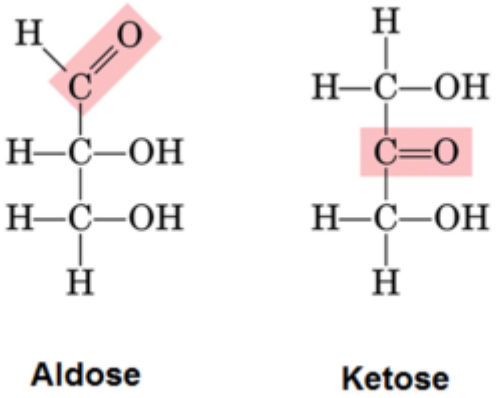
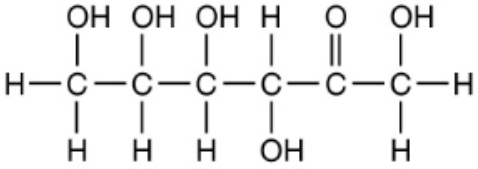
**monosaccharide**, also called **simple sugar**, any of the basic compounds that serve as the building blocks of carbohydrate, have general formula of $C_6H_{12}O_6$.

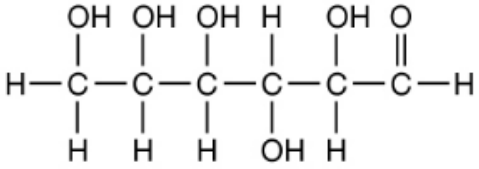
- Monosaccharides are polyhydroxy aldehydes or Ketones; they are molecules with more than one hydroxyl group (—OH), and **a carbonyl group (C=O)** either at the **terminal** carbon atom (aldose) or at the second carbon atom (ketose).
  **1- Aldose:** when the sugar have aldehyde group at one end such as (glucose).
  **2- Ketose:** when sugar have keton group at usually C2 such as (fructose).




- They are usually colorless, water-soluble, and crystalline solids. Contrary to their name (sugars), only some monosacchrides have a sweet taste.
- Cannot be further hydrolyzed into simple carbohydrate???
- Examples of monosaccharide include **glucose** (dextrose), **fructose** (levulose), and **galactose**.
- Monosaccharides are the building blocks of disaccharides (such as sucrose and lactose) and polysaccharides (such as cellulose and starch).
- Monosaccharides have a number of **isomeric forms**, all with the same **chemical formula**. For instance, galactose and glucose are both aldohexoses, but have different **physical structures** and **chemical properties**.



Fructose



Glucose

- The monosaccharide **glucose** plays very important role in **metabolism**, where the **chemical energy** is extracted through **glycolysis** and the citric acid cycle to provide energy to living organisms

**Disaccharide**, also called **double sugar**, any substance that is composed of two molecules of simple sugars (monosaccharide) linked to each other.

- Disaccharide are crystalline, water-soluble compounds.
- Disaccharide produce by linking together two monosaccharide by bonds called **(glycosidic bonds)** and the reaction of these two units called **(condensation reaction)** .
- Examples of Disaccharide include (Sucrose, Lactose and Maltose) all have chemical formula $\mathbf{C_{12}H_{22}O_{11}}$.

**Condensation reaction:** chemical reaction result in the formation of organic materials (polymers), in the carbohydrate, this chemical reaction occurs when two monosacchride links together to produce polymer (Disaccharide )

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow{\text{hydrolysis}} C_6H_{12}O_6 + C_6H_{12}O_6$$

A disaccharide → monosaccharide + monosaccharide

1- Maltose → glucose + glucose

2- Lactose → glucose + galactose

3- Sucrose → glucose + fructose

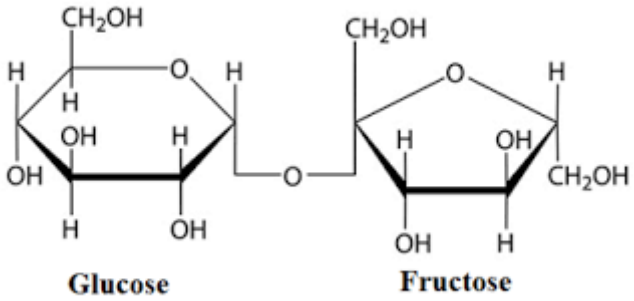
**Examples:**

1) 2 glucose molecules to form maltose.

