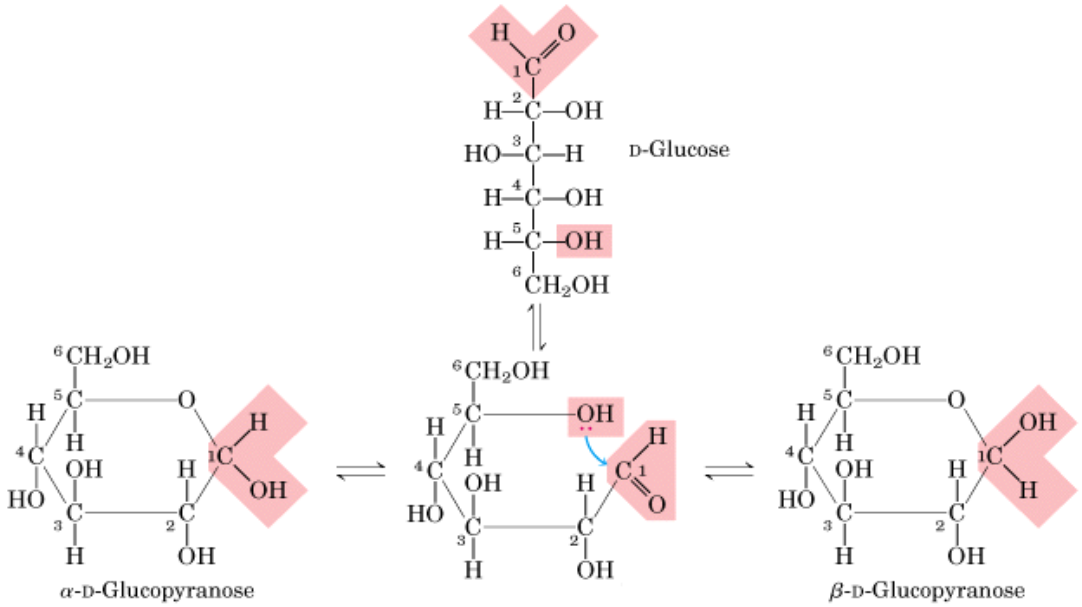
3. CYCLIC ISOMERS-

A monosaccharide often switches from the acyclic (open-chain) form to a cyclic form, through a nucleophilic addition reaction between the carbonyl group and one of the hydroxyls of the same molecule. The reaction creates a ring of carbon atoms closed by one bridging oxygen atom. The resulting molecule has an hemiacetal or hemiketal group, depending on whether the linear form was an aldose or a ketose. The reaction is easily reversed, yielding the original open-chain form.



4. MUTAROTATION-

It is defined as the change in the specific optical rotation representing the interconversion of α and β forms of D-glucose to an equilibrium mixture.



5. EPIMERS-

If two monosaccharides differ from each other in their configuration around a single specific carbon atom they are referred to as epimers to each other.