



Practical General Chemistry

Lecture notes

Presented by

Lec. Rusl Mahdi Obaid

Medical laboratory Techniques Department

Al-Mustaqbal University College,

Babil, Iraq

First year students

Sixth Lecture: Carbohydrates



Carbohydrates

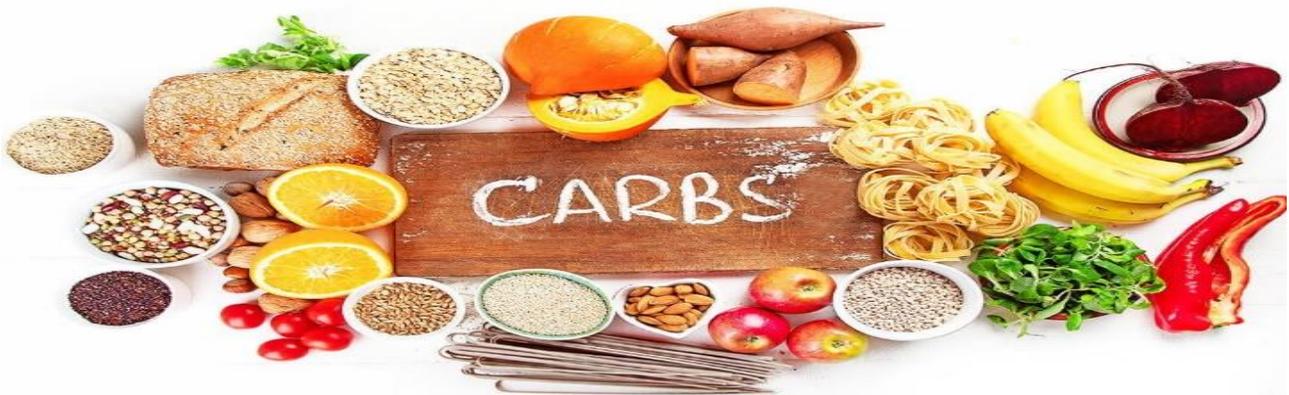
are compounds of tremendous biological importance:

- ✚ they provide energy through oxidation
 - ✚ they supply carbon for the synthesis of cell components
 - ✚ they serve as a form of stored chemical energy
 - ✚ they form part of the structures of some cells and tissues
- Carbohydrates, along with lipids, proteins, nucleic acids, and other compounds are known as biomolecules because they are closely associated with living organisms.

Biochemistry is the study of the chemistry of biomolecules and living organisms.

