

Carbohydrates

Carbohydrates are on the basis of mass the most abundant class of biomolecules on earth. Although all organisms can synthesise carbohydrate, much of it is produced by photosynthetic organisms including bacteria, algae and fungi. These organisms convert solar energy to chemical energy which is then used to make carbohydrate from carbon dioxide.

Carbohydrates play several roles in living organisms. In animals and plants carbohydrate polymers act as energy storage molecules. Animals can ingest carbohydrate that can then be oxidized to yield energy for metabolic processes.

These carbohydrates are described by the number of monomeric units they contain.

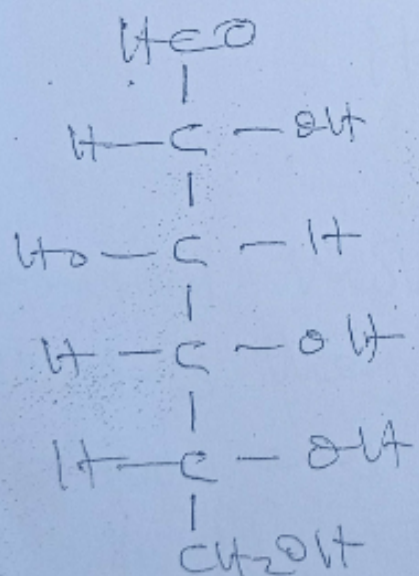
Monosaccharides are the smallest units of carbohydrate structure $(CH_2O)_n$ where $n = 3$ or more upto 9.

Oligosaccharides are polymers of 2 to 20 monosaccharide residues. The most common oligosaccharides are disaccharides which consist of two linked monosaccharide residues.

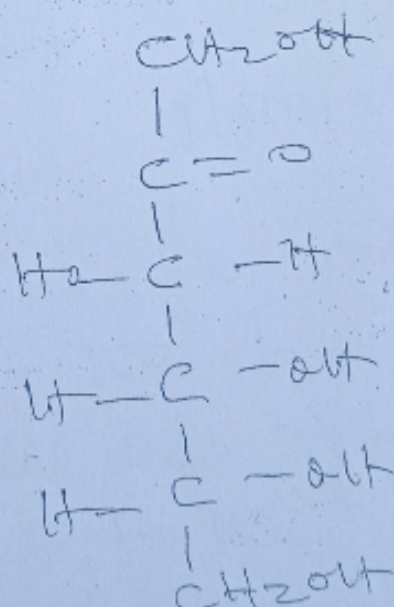
Polysaccharides are polymers that contain many monosaccharide residues usually more than 20.

Oligosaccharides and polysaccharides do not have the empirical formula $(C_6H_{12}O_6)_n$ because water is eliminated during polymer formation.

Monosaccharides



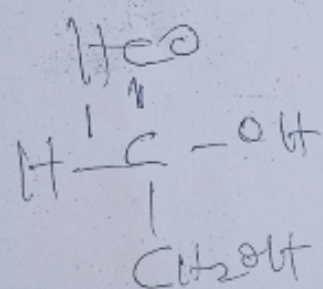
Glucose



Fructose

Monosaccharides are polyhydroxy-aldehyde or polyhydroxy ketone. They are classified by the number of carbon atoms or the carbonyl group they contain. all carbohydrates contain at least 3 carbon atoms and one of these is carbonyl carbon.

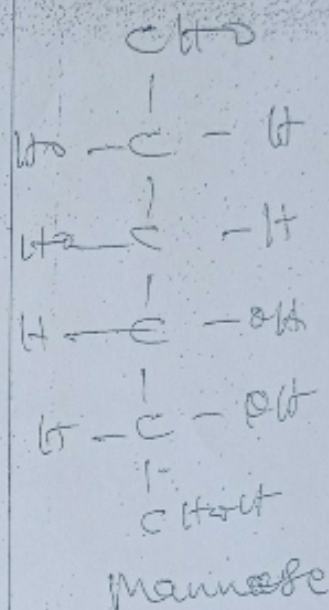
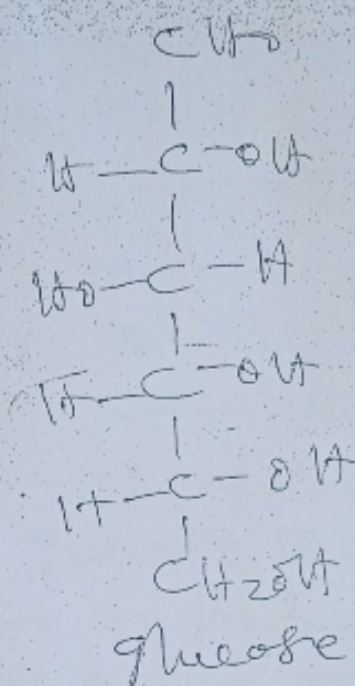
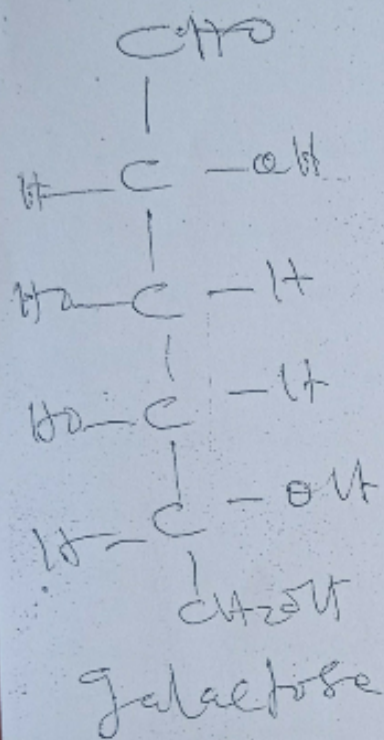
The smallest monosaccharides are trioses or 3 carbon sugar. (eg) glyceraldehyde. Glyceraldehyde is said to be chiral because it has four different groups attached to it.



glyceraldehyde

Chiral molecules are optically active, that is they rotate the plane polarized light. any molecule that rotates the plane polarized light to the right is designated dextrorotatory and if it rotates to the left it is laevorotatory.

imers Sugar molecules that differ in configuration at only one of several chiral centers are called epimers. eg galactose and glucose.



anomers
 The term anomer refers to isomers that differ in configuration at carbon one (C1). (e) anomers of glucose are isomers of glucose that differ in configuration at carbon one of glucose molecule.

Functions of Carbohydrates

Carbohydrates have numerous functions within the body system.

1) **Energy Production:** The primary role of carbohydrates is to supply energy to the cells in the body. Many cells prefer glucose as a source of energy to other compounds like fatty acids.

Some cells such as red blood cells are only able to produce cellular energy from glucose. The brain is also highly sensitive to low blood glucose levels because it uses only glucose to produce energy and function. Unless under extreme starvation.

2) **Energy Storage:** When the body has enough energy to support its functions, the excess glucose is stored as glycogen. Majority of this glucose is stored as glycogen in the muscles and liver.

A molecule of glycogen may contain more than 50,000 glucose units and it is highly branched. Prolonged muscle use such as physical exercise can deplete the glycogen energy reserve. The liver uses this glycogen reserve as a way to keep blood glucose level within range.