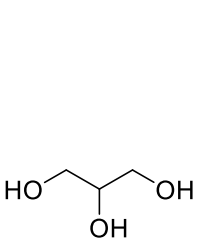
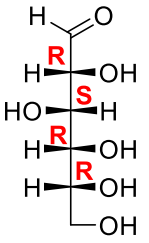
**Recall**: Carbohydrates (sugars and saccharides)

- Sugars are compounds that are composed of at least 3 carbons and has a formula of approximately $C_NH_{2N}O_N$

- **Monosaccharides –** simple sugars such as glucose and fructose – can't be converted to smaller sugars by chemical reaction (i.e., hydrolysis)

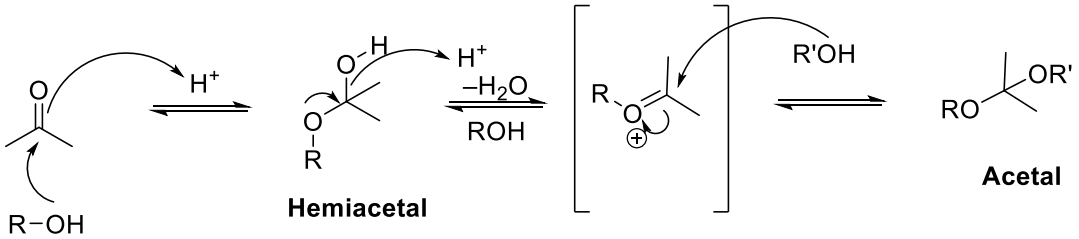



**Glycerol**
A Triose

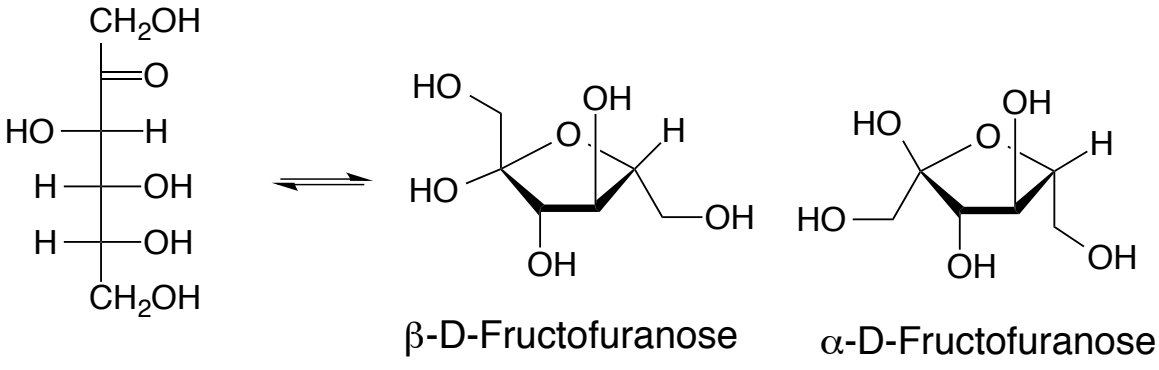



**D-Glucose**
An Aldohexose

**Recall:** Hemiacetal and Acetal Formation

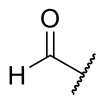



**Example:** Fructose

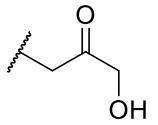


**Reducing Sugars**

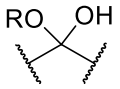
- Contains either an aldehyde, α-hydroxyketone, or a hemiacetal
- All aldoses are reducing sugars




**Aldehyde**



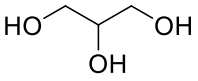

**-Hydroxyketone**



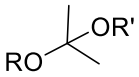

**Hemiacetal**

**Non-reducing sugars**

- Any sugars that do not contain any of the above functionality (i.e., glycerol) or an acetal group (i.e., sucrose)