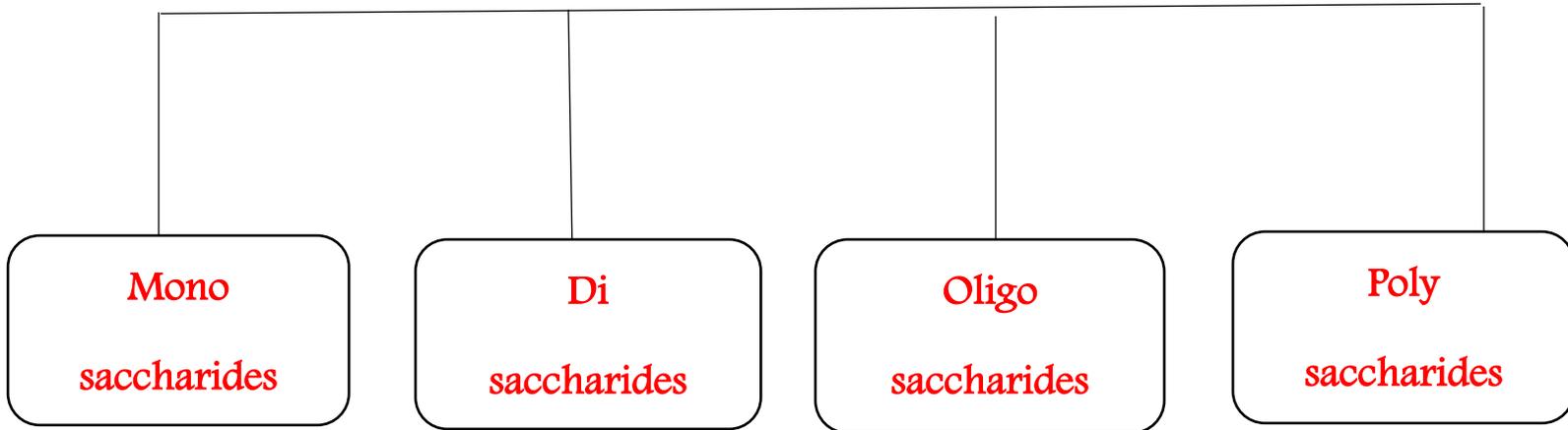
Classification of Carbohydrates

Carbohydrates are polyhydroxy aldehydes or ketones, or substances that yield such compounds on Hydrolysis





Therefore, carbohydrates are classified into

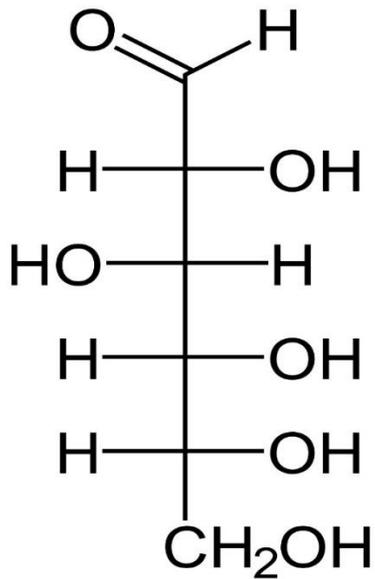


➤ Monosaccharides

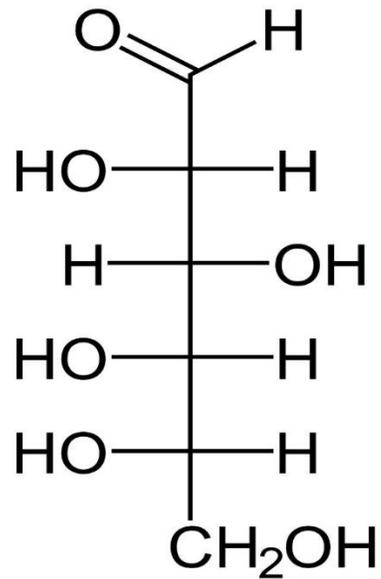
contain a single polyhydroxy aldehyde or ketone unit (saccharo is Greek for “sugar”) (e.g., glucose, fructose).

Classification of Monosaccharides

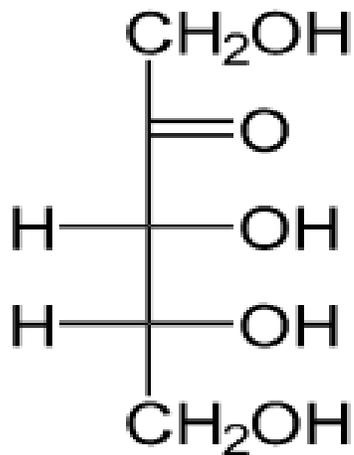
Thus, glucose is an aldohexose (aldehyde + 6 Cs) and ribulose is a ketopentose (ketone + 5 Cs)



