

## Learning Target:

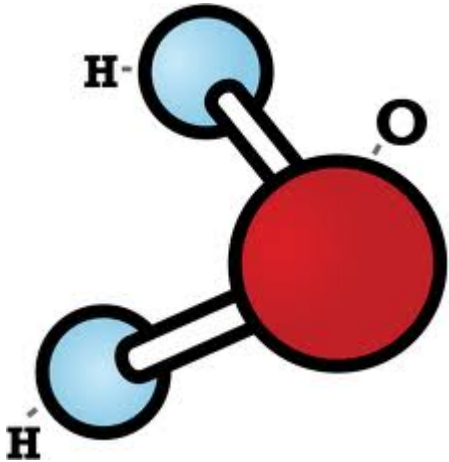
- Describe characteristics and functions of carbohydrates, lipids, and proteins.
- Compare and contrast the classes of organic compounds.

# What are inorganic molecules?

➤ Molecules that **CANNOT** be produced by organisms.

- Water

- 65-95% of the weight of an organism
- Very good solvent (polar)
- Source of hydrogen and oxygen

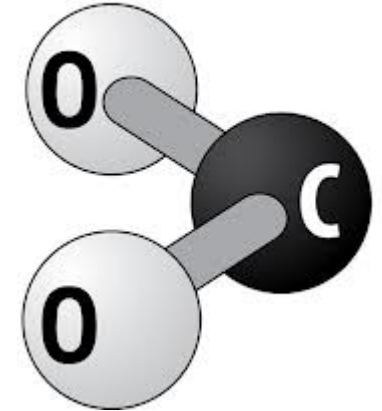


# What are inorganic molecules?

- Carbon dioxide

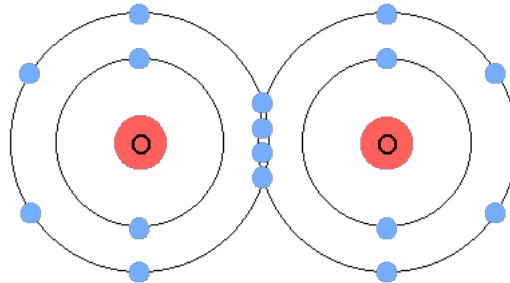
- Used by plants for photosynthesis.
- Source of carbon for organic molecules.

Carbon Dioxide Molecule



- Oxygen

- 21% of air
- Needed for respiration (breakdown of food to release energy).

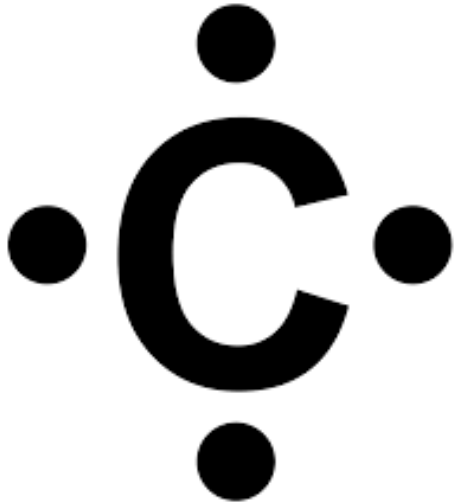


# What are organic molecules?

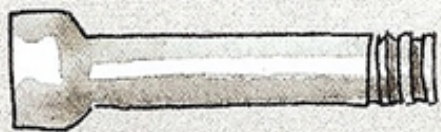
- Molecules that **CAN** be produced by organisms.
  - Macromolecules based on **carbon**.
    - Every living thing is made of four organic molecules
      - Carbohydrates
      - Lipids
      - Proteins
      - Nucleic Acids

# What are organic molecules?

- Carbon is very unique!
  - It has up to 4 bonding sites.



