Food Chemistry I

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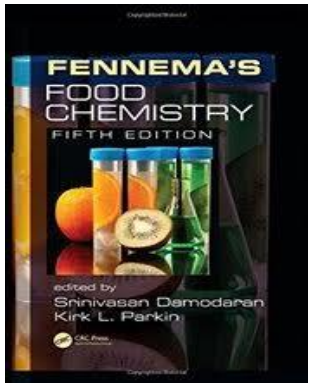
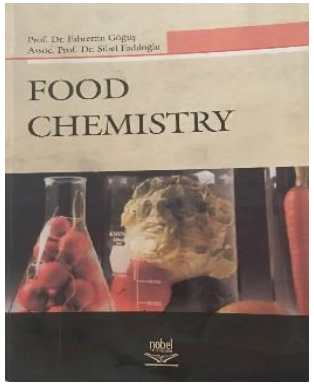
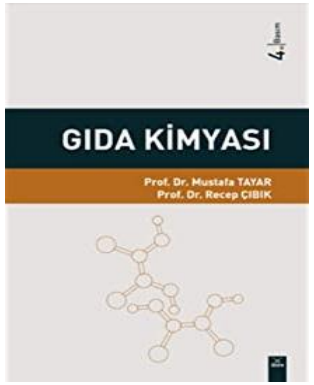
1. 

2. 

3. 

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2. Göğüş F. and Fadıloğlu S. 2006. *Food Chemistry*, Nobel Akademik Yayıncılık, Ankara.
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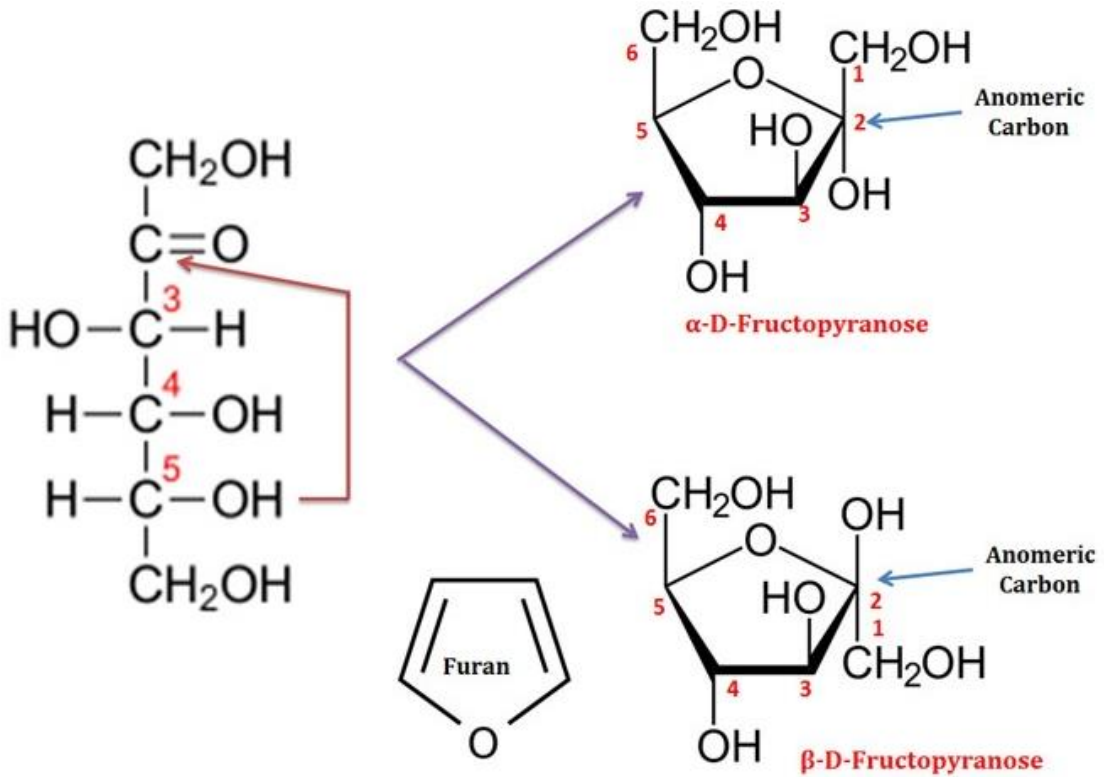
MONOSACCHARIDES

* The simplest sugars or monomeric units

* Chemically, they are aldehydes or ketones (open-chain or acyclic form)



* Monosaccharides are classified according to the different characteristics:

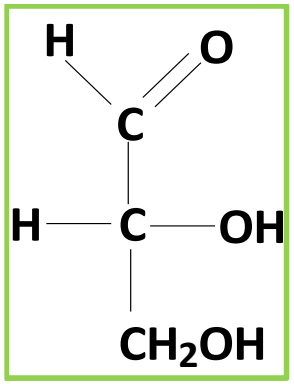
- Number of carbon atoms
- Nature of the carbonyl group
- Orientation of hydroxyl groups about chiral carbon atoms
- Type of ring conguration, ring size, and ring conformation.

