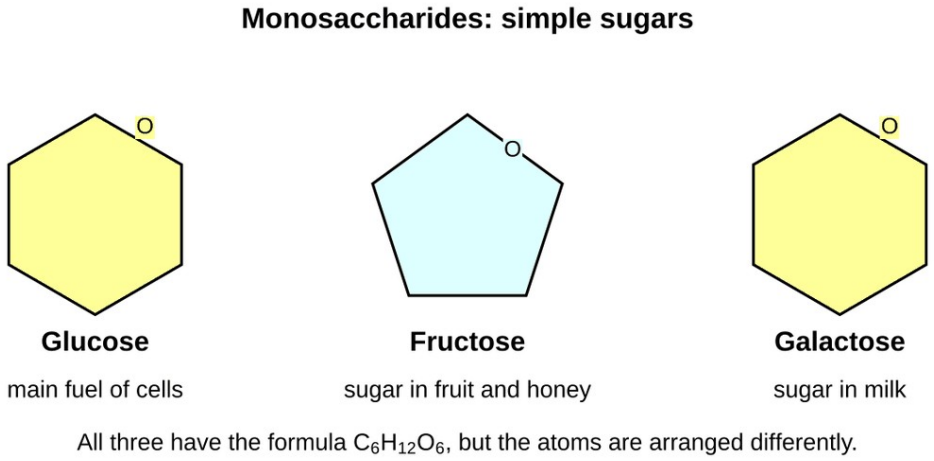
Carbohydrates

Essential Question

How do cells use sugars and starches for energy and structure?

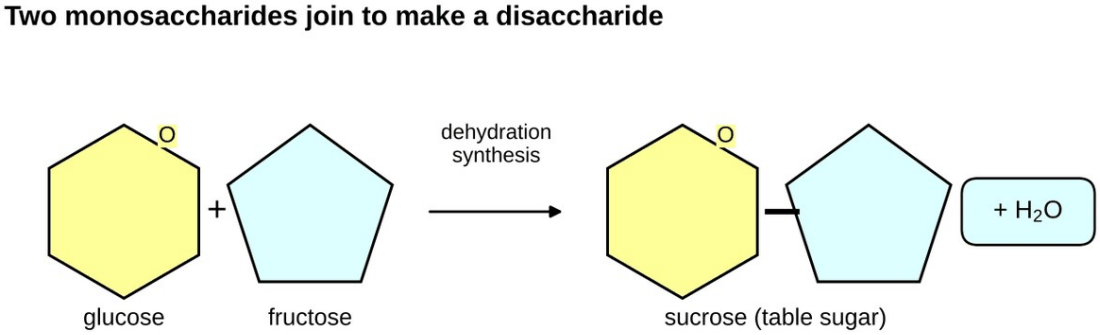
Monosaccharides

- Monosaccharide: one sugar unit
- Examples: glucose, fructose, galactose
- Glucose, $C_6H_{12}O_6$, is the main fuel of cells
- C, H, and O are in a ratio of about 1 : 2 : 1



Disaccharides

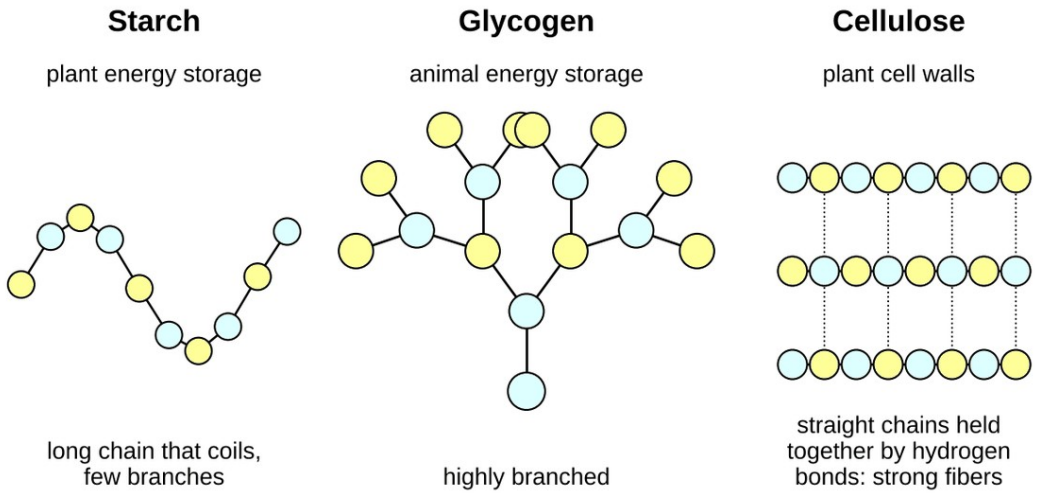
- Disaccharide: two monosaccharides joined
- Joined by dehydration synthesis
- Sucrose = glucose + fructose
- Lactose = glucose + galactose



