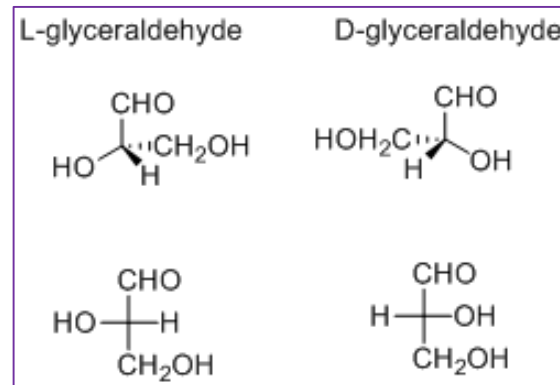


The D and L Notations

The notations D and L are used to describe the configurations of carbohydrates and amino acids.

Glyceraldehyde has been chosen as arbitrary standard for the D and L notation in sugar chemistry. Because, this has an asymmetric carbon and can exist as a pair of enantiomers.

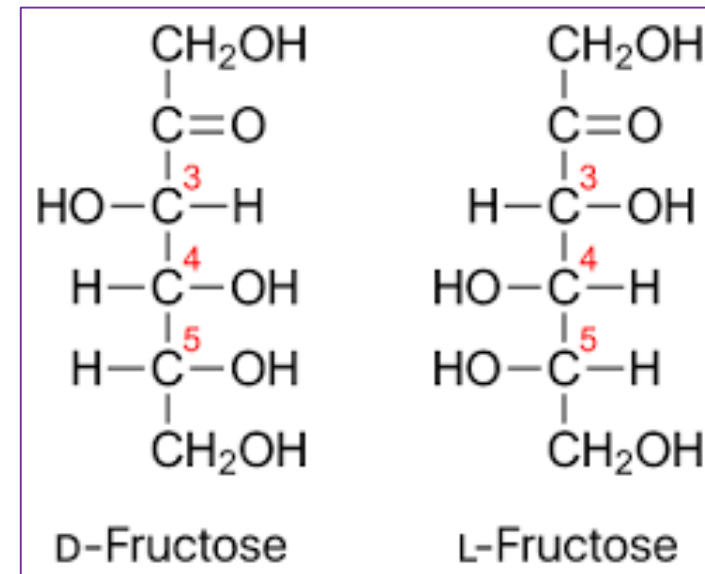
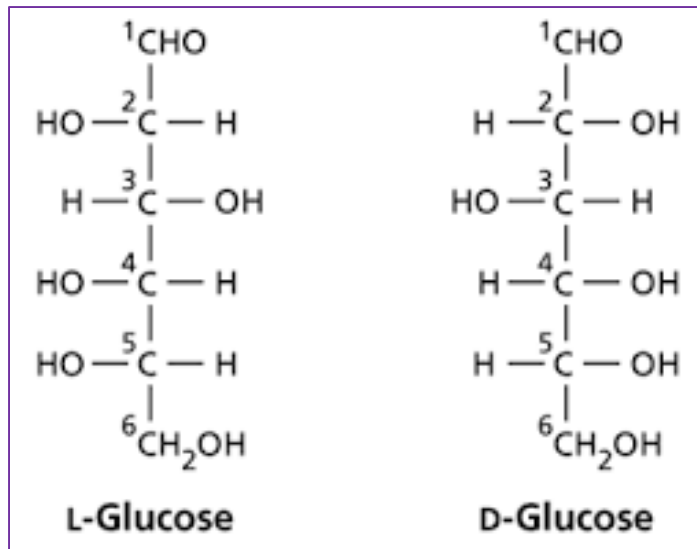


In a Fischer projection, the carbonyl group is always placed on the top position for monosaccharide. From its structure, if the $-\text{OH}$ group attached to the bottom-most asymmetric center (the carbon that is second from the bottom) is on the right, then, the compound is a D-sugar. If the $-\text{OH}$ group is on the left, then, the compound is a L-sugar. Almost all sugars found in nature are D-sugar.

Like *R* and *S*, *D* and *L* indicate the configuration of an asymmetric carbon, but they do not indicate whether the compound rotates polarized light to the right or to the left. For example, *D*-glyceraldehyde is dextrorotatory, whereas *D*-lactic acid is levorotatory. In other words, optical rotation, like melting or boiling points, is a physical property of a compound, whereas “*R*, *S*, *D*, and *L*” are conventions humans use to indicate the configuration of a molecule.

