



AL-Mustaqbal University College

Medical laboratory Techniques Department

Practical General Chemistry

Lecture seven (7) (Carbohydrates)



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Carbohydrates :- are compounds of tremendous biological importance:

- ✓ they provide energy through oxidation
- ✓ they supply carbon for the synthesis of cell

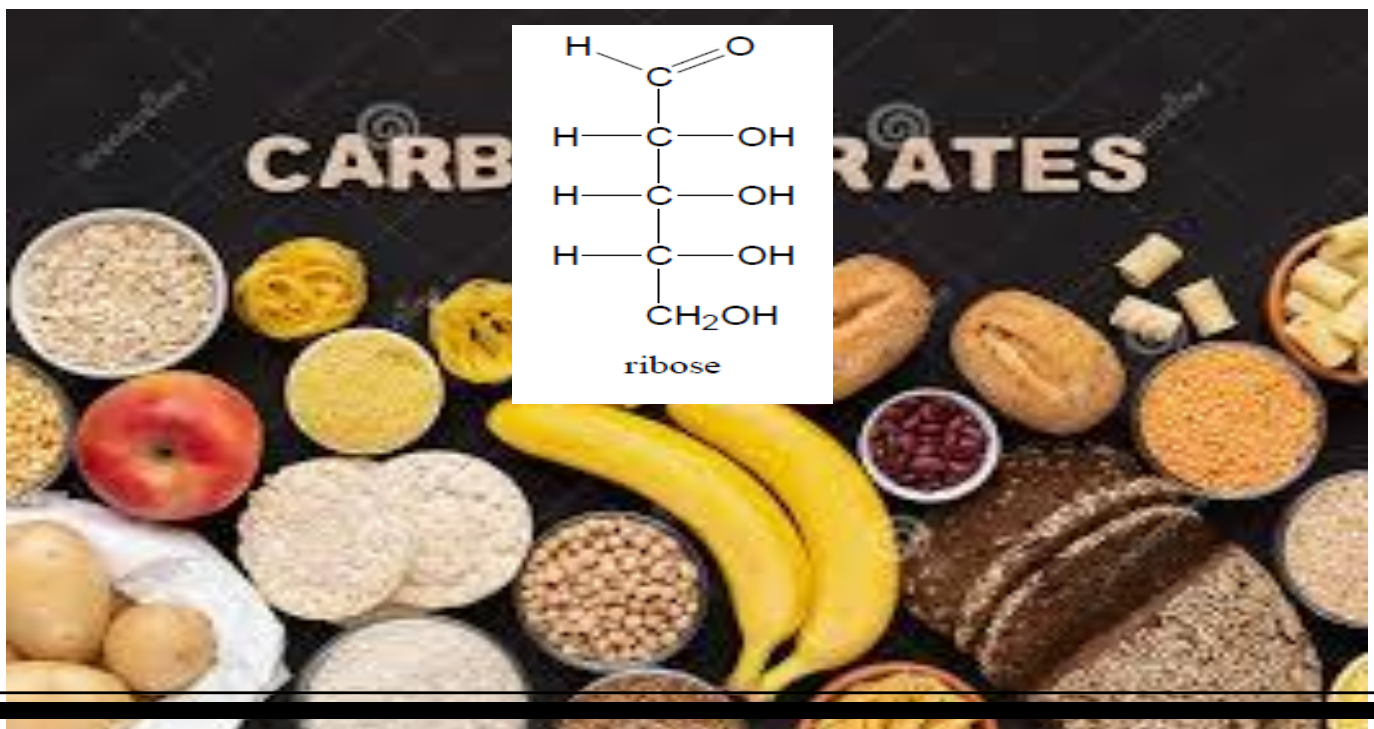
components

- ✓ 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

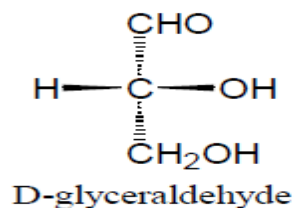
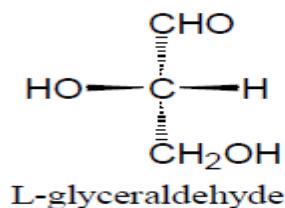
Carbohydrates are polyhydroxy aldehydes or ketones, or substances that yield such compounds on Hydrolysis



- **Monosaccharides** contain a single polyhydroxy aldehyde or ketone unit (saccharo is Greek for “sugar”) (e.g., glucose, fructose).
- **Disaccharides** consist of two monosaccharide units linked together by a covalent bond (e.g., 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).