$$C_6H_{12}O_6 + C_6H_{12}O_6 \rightarrow C_{12}H_{22}O_{11} + H_2O$$

Polysaccharides: Storage and Structure

- Polysaccharide: a polymer of many sugar units
- Starch stores energy in plants
- Glycogen stores energy in animals
- Cellulose makes up plant cell walls



All three are polymers of glucose, but the bonds and shapes differ.

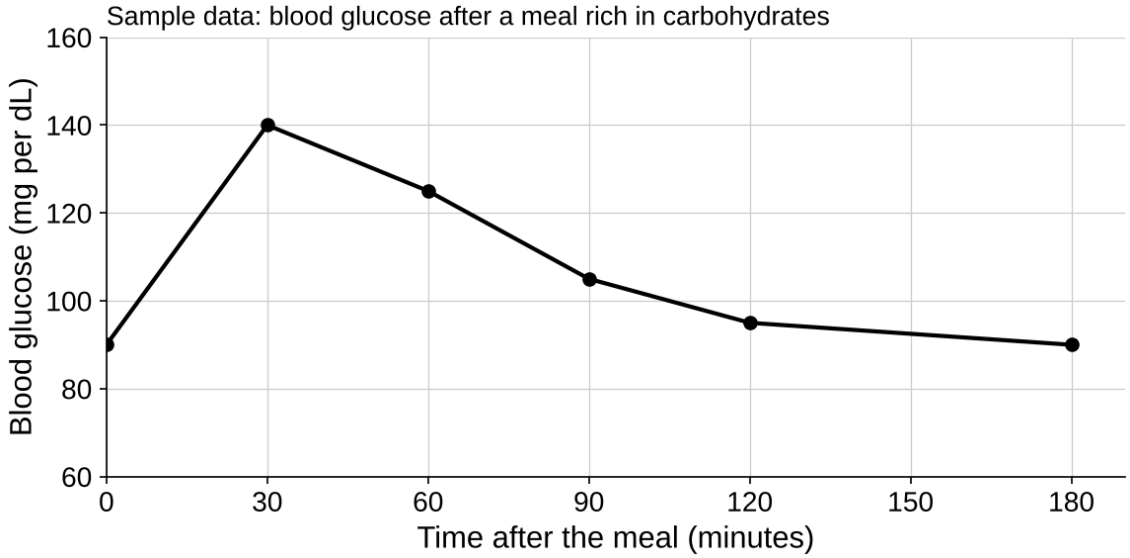
Same Monomer, Different Job

- Starch, glycogen, and cellulose all contain only glucose
- Bonds and branching make the shapes different
- Shape decides the job
- Humans cannot digest cellulose

Type	Found in	Job	Can humans digest it?
Starch	Plants (potatoes, rice, wheat)	Stores energy	Yes
Glycogen	Animals (liver and muscle)	Stores energy	Made and broken down in the body
Cellulose	Plant cell walls	Gives support	No, it passes through as fiber

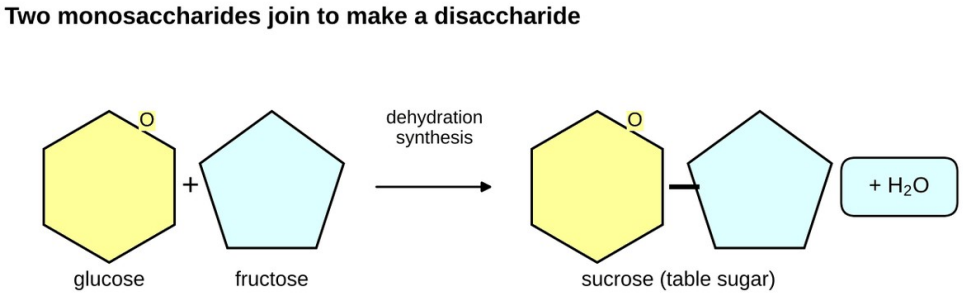
Using Carbohydrates

- Digestion breaks starch into glucose by hydrolysis
- Glucose enters the blood
- Cells use glucose as a fuel
- Extra glucose is stored as glycogen