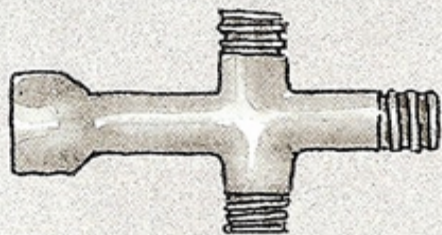




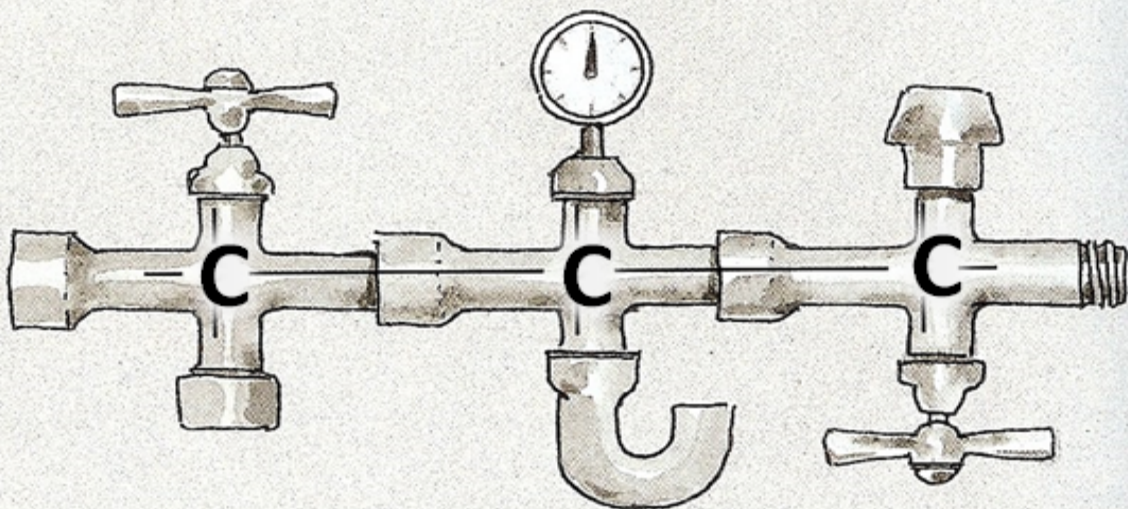
A length of pipe with only two connections (one at each end)...



...can only make a longer pipe (or backbone).



But a length of pipe with four connections...



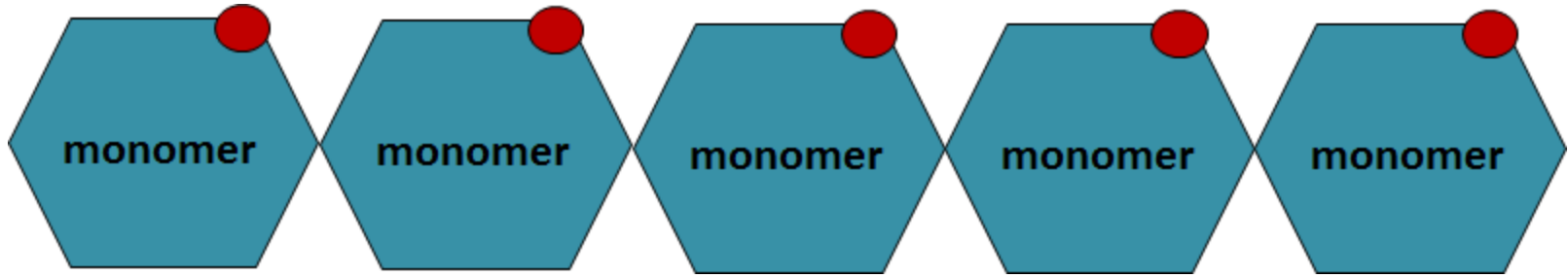
...can make a backbone *plus* places for additional fittings. In this way, every segment of backbone can be unique.

# What makes up macromolecules?

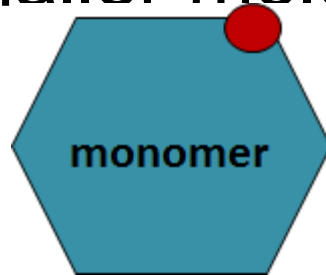
- Macromolecules can also be called **polymers**.
- Each polymer is built from smaller molecules called **monomers**.

# What makes up macromolecules?

- **Polymer** = a large molecule made up of smaller molecules joined together.




- **Monomer** = a smaller molecule used to build a polymer.





# What are the four types of macromolecules?

- **Carbohydrates** 
- **Lipids**
- **Proteins**
- **Nucleic Acids**

# Carbohydrates



# What are carbohydrates?

- *Compounds made up of carbon, hydrogen, and oxygen atoms.*
  - There are 2 hydrogens for every 1 oxygen
  - Primary energy source for organisms.
  - Give plants, some animals, and other organisms structure.