2) A glucose and a fructose to form sucrose.

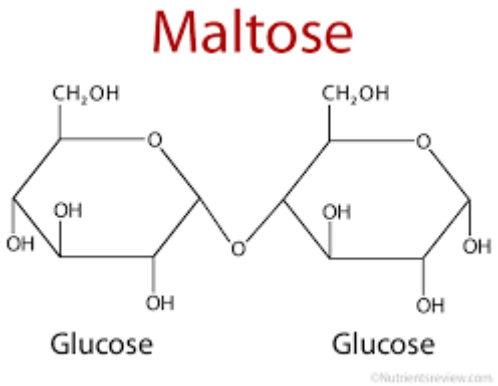
**A)Sucrose:**

- Is a sugar used at home
- Also known as the cane sugar
- When hydrolyzed, it forms a mixture of glucose and fructose.




**B) Maltose**

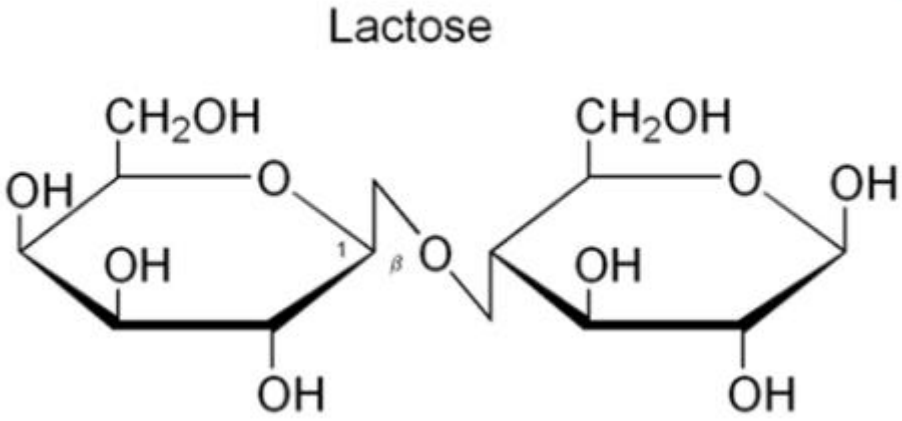
- Commonly known as malt sugar.
- Produce commercially by hydrolysis of starch.




**C) Lactose**

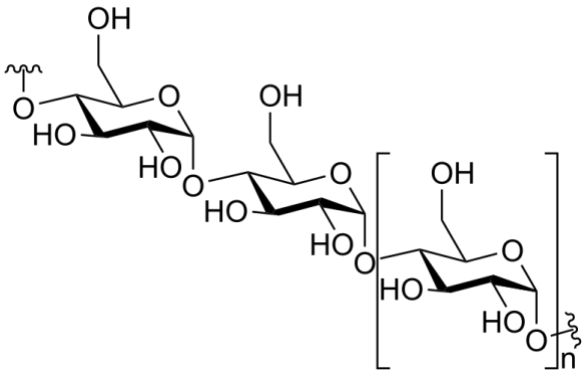
- Commonly known as milk sugar.

- Of animal origin
- Bacteria cause **<u>fermentation</u>** of lactose forming lactic acid.
- When these reaction occur, it changes the taste to a sour one.




Glucose Galactose

**Polysaccharide** are long chains of monosaccharides linked by **<u>glycosidic bonds.</u>** Three important polysaccharides, **starch**, **glycogen**, and **cellulose**, are composed of glucose. Starch and glycogen serve as short-term energy stores in plants and animals, respectively.




**A) Glycogen (Storage Polysaccharide)**

- Known as animal starch.
- Stored in muscle and liver.

- In liver, glycogen synthesis and degradation are regulated?? to maintain blood-glucose levels are required to meet the needs of the organism as a whole.
- In muscles, these processes are regulated??? to meet the energy needs of the muscles itself.
- The concentration of glycogen is higher in the liver than in muscles (10% versus 2% by weight), but more glycogen stored in skeletal muscles overall because of its much greater mass.