Example: Counting Atoms in Sucrose

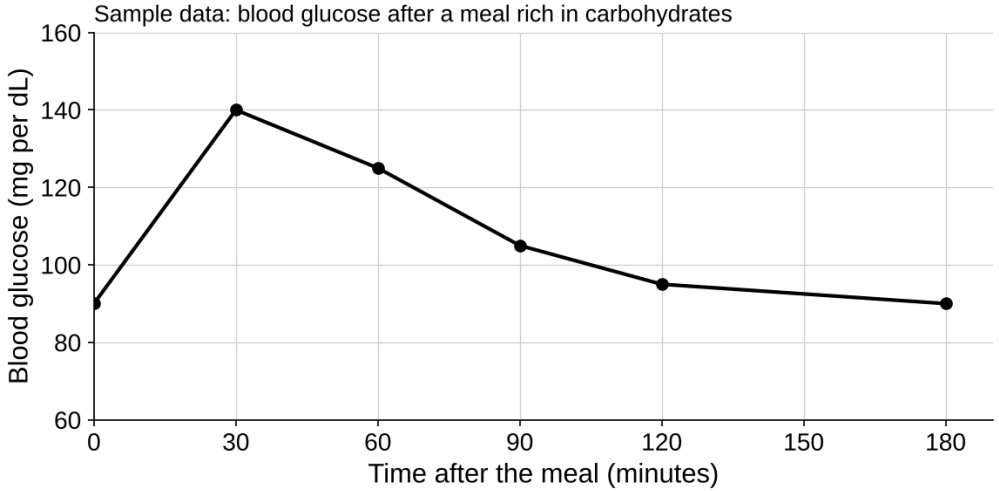
Glucose and fructose each have the formula $C_6H_{12}O_6$. (a) Find the formula of sucrose, which forms when one glucose and one fructose join by dehydration synthesis. (b) A starch molecule is a chain of 500 glucose units. How many molecules of water were released when it formed? How many are used when it is digested completely to glucose?



$$C_6H_{12}O_6 + C_6H_{12}O_6 \rightarrow C_{12}H_{22}O_{11} + H_2O$$

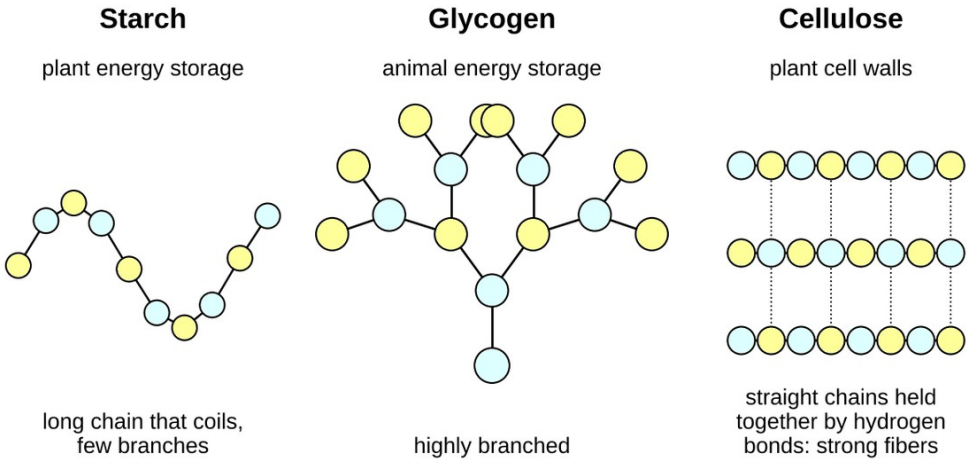
Example: Glucose After a Meal

Use the graph of blood glucose. (a) What was the highest blood glucose level, and when did it occur? (b) By how many mg per dL did it rise from 0 to 30 minutes? What percent increase is that? (c) Explain why the level fell after 30 minutes.



Example: Which Polysaccharide?

Name the polysaccharide in each situation, using the diagram. (a) A marathon runner's muscles break down a stored polysaccharide for quick glucose. (b) A tree trunk resists bending. (c) A potato tuber stores energy for the plant.



All three are polymers of glucose, but the bonds and shapes differ.

Carbohydrates

Big Ideas

- Monosaccharides are simple sugars, such as glucose
- Disaccharides form by dehydration synthesis
- Starch and glycogen store energy; cellulose gives support
- Shape and bonding decide the job of a polysaccharide
- Glucose is the main fuel of cells