# What are carbohydrates?

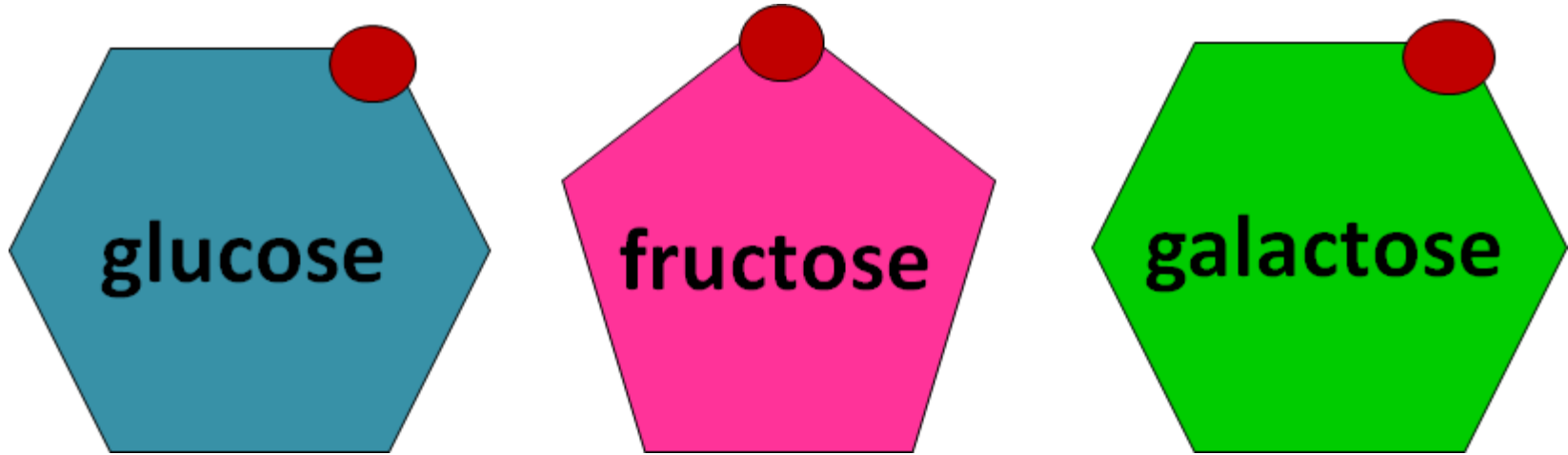
- The breakdown of sugars, such as glucose, supplies energy for cell activity.
- Many living things store extra sugar as a carbohydrate called starch.
- Three types of carbohydrates
  - Monosaccharides ← *MONOMERS!*
  - Disaccharides
  - Polysaccharides

# What are monosaccharides?

- Single sugar molecules are called both monosaccharides and simple sugars.
  - “mono” = one
  - “saccharide” = sugar
- All are  $C_6H_{12}O_6$
- Your body uses monosaccharides for “quick” energy.

# What are monosaccharides?

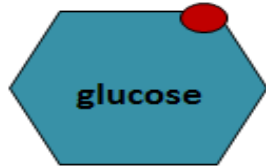
- There are three different monosaccharides!



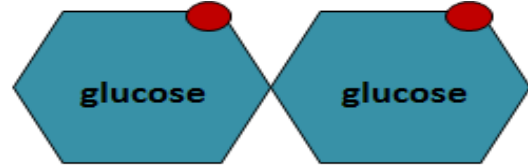
They have the same molecular formula ( $C_6H_{12}O_6$ ), but they are put together differently, giving them different structures!

# What are carbohydrates?

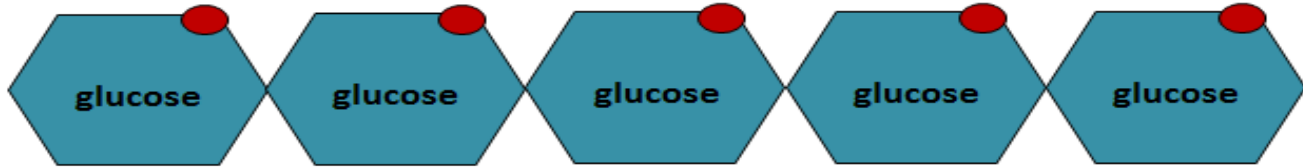
- Monosaccharides can join in chains to make MACROmolecules.