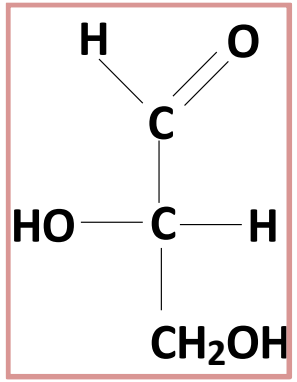
- Number of carbon atoms (3–9 most common)
- Nature of the carbonyl group: aldehyde (aldose) versus ketone (ketose)

Number of Carbon Atoms	Kind of Carbonyl Group	
	Aldehyde	***Ketone***
3	Triose	Triulose
4	Tetrose	Tetrulose
5	Pentose	Pentulose
6	Hexose	Hexulose
7	Heptose	Heptulose
8	Octose	Octulose
9	Nonose	Nonulose

- Orientation of hydroxyl groups about chiral carbon atoms. Hydroxyl group orientation about the highest numbered chiral carbon atom: D- vs L.

Monosaccharides are asymmetric and optically active. Taking glyceraldehyde as an example, the C atom in position 2 is chiral and glyceraldehyde therefore has two enantiomers.





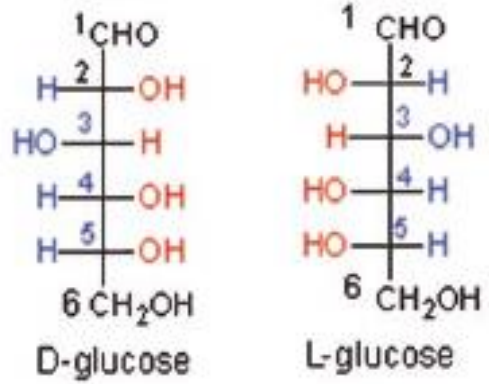
+ glyceraldehyde	-glyceraldehyde
D-glyceraldehyde	L-glyceraldehyde
R-glyceraldehyde	S-glyceraldehyde

- Type of ring conguration (α vs. β), ring size (commonly 5- membered (furanose ring) or 6-membered (*pyranose ring*)), and ring conformation.

Conformational isomers of glucose

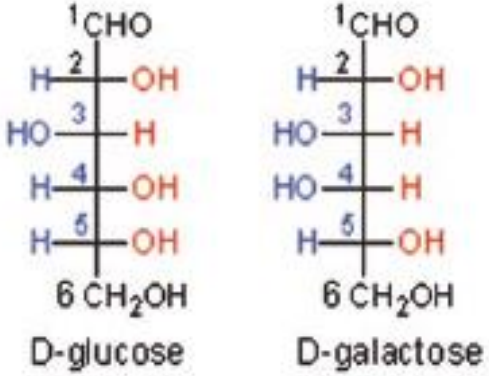
enantiomers

stereoisomers that are mirror images



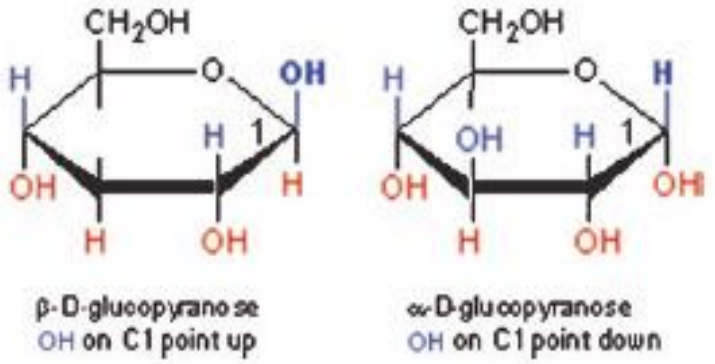
diastereomers

stereoisomers that are not mirror images



anomers

stereoisomers and diastereomers that differ in config. around anomeric C



Glycosides and Glycoside Bonds

The hemiacetal form of sugars can react with an alcohol to produce a full acetal; the product is called a *glycoside*.

in the laboratory:

* under anhydrous conditions
* in the presence of an acid (as a catalyst)
* at elevated temperatures

made in nature:

* in aqueous environments
* by enzyme-catalyzed reactions

The acetal linkage at the anomeric carbon atom is called a *glycosidic linkage* (or bond).

