Chapter 2 CARBOHYDRATES-I

Carbohydrates are the most abundant biomolecules on Earth. Each year, photosynthesis converts more than 100 billion metric tons of CO2 and H2O into cellulose and other plant products. Certain carbohydrates (sugar and starch) are a dietary staple in most parts of the world, and the oxidation of carbohydrates is the central energy-yielding pathway in most nonphotosynthetic cells.

Carbohydrates are polyhydroxy aldehydes or ketones, or substances that yield such compounds on hydrolysis. Many, but not all, carbohydrates have the empirical formula (CH2O)n.

Some Important Functions of Carbohydrates

1. Carbohydrates provides energy and regulation of blood glucose.
2. Carbohydrates form a part of genetic material like DNA and RNA in the form of deoxyribose and ribose sugars.
3. It plays important roles in cellular recognition processes**.**
4. They help make up the body mass by being included in all the parts of the cell and tissues.
5. They form components of bio-molecules which have a key role in blood clotting, immunity, fertilization etc.
6. Some polysaccharides such as (Pectine and Hemiceliulose) are the structural carbohydrate in plant cell walls.

Monosaccharides and Disaccharides

The simplest of the carbohydrates, the monosaccharides, are either aldehydes or ketones with two or more hydroxyl groups; the six-carbon monosaccharides glucose and fructose have five hydroxyl groups.

Monosaccharides Have Asymmetric Centers

All the monosaccharides except dihydroxyacetone contain one or more asymmetric (chiral) carbon atoms and thus occur in optically active isomeric forms.

The simplest aldose, glyceraldehyde, contains one chiral center (the middle carbon atom) and therefore has two different optical isomers, or enantiomers: D and L

The Common Monosaccharides Have Cyclic Structures

For simplicity, we have thus far represented the structures of aldoses and ketoses as straight-chain molecules. In fact, in aqueous solution, aldotetroses and all monosaccharides with five or more carbon atoms in the backbone occur predominantly as cyclic (ring) structures in which the carbonyl group has formed a covalent bond with the oxygen of a hydroxyl group along the chain.

The formation of these ring structures is the result of a general reaction between alcohols and aldehydes or ketones to form derivatives called hemiacetals or hemiketals, which contain an additional asymmetric carbon atom and thus can exist in two stereoisomeric forms.

Isomeric forms of monosaccharides that differ only in their configuration about the hemiacetal or hemiketal carbon atom are called anomers.

The α and β anomers of D-glucose interconvert in aqueous solution by a process called mutarotation.