**Glycerol**
A Triose

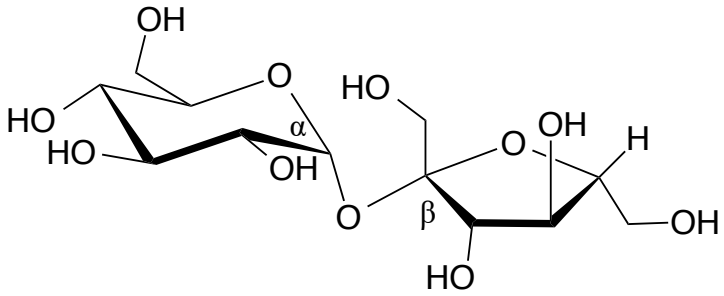



**Acetal**

**Polymers of Sugars:**

- **Disaccharide:** sugars that are composed of 2 monosaccharide units
- **Trisaccharide:** sugars that are composed of 3 monosaccharide units
- **Tetrasaccharide:** sugars that are composed of 4 monosaccharide units
- **Oligosaccharides:** sugars that are composed of 3 to 10 monosaccharide units
- **Polysaccharides:** long chain of carbohydrates containing more than ten (> 10) monosaccharide monomers.

**Table Sugar (**Sucrose):

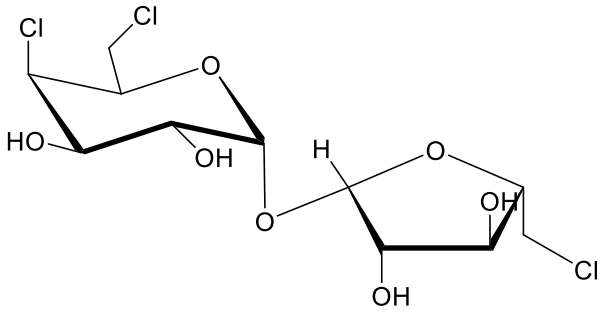



α–D-Glucopyranosyl-β–D-Fructofuranoside

- Has 2 anomeric carbons
- Non-reducing sugar since it contains an acetal group and does not contain hemiacetals, aldehydes, or alpha-hydroxy ketone
- Can be broken down by the body to glucose and fructose monomers