**mono**saccharide



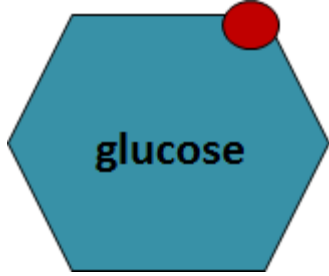
**di**saccharide



**poly**saccharide

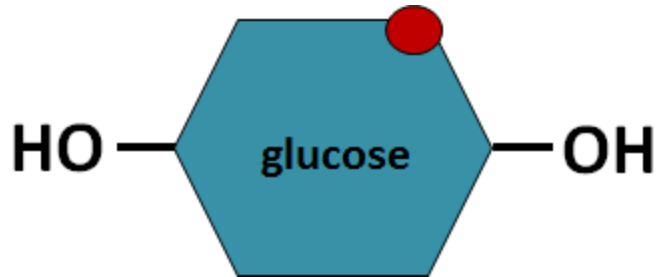


# What are carbohydrates?

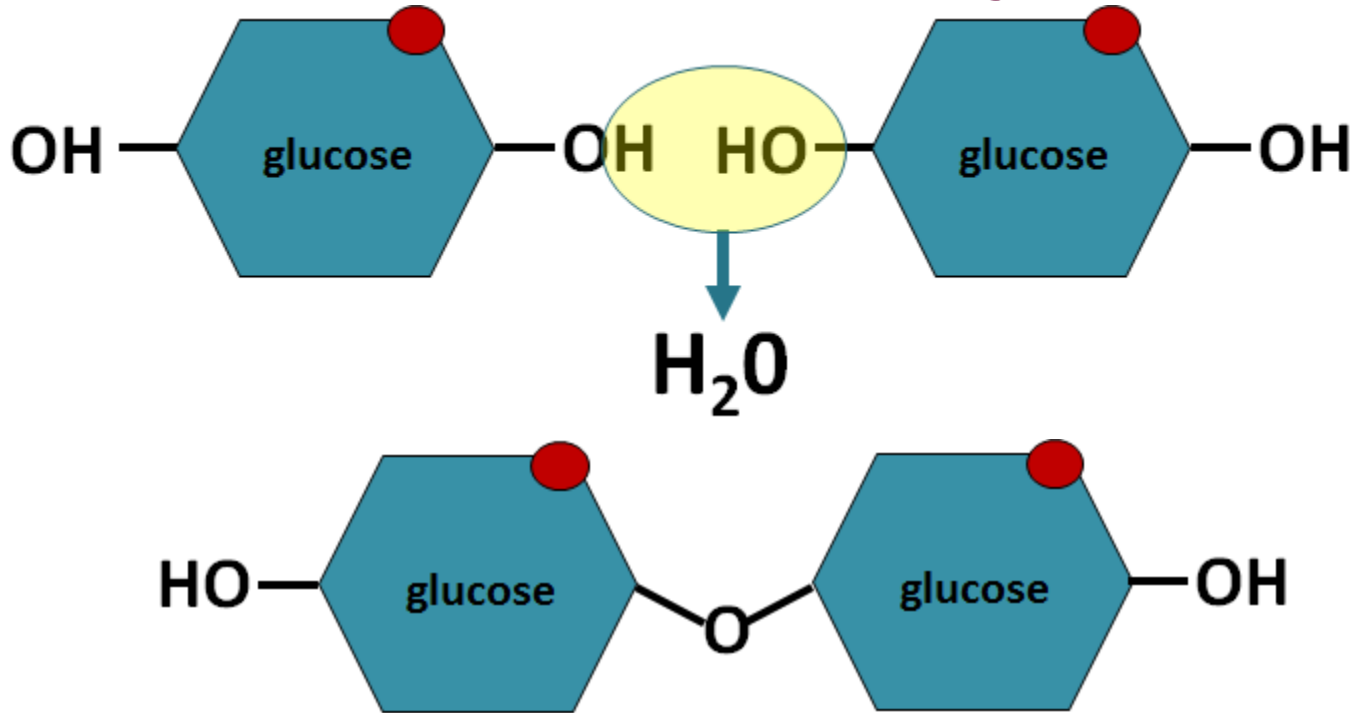


If this is a monosaccharide....

.... we can add more detail showing some of the atoms, like this.

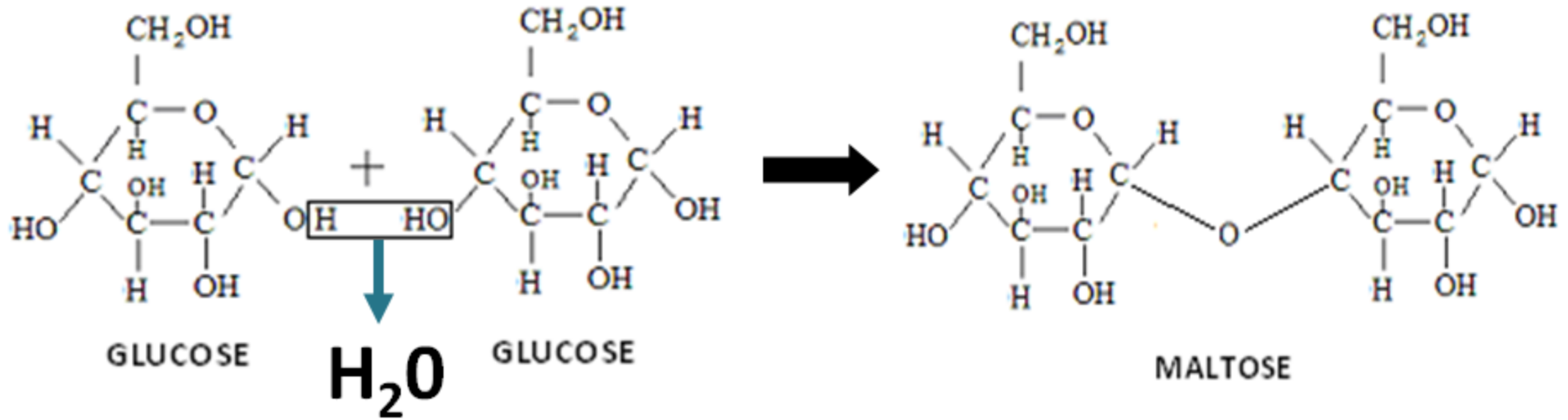


# How do monosaccharides join?



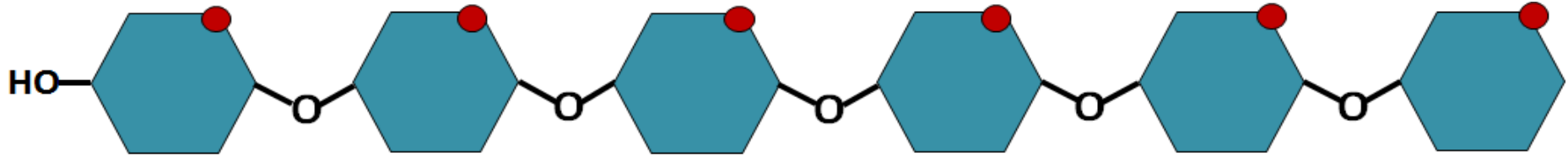
A disaccharide!