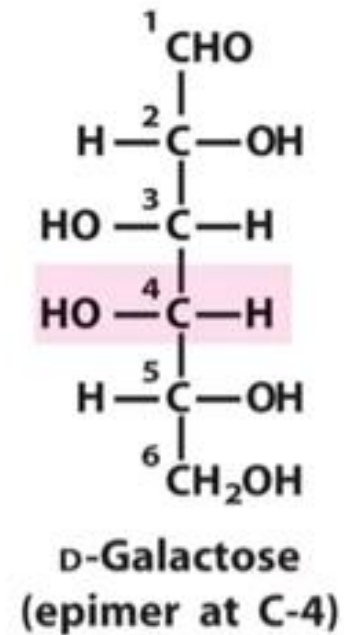
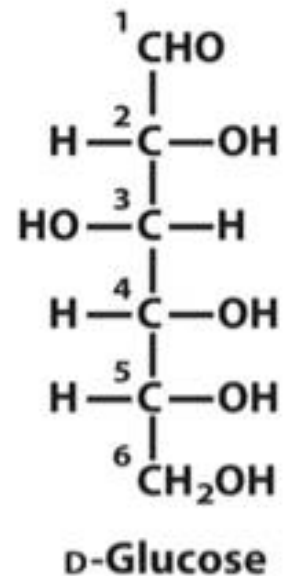
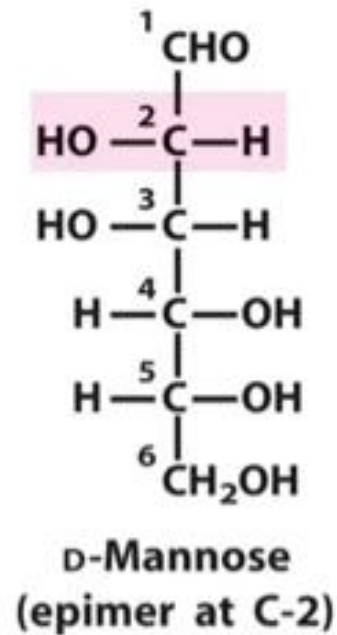
D/L Configuration of the Aldoses and Ketose

Aldohexose (Glucose), Ketohexose (Fructose):



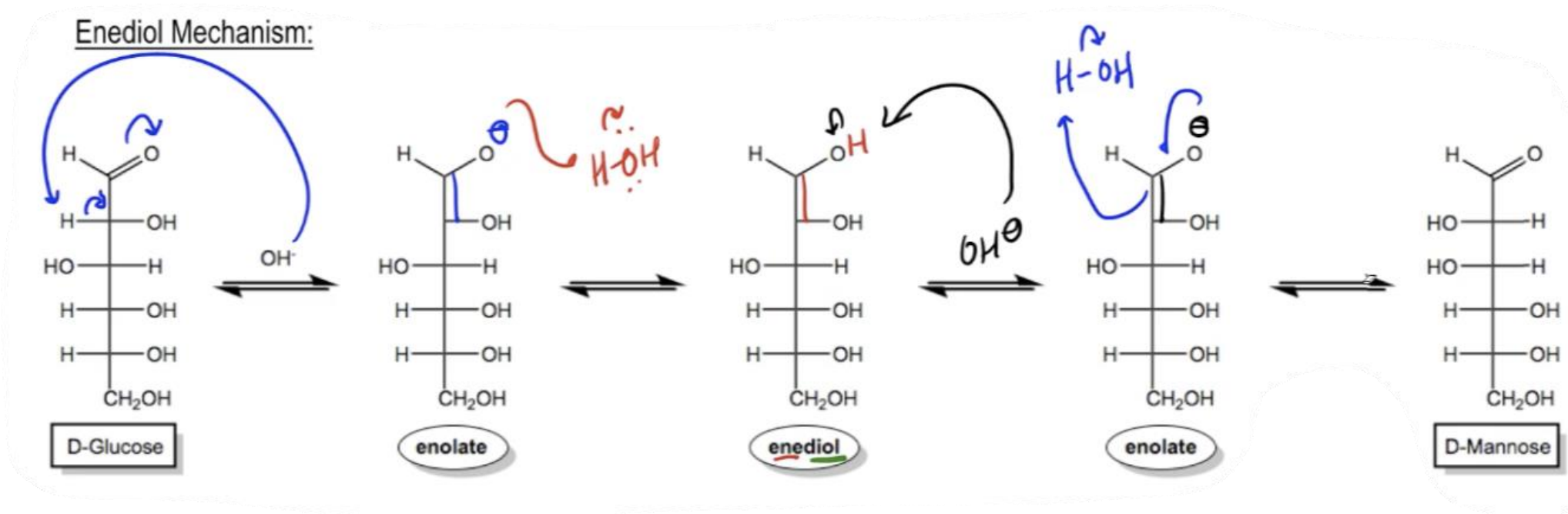
Epimers

Epimers are stereoisomers that differ in configuration of only one asymmetric carbon of enantiomers or diastereomers. Example, D-glucose and D-mannose are C-2 epimers and D-glucose and D-galactose are C-4 epimers. D-fructose and D-tagatose are C-4 epimers of ketohexoses.