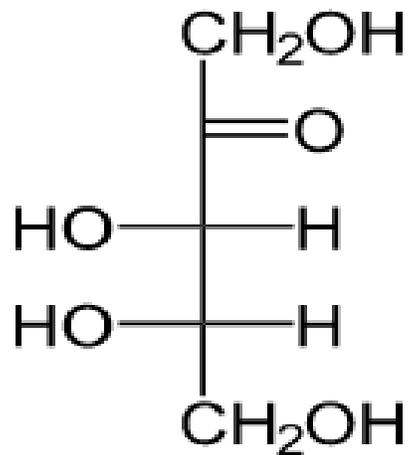
D-Glucose



L-Glucose



D-Ribulose



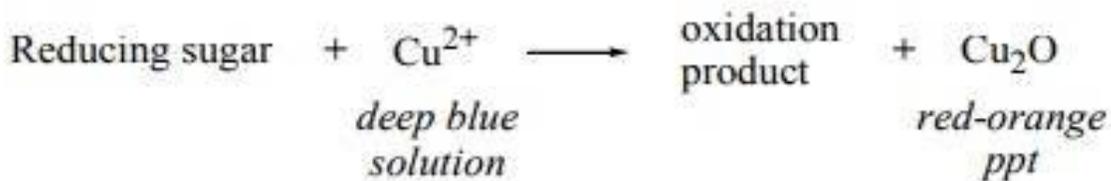
L-Ribulose



Oxidation of Monosaccharides

Aldehydes and ketones that have an OH group on the carbon next to the carbonyl group react with a basic solution of Cu^{2+} (Benedict's reagent) to form a red-orange precipitate of copper(I) oxide (Cu_2O).

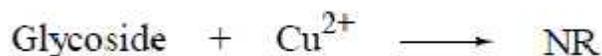
Sugars that undergo this reaction is called reducing sugars. (All of the monosaccharides are reducing sugars.)



Glycoside Formation

The hemiacetal and hemiketal forms of monosaccharides can react with alcohols to form acetal and ketal structures called glycosides.

The new carbon-oxygen bond is called the glycosidic linkage.
Once the glycoside is formed, the ring can no longer open up to the open-chain form. Glycosides, therefore, are not reducing sugars?

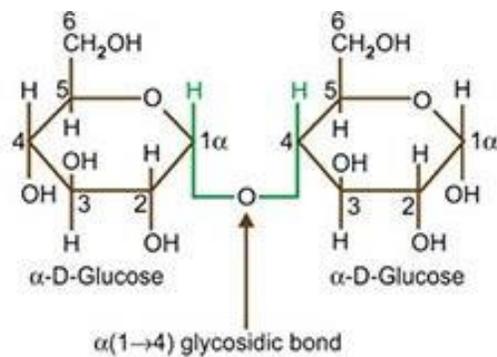




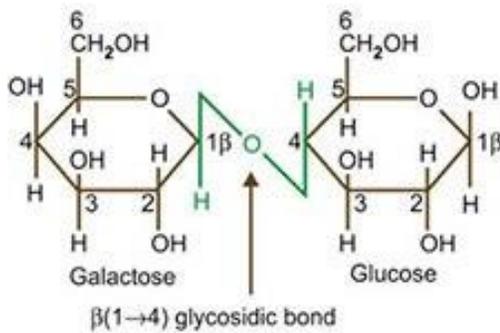
➤ Disaccharides

consist of two monosaccharide units linked together by a covalent bond (e.g., sucrose).

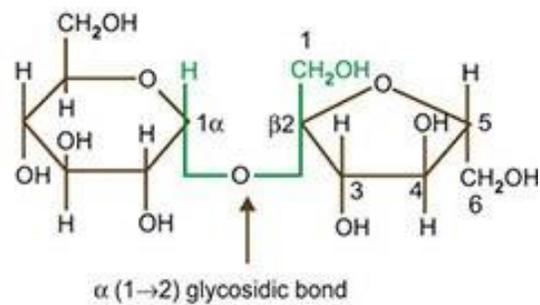
Two monosaccharides can be linked together through a glycosidic linkage to form a disaccharide.