# How do monosaccharides join?



# How do monosaccharides join?

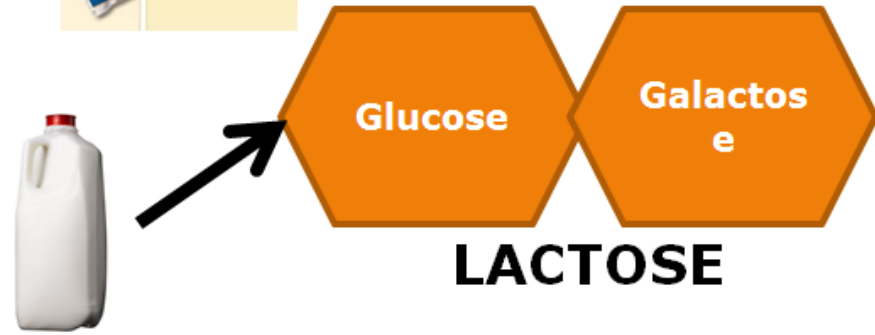
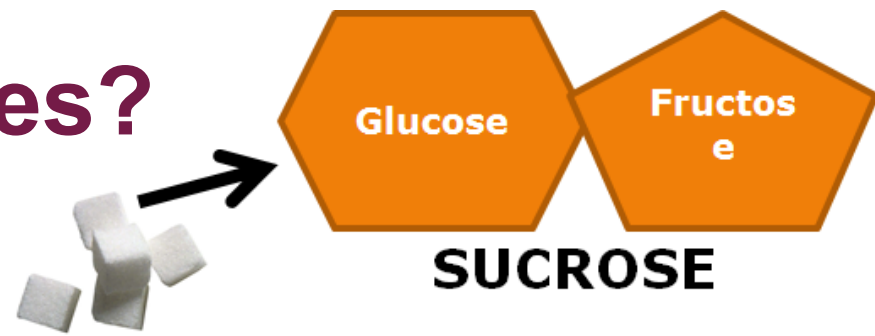
- The process of removing water (“dehydrate”) to build a large molecule (“synthesize”) is called **dehydration synthesis**.



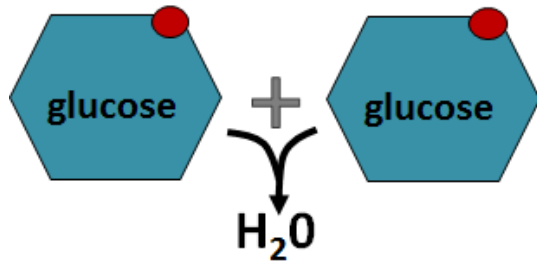
- It can happen over and over to make the chain very long!

# What are disaccharides?

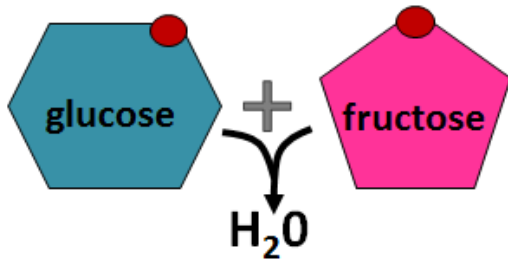
- Double sugar
  - “di” = two
  - “saccharide” = sugar
- 2 Monomers joined together
- All are  $C_{12}H_{22}O_{11}$



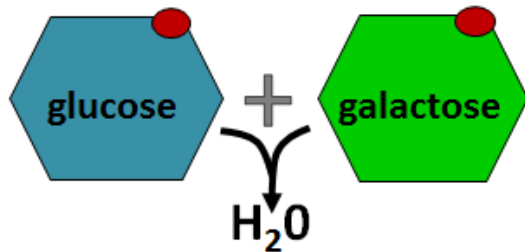
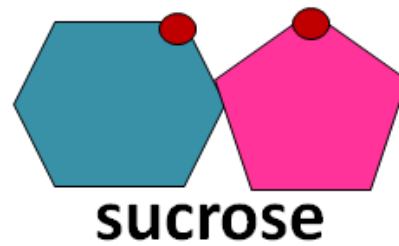
# What are disaccharides?