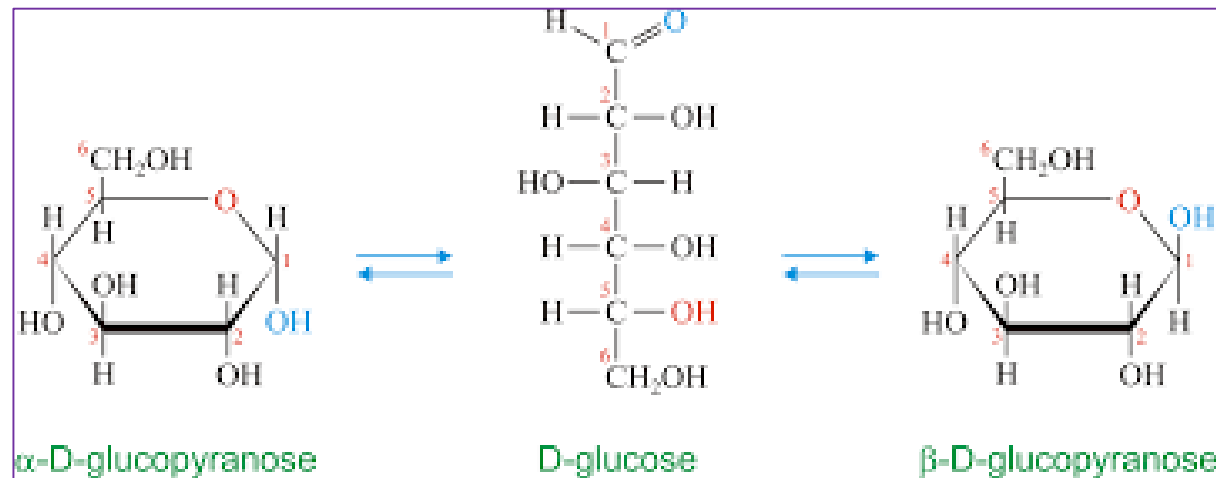
Mechanism of Epimerisation

- ❖ In the presence of base, D-glucose may be converted into D-mannose via the removal of hydrogen at C-2 carbon followed by protonation of the enolate



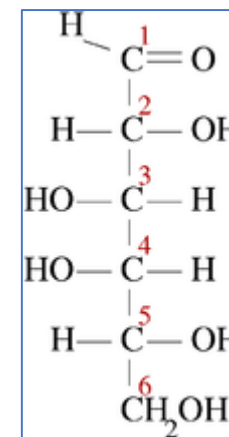
Anomers:

- ❖ Anomer is the stereoisomer, having different configuration at anomeric carbon.
- ❖ It is a type of geometric isomer found at certain atoms in carbohydrate molecules.
- ❖ The anomeric carbon is the carbon derived from the carbonyl carbon (the ketone or aldehyde functional group) of the open-chain form of the carbohydrate molecule.
- ❖ Anomerization is the process of conversion of one anomer to the other.
- ❖ The different anomers have different physical properties, melting points and specific rotation.



Mechanism of anomerization

- ❖ The cyclic structure of sugars are usually favoured, hemiacetals in aqueous solution are in equilibrium with their open-chain forms.
- ❖ In aldohexoses this equilibrium is established as the hemiacetal bond between C-1 (the carbon bound to two oxygens) and C-5 oxygen is cleaved (forming the open-chain compound) and reformed (forming the cyclic compound).
- ❖ When the hemiacetal group is reformed, the OH group on C-5 may attack either of the two stereochemically distinct sides of the aldehyde group on C-1.
- ❖ Which side it attacks on determines whether the α - or β -anomer is formed.
- ❖ Anomerization of glycosides typically occurs under acidic conditions.
- ❖ Typically, anomerization occurs through protonation of the exocyclic acetal oxygen, ionization to form an oxocarbenium ion with release of an alcohol, and nucleophilic attack by an alcohol on the reverse face of the oxocarbenium ion, followed by deprotonation.



Open chain structure of D-Glucose