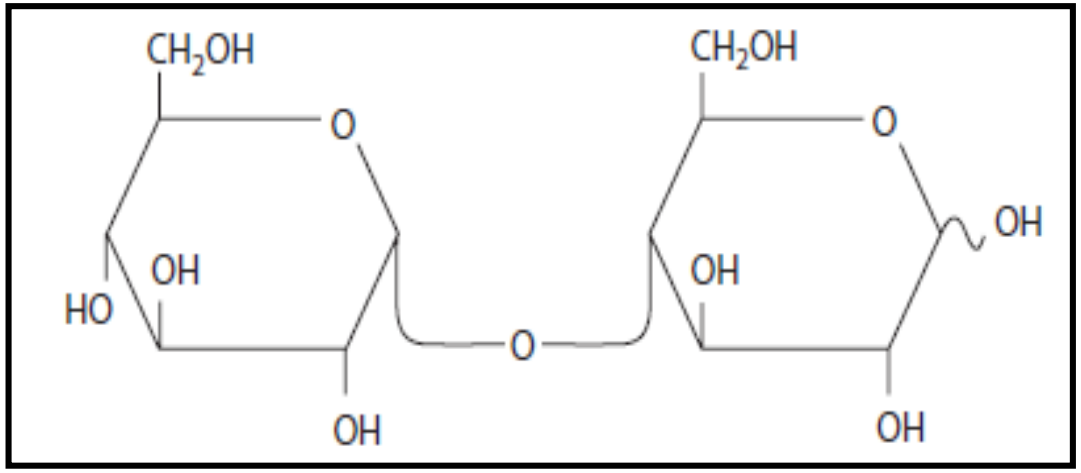
The methyl group in this case, and any other group bonded to a sugar to make a glycoside, is termed an *aglycon*.

OLIGOSACCHARIDES

- contain 2–20 monosaccharide units joined via glycosidic linkages
- water-soluble and occur widely in nature
- naturally occurring oligosaccharides contain less than six monosaccharide units
- cyclodextrins (high-molecular weight oligosaccharides)consist of 6-8 D-glucopyranose units, corresponding to α-, β-, and γ-cyclodextrins respectively

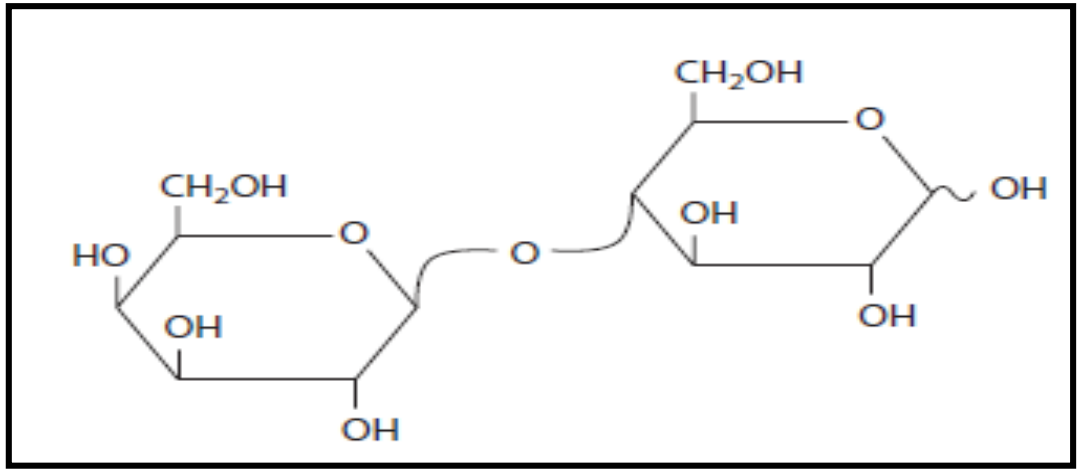
Some Important Oligosaccharides

Maltose:



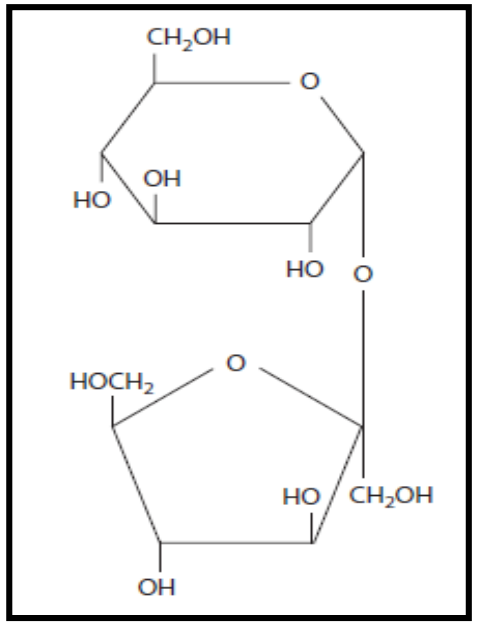
Maltose is an example of disaccharide consisting of **2 glucose** molecules.

Lactose:



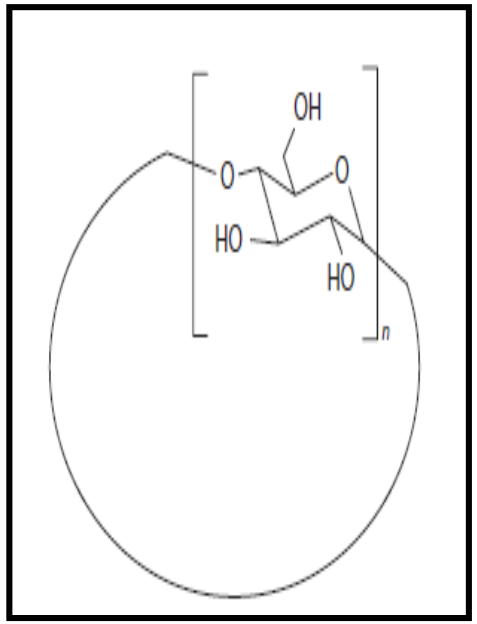
Its constituent monosaccharides D-**glucose** and D-**galactose**.

Sucrose:



Sucrose is composed of an α-**gluco pyranosyl** unit and a β-**fructofuranosyl** unit linked head to head .

Cyclodextrins:



Cyclodextrins and cycloamyloses, are a family of cyclic oligosaccharides comprised of (1→4)-linked α-glucopyranosyl units .

POLYSACCHARIDES

* diverse polymers comprised of >20 to >60,000 monosaccharide units joined together by glycosidic linkages

* all polysaccharides are either water-soluble or water-binding

* viscosity of a polysaccharide solution is determined by the molecular size, shape, rigidity, and concentration of the polysaccharide chains

* exhibit either pseudoplastic or thixotropic flow behavior

* polysaccharide gels are generally stabilized by junction zones formed between polymer chains

* Polysaccharides may undergo hydrolytic cleavage under acidic conditions

Polysaccharides are classified into two groups as **homopolysaccharides** (**homoglycans**) and **heteropolisaccharides** (**heteroglycans**) due to their chemical structure.

Polysaccharides derived from glucose are called **glycans** and those derived from fructose are called **fructans**.

Some Important Polysaccharides

Examples of **homoglycans** are ***starch***, ***cellulose*** and ***glycogen***.

Inulin: It consists of fructose. Therefore, it is in the class of fructans.

Agar agar: It consists of only galactose molecules. For this reason, it is in the class of galactane.

Pectin and ***alginate***: They are uronic acid components. They are also called glucorors.

Heteroglycans: They are composed of different monosaccharide and uronic acid molecules. They break down under the influence of enzyme, acid and heat.

CARBOHYDRATES

MONOSACCARIDES (Simple Sugars)

PENTOSES

arabinose
xylose
ribose

HEXOSES

*** Aldohexoses**

galactose, glucose

*** Ketohexose**

fructose

OLIGOSACCARIDES

DISACCARIDES

*** Reducing**

maltose, lactose

*** Nonreducing**

sucrose

TRISACCARIDES

*** Nonreducing**

raffinose
gentianose

POLYSACCARIDES

HOMO-

(one kind of monosaccaride unit)

*** Pentosans** (xylan, araban)

*** Hexosans**

Glucans (starch, dextrin, glycogen, cellulose), **Fructosan** (inulin), **Mannan, Galactan**

HETERO-

(two or more kinds of monosaccaride units)

(pectins, gums, musilages)

NITROGEN CONTAINING-

(chitin)