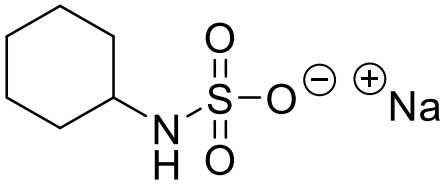
**Artificial Sweeteners**

**Sucralose**

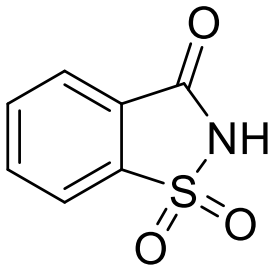



- Non-reducing sugar

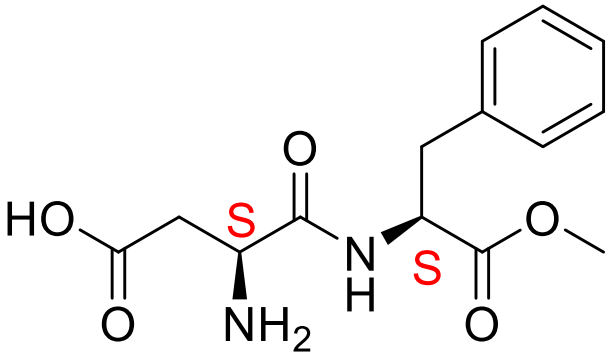
**Sodium Cyclamate**



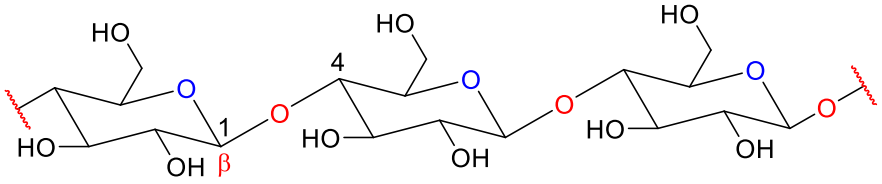

**Saccharine**




**Aspartame**



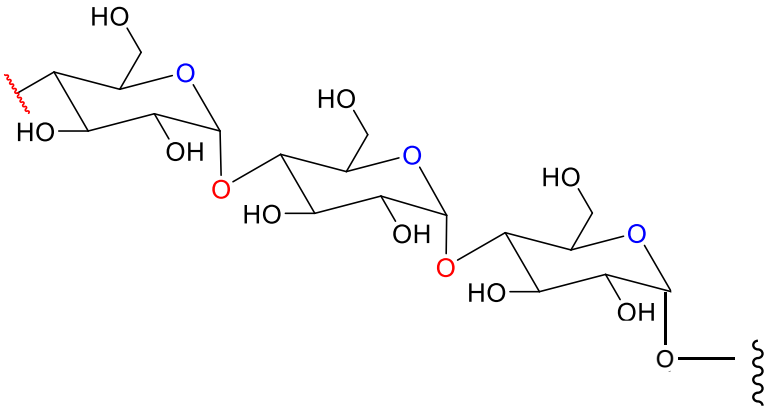
**Cellulose:**




**β-(1→4)-D-Glucopyranoside polymer (Cellulose)**

- Cellulose is a polysaccharide composed of D-glucose monomers linked via **β-1,4 glycosidic linkages**.
- Cellulose is a main component of cotton
- Cellulose is also a raw material for producing cellulose nitrate which is the major component of smokeless powder used as a propellant in ammunition of firearms and artillery.
- β-linkages cannot be digested by most mammals

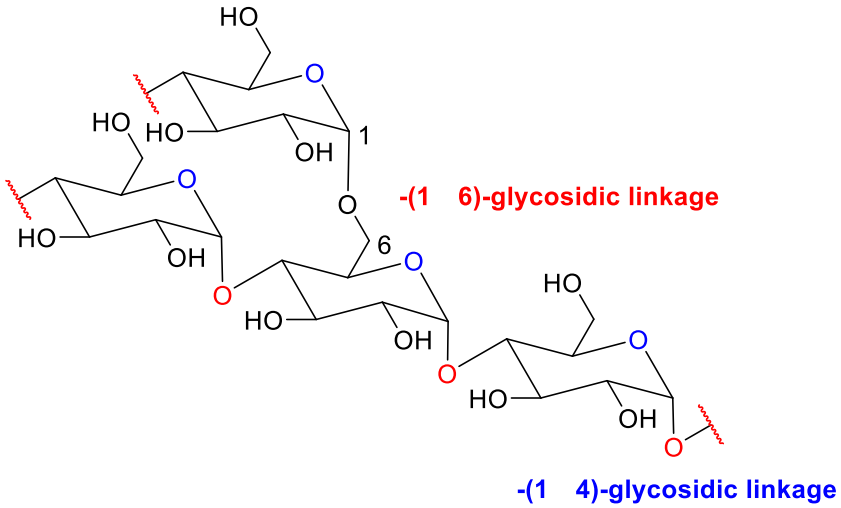
**Starch (Amylose)**




**α-(1→4)-D-Glucopyranoside polymer (Amylose)**

- Amylose (accounts for 20% of the weight of starch) is a polysaccharide composed of D-glucose units linked via α-1,4 glycosidic linkages

**Starch (Amylopectin)**




**Amylopectin: α-(1→4) and α-(1→6) linked D-glucopyranoside polymer**

- Amylopectin is the main component of starch (80% dry weight)
- Amylopectin is characterized by branching via α-(1→6)-glycosidic linkages in approximately every 25 glucose units along the main polymer chain.