

Name: \_\_\_\_\_

Date: \_\_\_\_\_

## Big Ol' Biomolecules

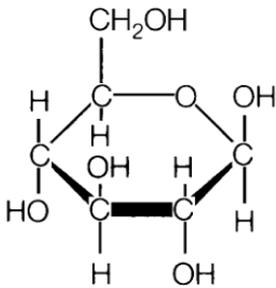
**Introduction:** As biologists, we depend on chemists for our understanding of how many chemicals play an important role in the life processes. Carbohydrates, proteins and fats are organic compounds made up of carbon, hydrogen and other elements. They are large molecules which are used by the cell for several purposes including: an energy source for respiration, components of cell structures like the cell membrane, cell growth, cell repair, energy storage, and catalyzing cellular and chemical reactions.

- Objectives:**
- A. To learn molecular formulas of carbohydrates
  - B. To make structural models of carbohydrates, proteins, and fats
  - C. To use those models to demonstrate how complex molecules are formed and broken down.

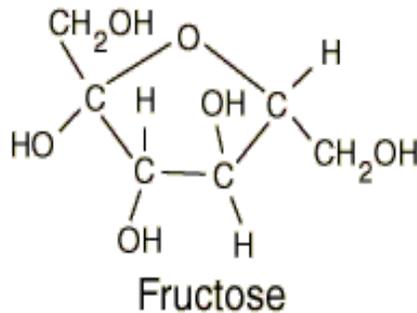
**Materials:** scissors  
glue

### Procedure:

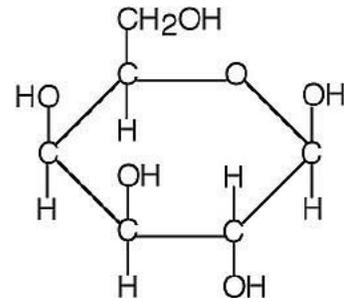
**Monosaccharides:** Glucose is an example of a monosaccharide which means it is **ONE** simple sugar. Fructose and Galactose are also examples of monosaccharides. Examine the pictures of the monosaccharides below and answer the questions that follow.



Glucose



Fructose



Galactose

1. What three elements are present in glucose, fructose and galactose?

2. How many carbon atoms are present in:

Glucose	_____
Fructose	_____
Galactose	_____

3. Write the structural formula for:

Glucose: C \_\_\_\_\_ H \_\_\_\_\_ O \_\_\_\_\_

Fructose: C \_\_\_\_\_ H \_\_\_\_\_ O \_\_\_\_\_

Galactose: C \_\_\_\_\_ H \_\_\_\_\_ O \_\_\_\_\_

4. How many times larger is the number of hydrogen atoms than oxygen atoms in each of the monosaccharides? \_\_\_\_\_

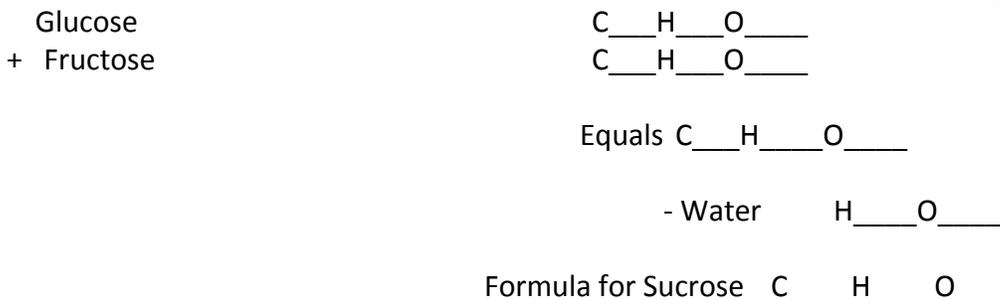
5. How many times larger is the number of hydrogen atoms than oxygen atoms in a molecule of water, H<sub>2</sub>O? \_\_\_\_\_

### Disaccharides

6. Cut out a glucose and fructose paper model molecule and attempt to join the two molecules together like puzzle pieces. Do they fit together easily? \_\_\_\_\_
7. In order to join them, remove the OH group from one and an H group from the other. Now do they fit together? \_\_\_\_\_
8. When put together, glucose and fructose create a molecule of sucrose. In addition, removing an OH and an H group has just formed what molecule? \_\_\_\_\_
9. Two molecules of sugar can be joined together by taking out the water in a process called \_\_\_\_\_
10. Glue the glucose and fructose models together as well as the molecules of water removed and fill in the equation below.

