Carbohydrates

Carbohydrates are the polyhydroxy aldehydes or ketones or these are the componds which on acidic hydrolysis give polyhydroxy aldehydes or ketones. (mono:1 saccharide: sugar unit) oligosaccharides (oligo: few, eg, 2-10), or polysaccharides (poly: many).

The terms "carbohydrate," "saccharide," and "sugar" are often used interchangeably. "Saccharide" comes from the word for "sugar" in several early languages (*sarkara* in Sanskrit, *sakcharon* in Greek, and *saccharum* in Latin).

The most abundant carbohydrate in nature is D-glucose. Living cells oxidize D-glucose in the first of a series of processes that provide them with energy.

- **Glucose break down in to CO_2 and H_2O providing energy**

$$\underset{\text{glucose}}{C_6H_{12}O_6} + 6\,O_2 \xrightarrow[\text{photosynthesis}]{\text{oxidation}} 6\,CO_2 + 6\,H_2O + \text{energy}$$

Classification of carbohydrates

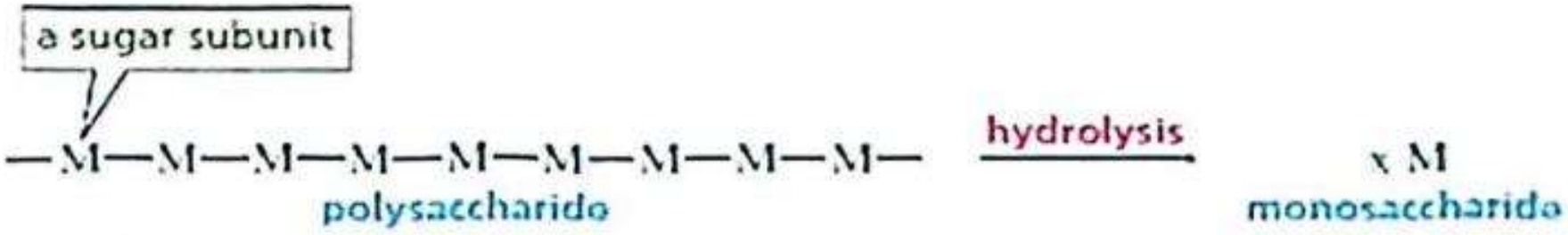
1. On the basic of behavior towards hydrolysis

(i) Monosaccharides (Simple Sugar)- Single unit carbohydrates that can not be broken into simpler carbohydrates by hydrolysis. Eg- Glucose, fructose, galactose etc.

(ii) Oligosaccharides- They are made of 2 to 10 units of monosaccharides(simple sugar). The oligosaccharides containing two monosaccharides units are called diasaccharides.

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow{H^+} \underset{\text{Glucose}}{C_6H_{12}O_6} + \underset{\text{Fructose}}{C_6H_{12}O_6}$$

(iii) **Polysaccharides**- These are the carbohydrates with high molecular weight which yield a large number of monosaccharides units on hydrolysis.



$$(C_6H_{10}O_5)_n + nH_2O \xrightarrow{H^+} nC_6H_{12}O_6$$

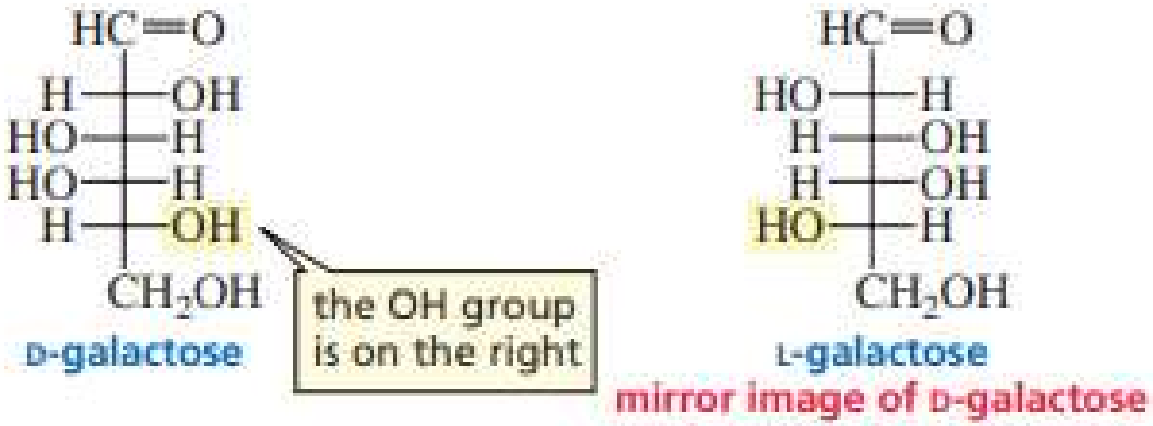
Starch or cellulose

2. On the basic of taste and solubility- The monosaccharides and oligosaccharides are soluble crystalline substances, and they have sweet taste. So they are called sugars. On the other hand polysaccharides are amorphous insoluble substances. They are called non-sugars.

