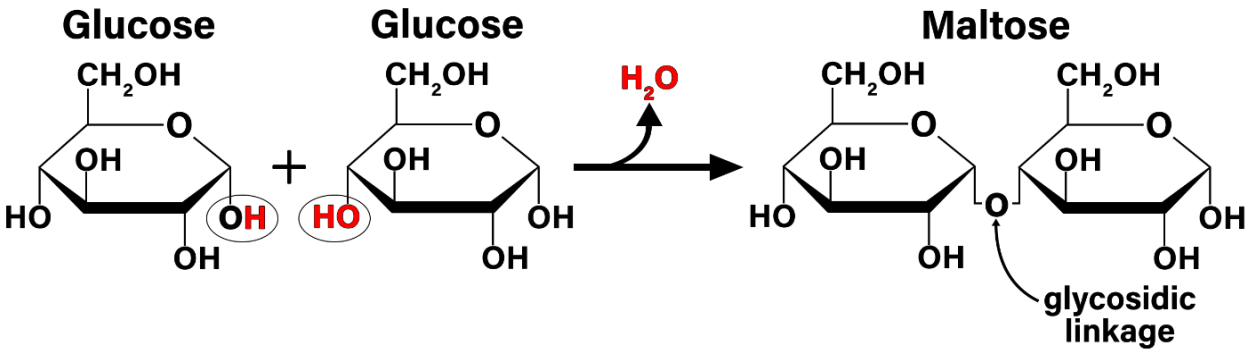
3.3.2

Disaccharides

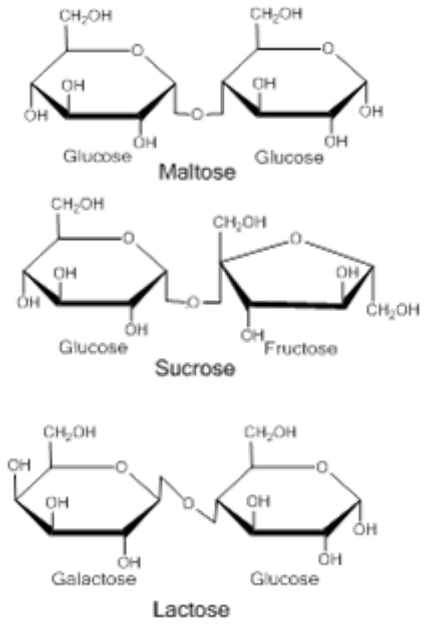
Disaccharides (Di = two, saccharide = sugar) are formed when two monosaccharide molecules are joined together covalently (glycosidic linkage) through a dehydration reaction. Glycosidic linkages occur from dehydration reactions of two hydroxyl groups, one of which is **anomeric** carbon, or the carbon associated with the carbonyl group. In the linear structure of glucose, the carbon with the carbonyl group is the anomeric carbon which becomes the carbon #1 (chiral center carbon) of the ring shape. Another way to find the anomeric carbon is to locate the one carbon that has two oxygen atoms attached to it.



Dehydration Synthesis Reaction Showing the Formation of Maltose.
Image by BYU-Idaho professor Spring 2021

The image above shows a dehydration synthesis reaction. The reactive hydroxyl groups (-OH) are circled. The hydrogens and oxygen that will be removed to form water are colored red. The resulting linkage is called a glycosidic linkage.

There are three important disaccharides that we will discuss: **sucrose, lactose, and maltose**. In all three of these disaccharides, glucose is one of the monosaccharides that make them up. The figure below shows the structure of these disaccharides, and the table below outlines their characteristics.



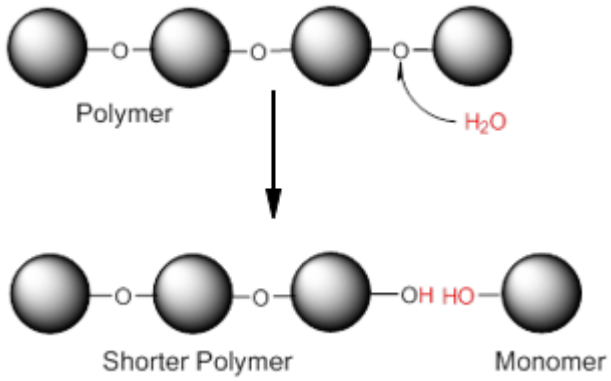
Disaccharide Structure: *Image created by MG, 2013*

The image above shows the structures of the three common dietary disaccharides. All contain glucose as one of their subunits. The difference between the three is the second subunit.

Table: Characteristics of three common disaccharides.

Name	Combined Monosaccharides	Nutritional Information
Sucrose	Glucose + Fructose	The most common dietary disaccharide. Naturally found in beets, cane sugar, brown sugar, maple syrup, and honey. You know it as table sugar.
Lactose	Glucose + Galactose	Found in dairy products. This is the least sweet of the disaccharides.
Maltose	Glucose + Glucose	Found in foods including breakfast cereals, germinating seeds, and beer.

Only monosaccharides can be absorbed from the digestive tract into the blood. Therefore, in order to enter the body, disaccharides must first be broken down (or digested) into their monosaccharide subunits. In the small intestine, there are specific enzymes for each of these disaccharides: **sucrase** to digest sucrose, **lactase** to digest lactose, and **maltase** to digest maltose. The reaction for digestion is essentially the reverse of the dehydration synthesis reaction (i.e. water is added back into the bond to break it). This type of reaction is called a **hydrolysis reaction**. Because disaccharides are easily digested and quickly absorbed into the blood, they, along with the monosaccharides, are often referred to as the **simple sugars**.



Hydrolysis Reaction. *Image created by BYU-I Student Hannah Crowder, 2013*

The image above shows a hydrolysis reaction. Bonds between the monomers in a polymer can be broken by the enzymatic addition of water to the bonds. Monomers can be defined as a single molecule that can bind to other molecules to form a polymer.