Maltose



Lactose

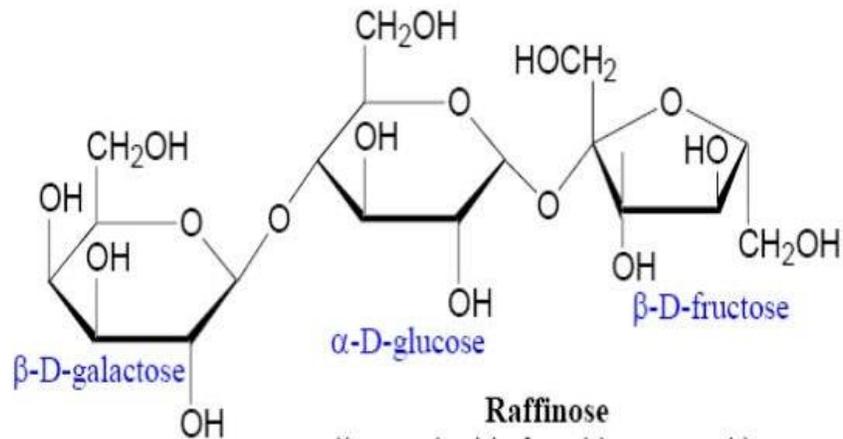


Sucrose



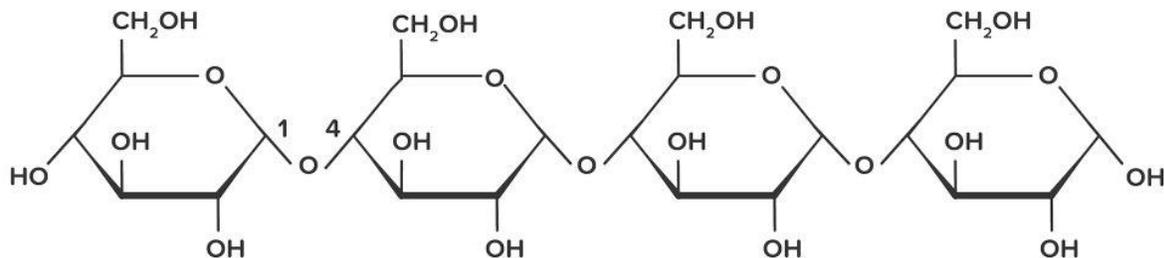
➤ Oligosaccharides

contain from 3 to 10 monosaccharide units (e.g., raffinose).



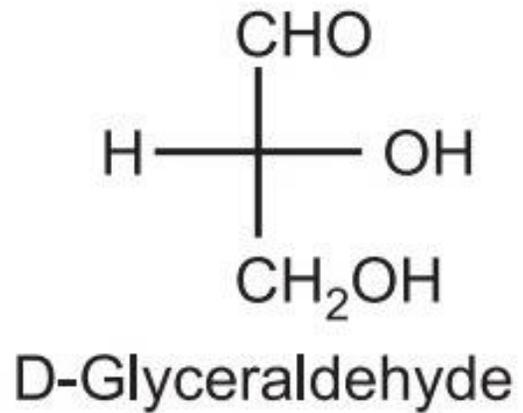
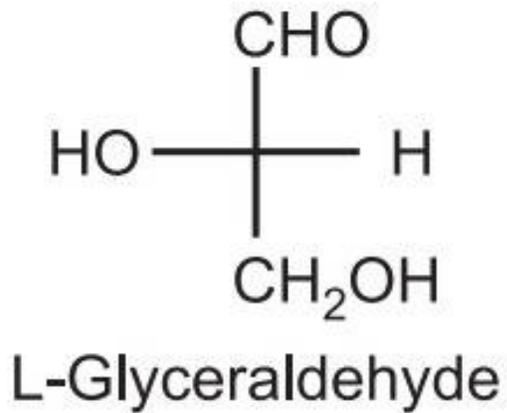
➤ Polysaccharides

contain very long chains of hundreds or thousands of monosaccharide units, which may be either in straight or branched chains (e.g., cellulose, glycogen, starch).