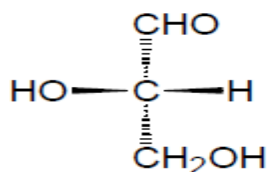
Stereoisomers

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

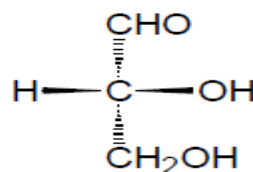


Fischer Projections

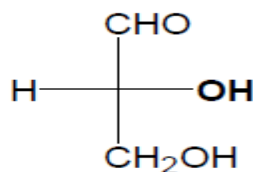
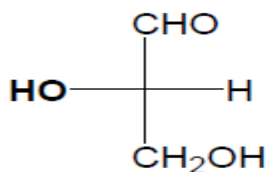
- Fischer projections are a convenient way to represent mirror images in two dimensions. Place the carbonyl group at or near the top and the last achiral CH₂OH at the bottom.



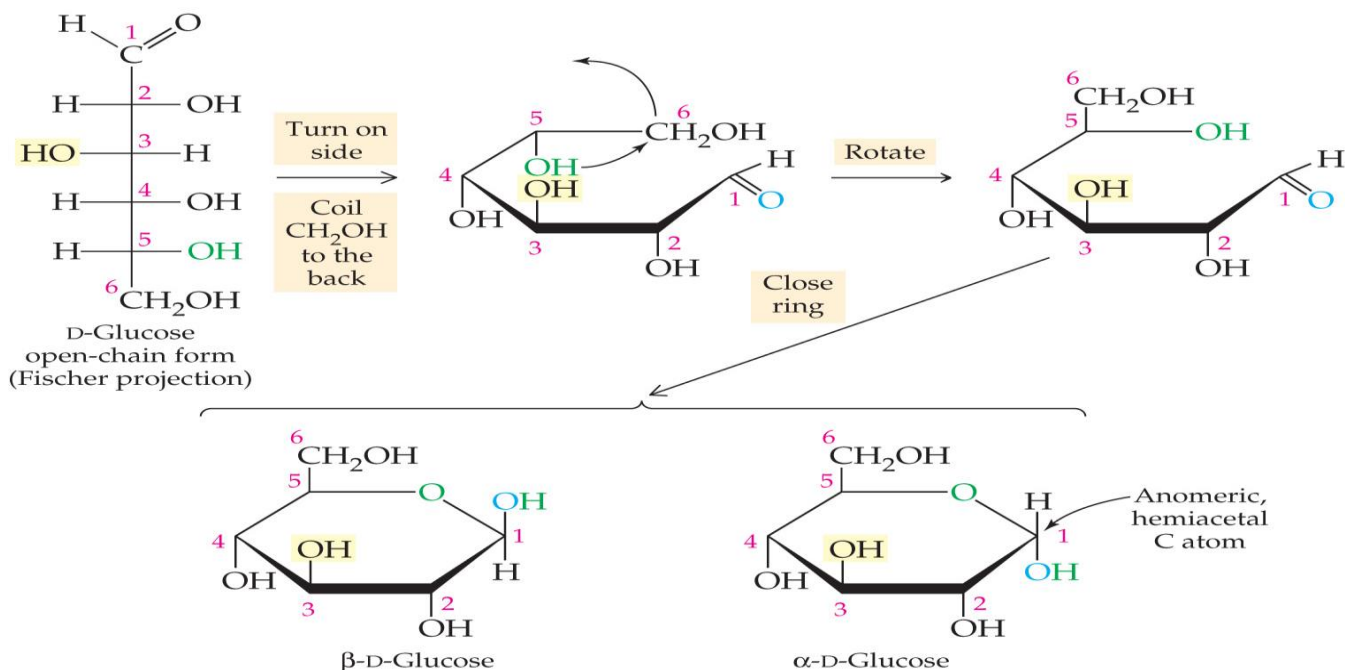
L-glyceraldehyde



D-glyceraldehyde

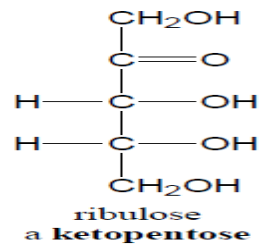
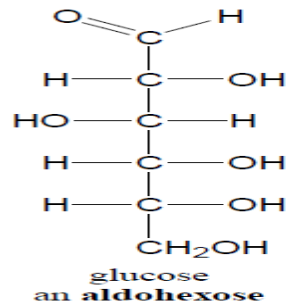