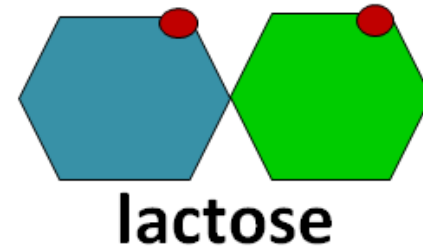
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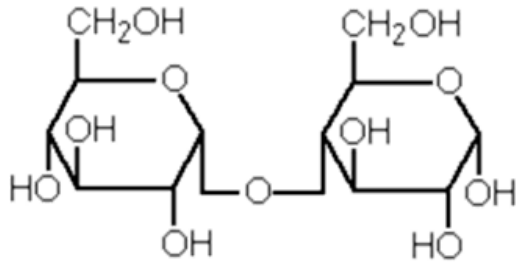


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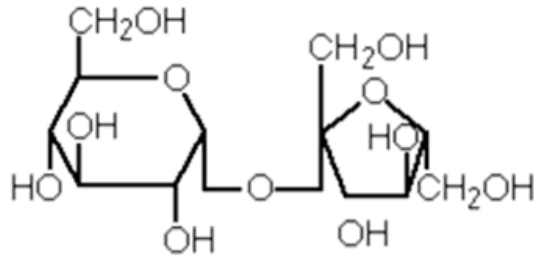


disaccharides

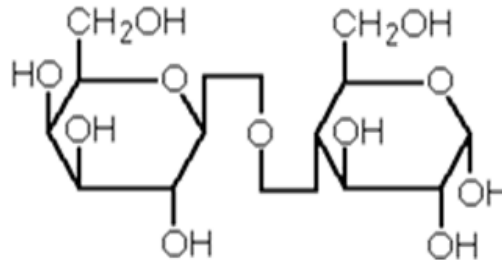
# What are disaccharides?



**maltose**



**sucrose**

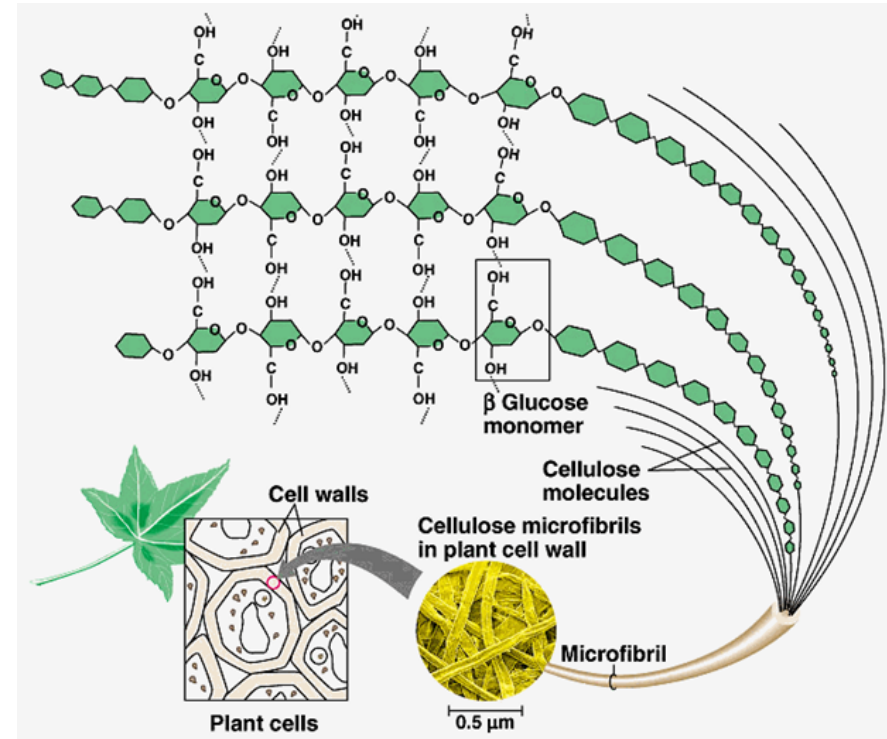


**lactose**



# What are polysaccharides?

- Complex sugars
  - “poly” = many
  - “saccharide” = sugar
- 3 or more monosaccharides joined together.
  - Usually thousands of simple sugars long!
- Used for stored energy



# What are polysaccharides?

## Cellulose

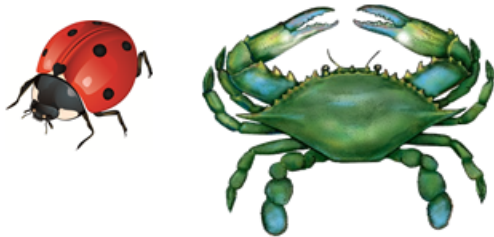
making  
plant cell  
walls strong



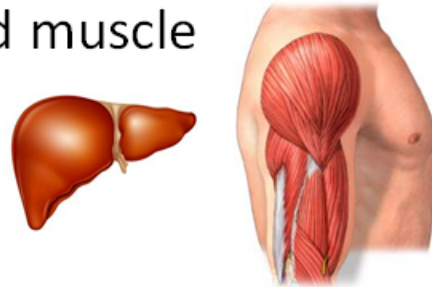
Starch storing energy in  
plants



Chitin building  
insect and crustacean  
exoskeletons



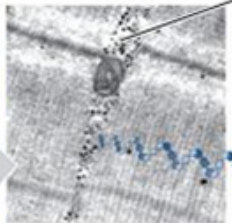
Glycogen storing  
energy in animal liver  
and muscle



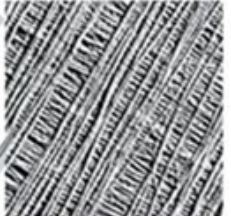
# What are polysaccharides?



