Dept. of Biochemistry

Introductory Biochemistry

Biomolecules_Carbohydrate _Lecture_2

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Classification of Carbohydrates

Carbohydrates are classified into three groups:

1. Monosaccharide's=single unit

2. Oligosaccharides =2-10 units

3. Polysaccharides >10 units

The suffix ose indicates that a molecule is a carbohydrate .e.g maltose, glucose, lactose, fructose ,ribose

Monosaccharides

Monosaccharides (Greek: Mono = one)

- Monosaccharides are also called simple sugars. The term sugar is applied to carbohydrates that are soluble in water and sweet to taste
- They consist of a single unit
- polyhydroxy aldehyde or ketone unit, and thus cannot be hydrolyzed into a simpler form.

Monosaccharides may be subdivided into two groups as follows:

1. Depending upon the number of carbon atoms they possess, e.g.

- **Trioses 3 carbon Glyceraldehyde**
- **Tetroses 4 carbon Erythrose**
- **Pentoses 5 carbon Ribose, Xylose**
- **Hexoses 6 carbon Glucose, Galactose, fructose**
- **Heptoses. 7 carbon Glucoheptos**

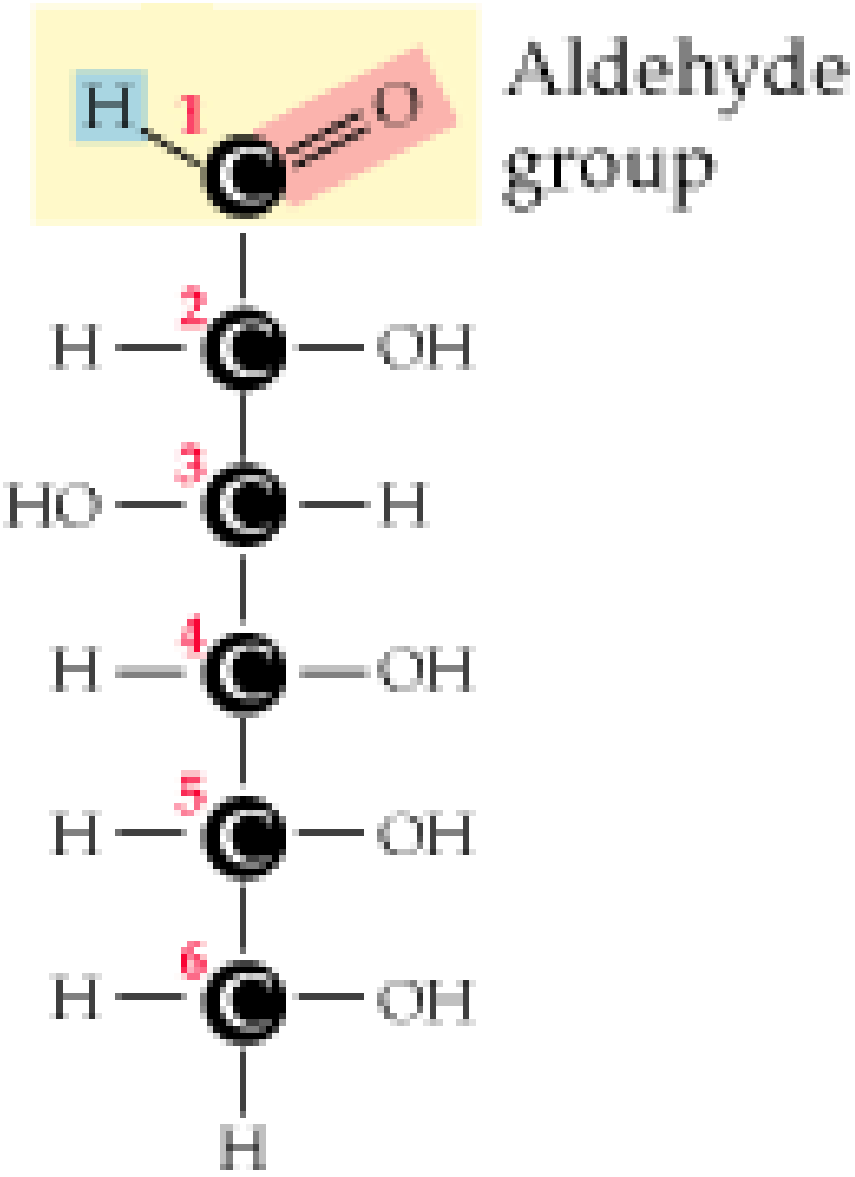
2. Depending upon the functional aldehyde (CHO) or ketone (C=O) group present:

- **Aldoses CHO Glucose, Galactose**
- **Ketoses C=O Fructose**

Aldoses

Aldehyde Sugars (Aldoses):

- All carbohydrates are characterized by the **carbonyl** functional group (C=O) along with a number of **hydroxyl** functional groups(C—OH).
  - **Aldehydes** have the carbonyl group at the end of the molecule.
- Glucose, pictured here, is an example of an aldehyde sugar (aldose).
  - It is the most common monosaccharide in living systems.
- Note how the carbon atoms are numbered beginning at the aldehyde functional group.

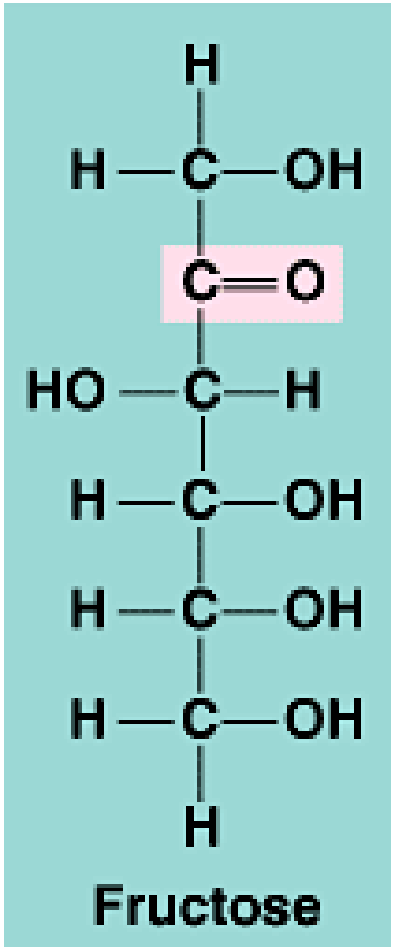

Aldehyde group
H
1
O
2
H
OH
3
HO
H
4
H
OH
5
H
OH
6
H
OH
H

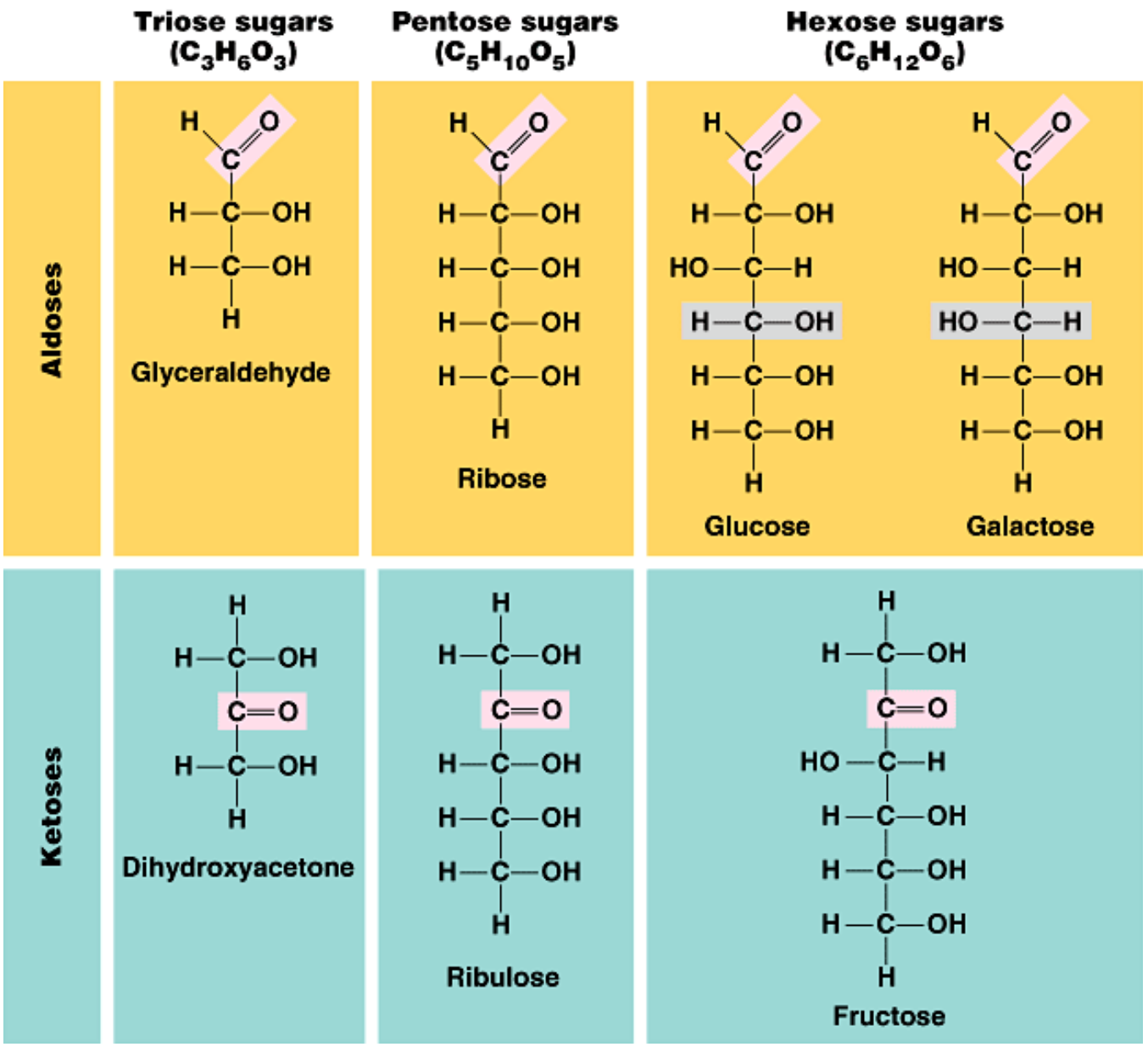
Ketoses

Ketone Sugars (Ketoses):

- In a ketone sugar (ketose), the **carbonyl group** end of the sugar.

- Fructose, pictured here, is one of the most common monosaccharide ketone sugars.




Triose sugars
(C3H6O3)
Pentose sugars
(C5H10O5)
Hexose sugars
(C6H12O6)
Aldoses
Ketoses
Glyceraldehyde
Ribose
Glucose
Galactose
Dihydroxyacetone
Ribulose
Fructose

GLUCOSE

GLUCOSE :

- Physiologically and biomedically, glucose is the most important monosaccharide
- It is called blood sugar
- C6H12O6
- It is monosaccharide (aldose)
- It is source of energy
- It is produced by hydrolysis of glycogen

Oligosaccharides

2. Oligosaccharides:

- Oligosaccharides consist of a short chain of monosaccharide units (2 to 10 units), joined together by a characteristic bond called **glycosidic bond which, on hydrolysis, gives two to ten molecules of simple sugar (monosaccharide) units**

Disaccharides

Disaccharides are the carbohydrates which on hydrolysis give two same or different monosaccharides. Their general formula is C12H22O11. The important members belonging to disaccahrides are sucrose, maltose, and lactose. On hydrolysis with dilute acids or enzymes these give the following two molecules of monosaccharides.

Polysaccharides

3.Polysaccharides:

They are high molecular weight polymers containing more than tenmonosaccharides. They are either linear or branched in structure.

Polysaccharides are further classified based on:

a) the kind of monosaccharides present as:

1. Homopolysaccharides when made from a single kind of monosaccharide.
   Eg starch, cellulose, inulin, glycogen, chitin

Polysaccharides

2. Heteropolysaccharides are made up of more than one type of monosaccharides.

   Eg. Hemicellulose, Mucopolysaccharides – Chondroitin sulphate, Hyaluronic acid Heparin and Keratan sulphate

b) functional aspect as:

1. Storage Polysaccharide eg. Starch, glycogen, inulin, Galactomannan
2. Structural Polysaccharide eg.Cellulose, Chitin, Hemicellulose