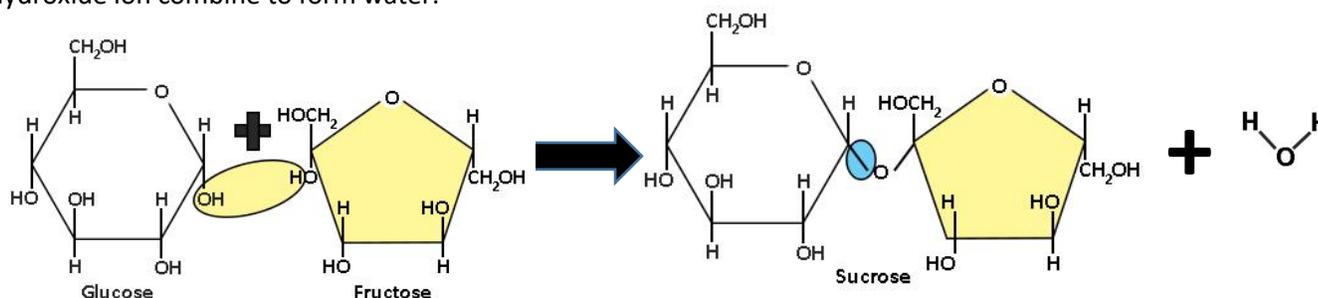


Carbohydrates: Build a Disaccharide

Polysaccharides or complex carbohydrates are macromolecular polymers built via dehydration synthesis (condensation synthesis) from monomer units called simple sugars or monosaccharides. Macro- indicates the molecules are very large; the term polymer suggests the molecules are made of many subunits. Dehydration synthesis or condensation synthesis joins two monomers by removing a hydrogen ion (H^+) from one unit and a hydroxide ion (OH^-) from another to form a new covalent bond. The hydrogen ion and hydroxide ion form a water molecule, hence the name dehydration synthesis.

In the example shown below a disaccharide is formed by covalently bonding glucose and fructose, two simple sugars. The solid lines between atoms below indicate a covalent bond. Unless otherwise indicated, carbon occupies the position where the lines (bonds) intersect. A hydroxyl group is removed from glucose (yellow oval) and the hydrogen ion (yellow oval) from the hydroxyl group of fructose. Sucrose is the disaccharide formed. The resulting bond, highlighted in light blue is called a glycosidic bond. The hydrogen ion and hydroxide ion combine to form water.



Dehydration Synthesis / Condensation Synthesis

Materials

Ball and stick chemistry models or other chemical modeling kits

Procedure

1. Use the chemistry modeling kit to build a glucose molecule. Carbon is typically depicted as a black ball, oxygen as a red ball and hydrogen as a small white ball. Single bonds are formed by inserting the wooden stick into the holes drilled in each colored ball. Take a photo of the glucose model you made.
2. Make a model of fructose using the molecular models. Take a photo of your molecule.
3. Review both models and identify the locations of the carbon and oxygen atoms within the ring structure. Simple sugars with 5 carbons are generically called pentoses. Which of these sugars is a pentose? _____ . Simple sugars with 6 carbons are generically called hexoses. Which of these sugars is a hexose? _____
4. Remove the hydrogen atom from the hydroxyl group of fructose. See the yellow oval above. Take a photo of the molecule now.
5. Remove the hydroxide group from glucose. See the yellow oval above. Take another photograph of the molecule.
6. Create bond between glucose and fructose in the location where you removed the hydrogen and hydroxyl ions. That new bond is called a glycosidic bond. Take a photo of your disaccharide molecule.

7. Take the hydroxide ion from glucose and add the hydrogen ion from fructose. Water is formed by the removal of ions during the formation (dehydration synthesis) of the glycosidic bond. Take a photo of your disaccharide and water molecules.

Data

Insert a photograph of the glucose molecule you made.



Insert a photograph of the fructose molecule you made.



Insert a photograph below of the disaccharide and water molecule you made.