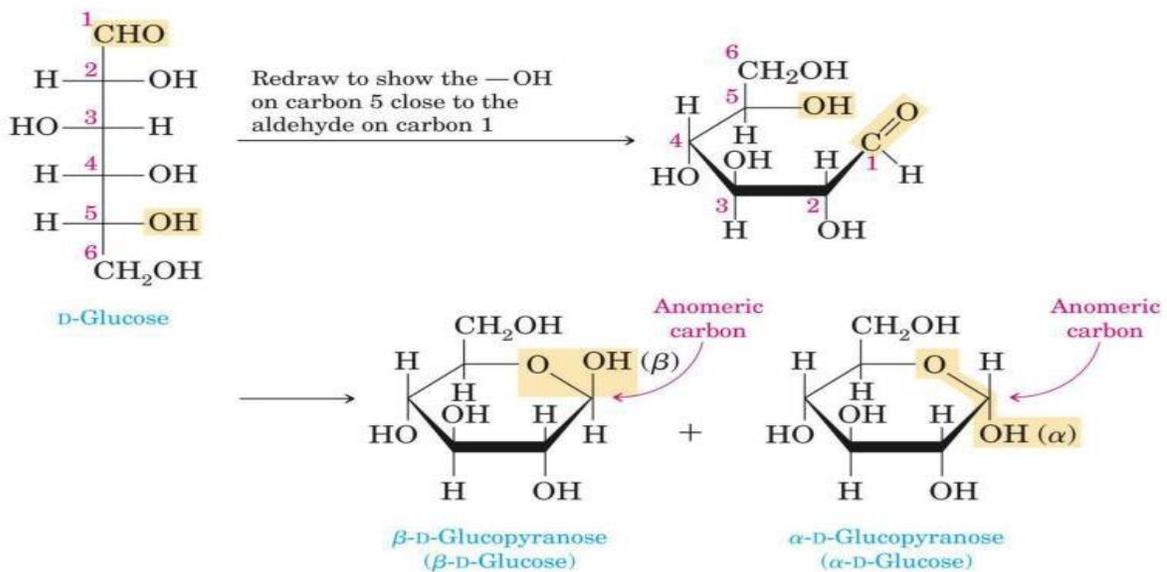
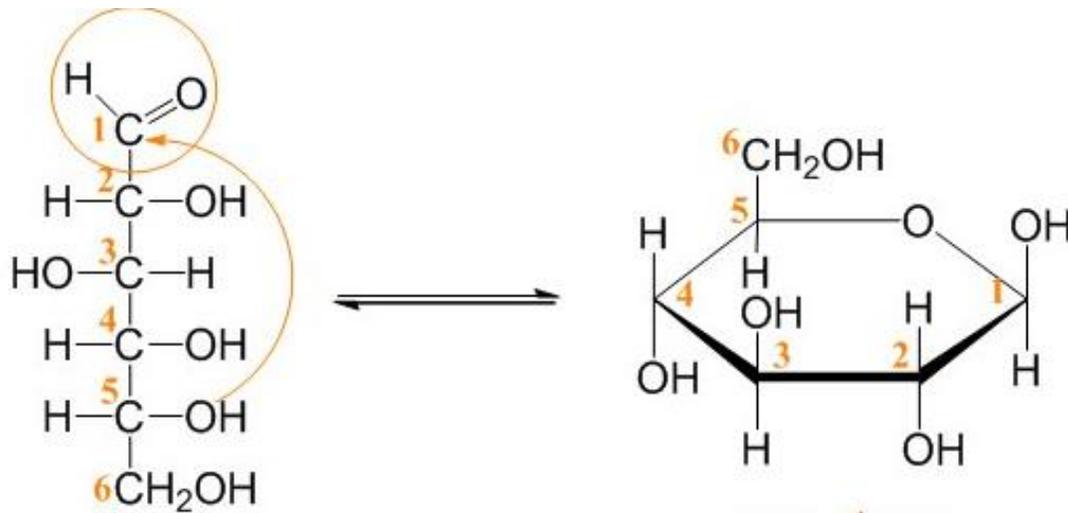


Stereoisomers: Glyceraldehyde, the simplest carbohydrate, exists in two isomeric forms that are mirror images of each other:



Open Chain to Cyclic Form Mechanism

➤ The mechanics of glucose



➤ The mechanics of fructose