3. On the basis of reducing property- Carbohydrates which can reduce Tollens reagent and Fehling's solution are termed as reducing sugar

The D and L Notation

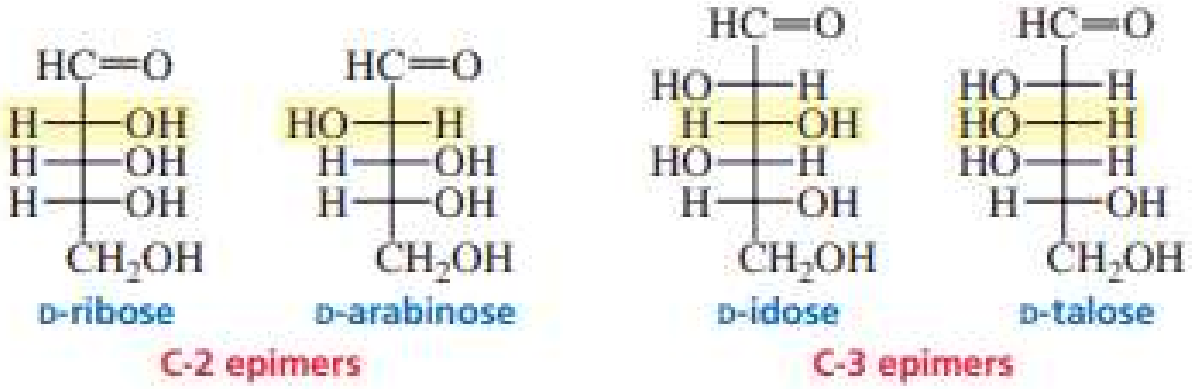
If the OH group attached to the bottom-most asymmetric carbon (the carbon that is second from the bottom) is on the right, then the compound is a D-sugar. If the OH group is on the left, then the compound is an L-sugar.



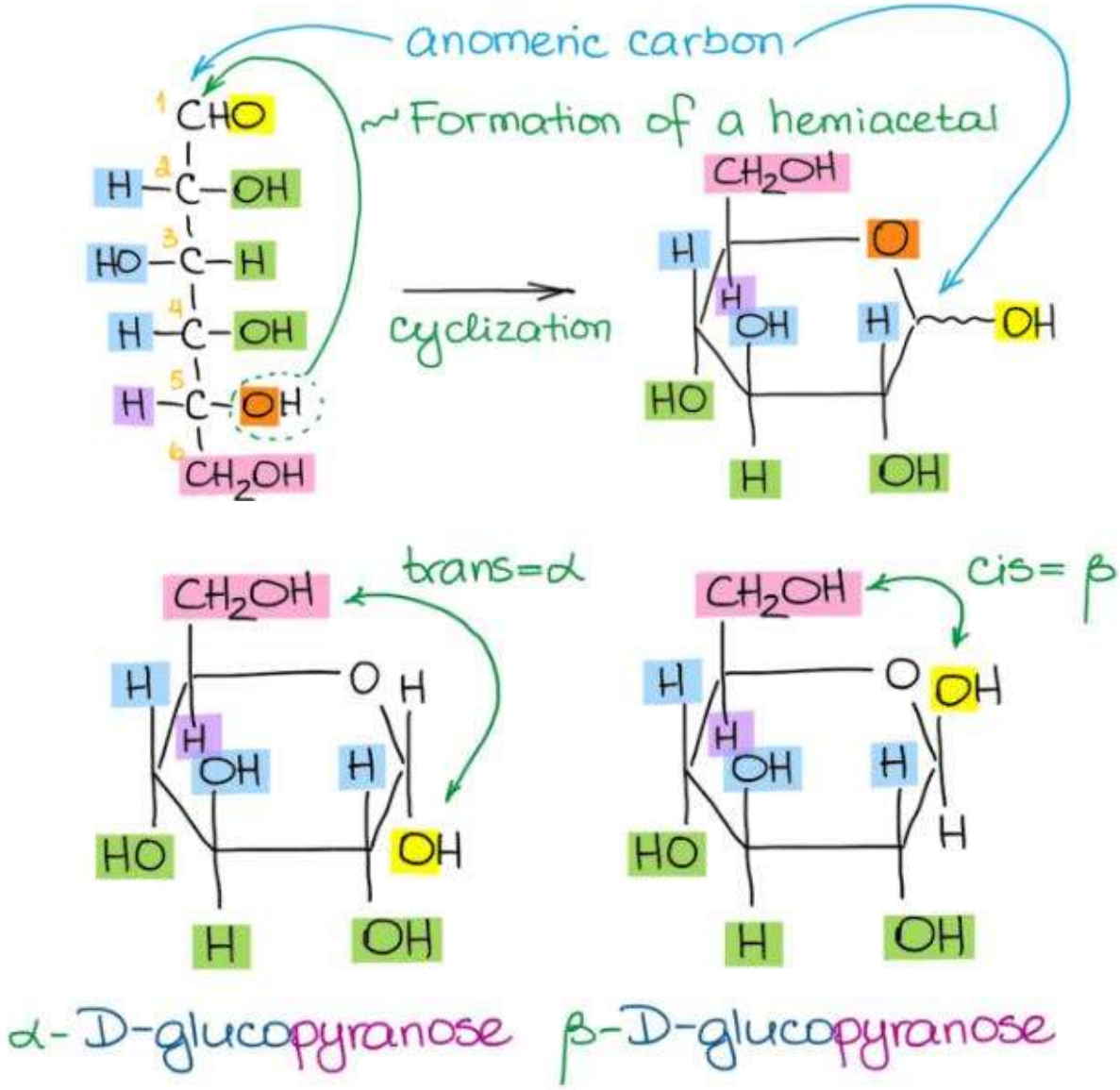
Almost all sugars found in nature are **D-sugars**.

Configurations of Aldoses

Diastereomers that differ in configuration at only one asymmetric carbon are called epimers. For example, D-ribose and D-arabinose are C-2 epimers (they differ in configuration only at C-2), and D-idose and D-talose are C-3 epimers.



Conversion of Fisher to Haworth in glucose



Anomers are two sugars that differ in configuration only at the carbon that was the carbonyl carbon in the open-chain form. This carbon is called the anomeric carbon.