Open Chain to Cyclic Form Mechanism



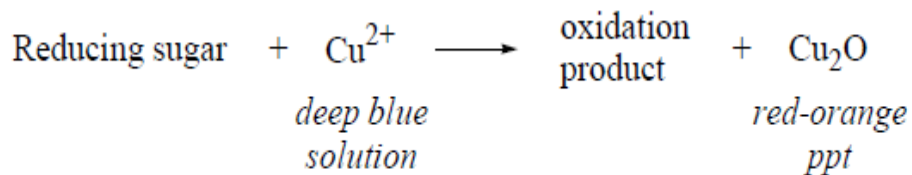
Classification of Monosaccharides

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



Oxidation of Monosaccharides

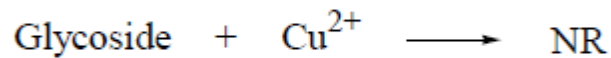
- Aldehydes and ketones that have an OH group on the carbon next to the carbonyl group react with a basic solution of Cu^{2+} (Benedict's reagent) to form a red-orange precipitate of copper(I) oxide (Cu_2O).
- Sugars that undergo this reaction are called reducing sugars. (All of the monosaccharides are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



Glycoside Formation

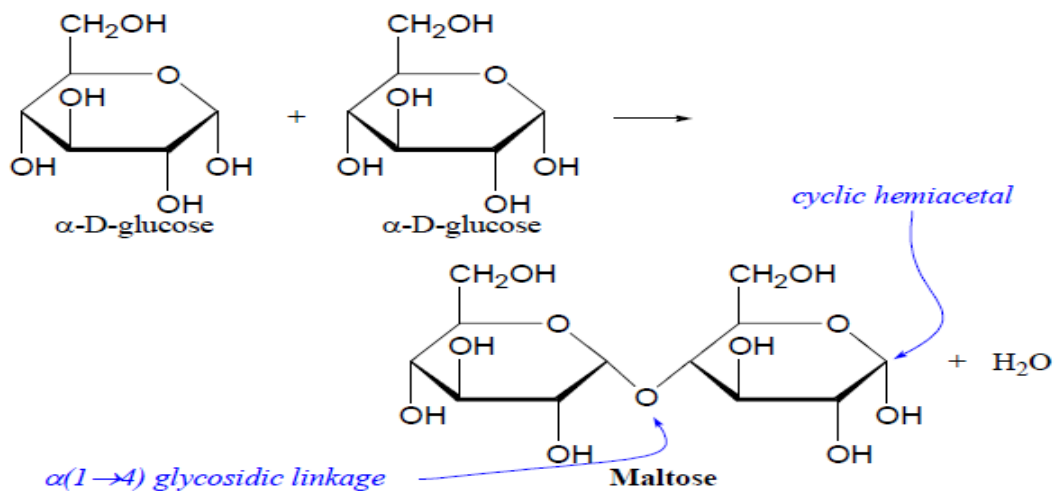
- The hemiacetal and hemiketal forms of monosaccharides can react with alcohols to form acetal and ketal structures called glycosides. **The new carbon-oxygen bond is called the glycosidic linkage.**

Once the glycoside is formed, the ring can no longer open up to the open-chain form. Glycosides, therefore, are not reducing sugars??.



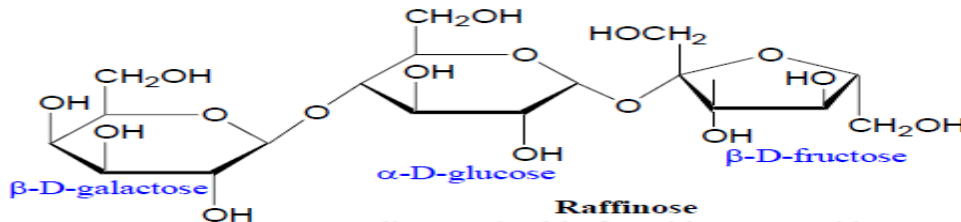
Disaccharides

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



Oligosaccharides

- Oligosaccharides contain from 3 to 10 monosaccharide units.



Polysaccharides

- ✓ Polysaccharides contain hundreds or thousands of carbohydrate units.
- ✓ Polysaccharides are not reducing sugars, since the
- ✓ anomeric carbons are connected through glycosidic linkages.
- ✓ We will consider three kinds of polysaccharides, all
- ✓ of which are polymers of glucose: starch, glycogen,
- ✓ and cellulose.