Starch in potato



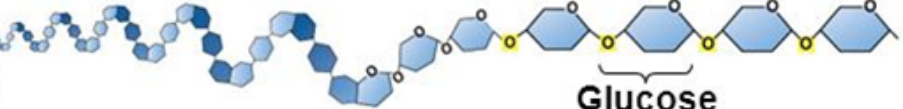
Glycogen in muscle tissue



Cellulose in a plant cell wall

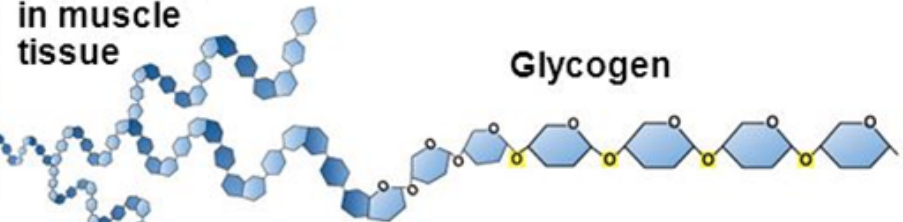


Cellulose molecules

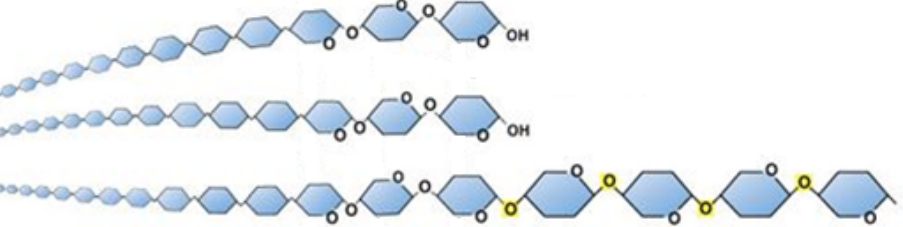


Starch

Glucose monomer



Glycogen



Cellulose

# How are polysaccharides broken down?

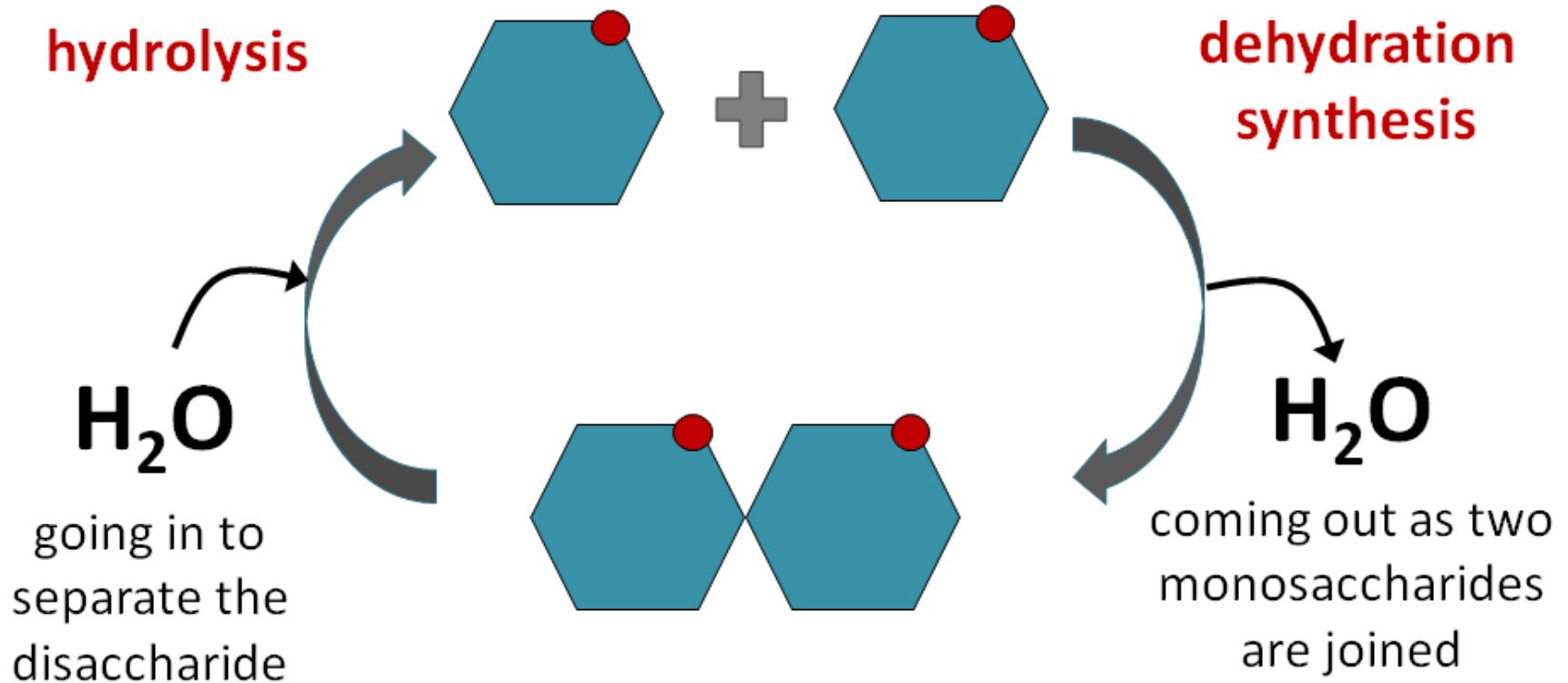
- If dehydration synthesis builds macromolecules, how do they break down?