Glucose + Fructose = \_\_\_\_\_ + \_\_\_\_\_

11. To determine the molecular formula for sucrose, complete the following equation

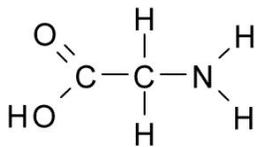


**Polysaccharides-** The prefix poly means **many**. Starch, cellulose, and glycogen are three polysaccharides made of three or more molecules of simple sugars. Cut out the three molecules of glucose and paste them below to make a molecule of starch. Then complete the formula.

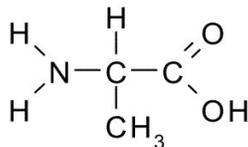
12. Glucose + Glucose + Glucose = \_\_\_\_\_ + \_\_\_\_\_ molecules of water

13. Determine the molecular formula for starch C \_\_\_\_\_ H \_\_\_\_\_ O \_\_\_\_\_

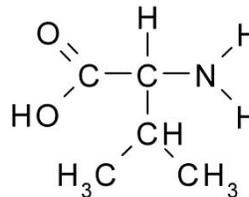
**Proteins:** are made of chains of **amino acids**. Examine the amino acids below and answer the following questions.



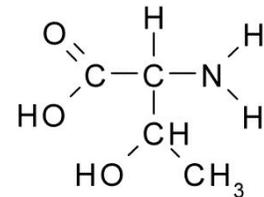
Glycine



Alanine



Valine



Threonine

14. Which element is present in amino acids that was absent from carbohydrates? \_\_\_\_\_

15. What is the formula for the following amino acids?

a. Glycine            C \_\_\_\_\_ H \_\_\_\_\_ O \_\_\_\_\_ N \_\_\_\_\_

b. Alanine            C \_\_\_\_\_ H \_\_\_\_\_ O \_\_\_\_\_ N \_\_\_\_\_

c. Threonine        C \_\_\_\_\_ H \_\_\_\_\_ O \_\_\_\_\_ N \_\_\_\_\_

16. Are the molecular formulas for all amino acids the same? \_\_\_\_\_

**17. Lipids:** are fats, waxes and oils. They are made up of the alcohol glycerol and three fatty acids. Cut out the glycerol and three fatty acids molecules and remove the water to join them together. Paste the newly formed lipid below.

### 18. Proteins

Cut out the four amino acid molecules and remove the water to join them together in the following order:  
**Valine—Threonine—Alanine—Glycine**

19. **Would the protein look the same if we switched the order?** Explain using the shapes of the amino acid chain.

### Nucleic Acids

# 19. Cut out the 3 parts that make up a nucleotide. They are the \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_  
Determine how you will bond them together. Hint: you may have done it already with other molecules  
Glue them on the page

### Analysis Questions:

1. How are glucose, fructose and galactose the same? How are they different?

2. How many simple sugars make a Monosaccharide \_\_\_\_\_  
Disaccharide \_\_\_\_\_  
Polysaccharide \_\_\_\_\_

3. When joining monosaccharides to make larger molecules, what is removed?

4. Define
  - a. Dehydration
  
  - b. Synthesis?
  
  - c. Combine the two terms above and explain how a polysaccharide is made from many monosaccharides?
  
5. Potato plants carry out photosynthesis to make molecules of glucose. If they can't use all the glucose they make in a day, they store it as starch. Explain how they convert glucose to starch.
  
  
  
  
  
  
  
  
  
  
6. A few days later, a potato plant has not made enough glucose to feed itself for the day. Explain how it gets glucose from the starch it is storing. (Include the name of the process it uses)
  
  
  
  
  
  
  
  
  
  
7. What are the building blocks of proteins?
  
  
  
  
  
  
  
  
  
  
8. What are the building blocks of lipids?
  
  
  
  
  
  
  
  
  
  
9. What are the building blocks of carbohydrates?
  
  
  
  
  
  
  
  
  
  
10. There are only 20 different amino acids but thousands of different proteins. How is this possible? Hint: look back to question #18.