- This process is called **hydrolysis**, the addition of water (“hydro” to split apart a polymer (“lysis”).

# How are polysaccharides broken down?

- It's a cycle!





# That was a lot of information!

- 1) What is a carbohydrate?
- 2) What is a polymer?
- 3) What is a monomer?
- 4) What are the monomers of carbohydrates?
- 5) What are the three different kinds of carbohydrates?
- 6) What are 3 examples of monosaccharides?
- 7) What are disaccharides?
- 8) What are 3 examples of disaccharides?
- 9) What are polysaccharides?
- 10) What are 4 examples of polysaccharides?
- 11) What process joins monosaccharides together?
- 12) What process breaks disaccharides and polysaccharides down?



# That was a lot of information!

1) What is a carbohydrate?

Compounds made up of carbon, hydrogen, and oxygen atoms, that are the primary energy source for organisms.

2) What is a polymer?

A large molecules that is made up of smaller monomers.

3) What is a monomer?

A small molecule used to build a polymer.

4) What are the monomers of carbohydrates?

Monosaccharides

5) What are the three different kinds of carbohydrates?

Monosaccharides, Disaccharides, Polysaccharides





# That was a lot of information!

6) What are 3 examples of monosaccharides?

Glucose, Fructose, Galactose

7) What are disaccharides?

Double sugar

8) What are 3 examples of disaccharides?

Maltose, Sucrose, Lactose

9) What are polysaccharides?

Complex sugars

10) What are 4 examples of polysaccharides?

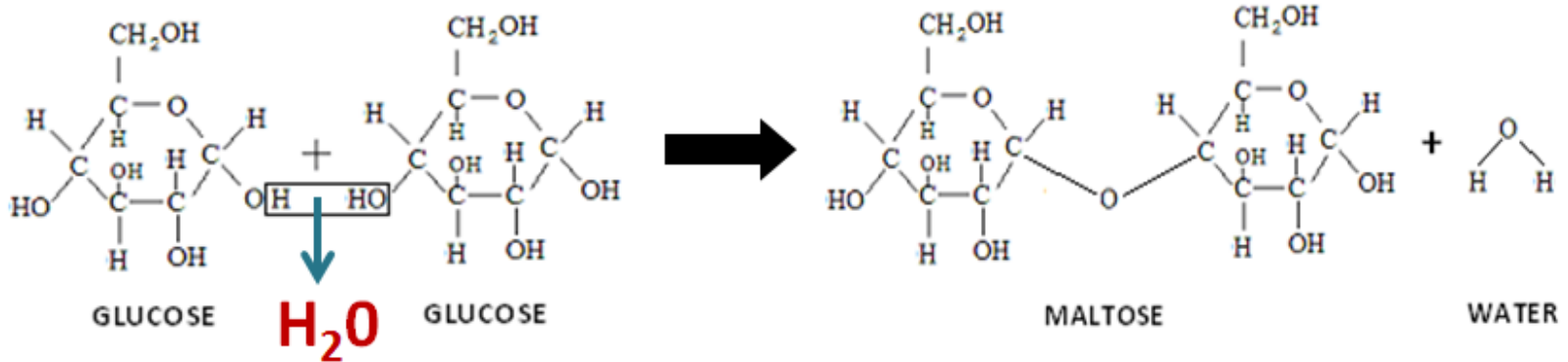
Cellulose, Starch, Chitin, Glycogen



# That was a lot of information!

11) What process joins monosaccharides together?

Dehydration synthesis = removing water





# That was a lot of information!

12) What process breaks disaccharides and polysaccharides down?

Hydrolysis = adding water

