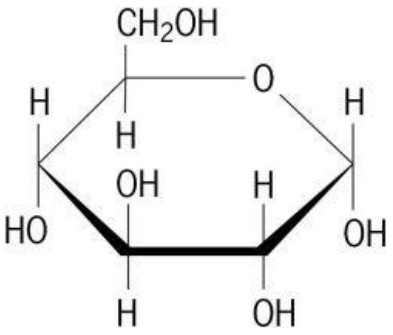
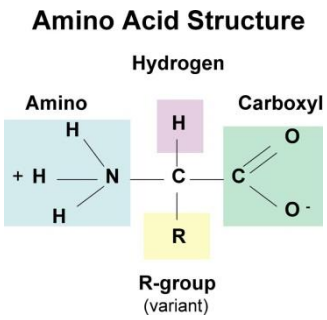


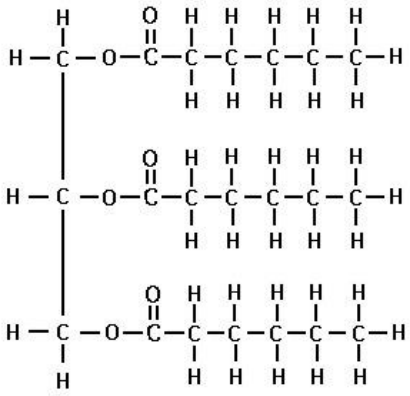


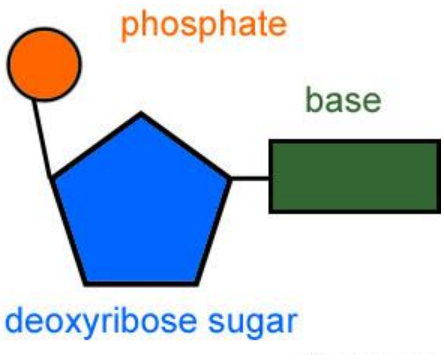
BIOMOLECULES

(AKA MACROMOLECULES)

Name: _____

Block: _____





BIOMOLECULES POGIL

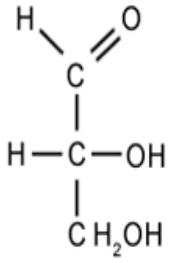
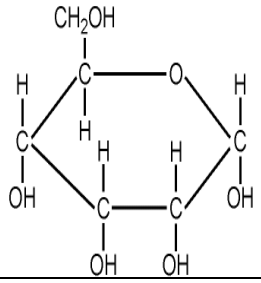
All living things share the same chemical building blocks and depend on chemical processes for survival. Life without **carbon (C)** would be as likely as life without water.
Other than water, most molecules of a cell are **carbon-based**.

The "**biomolecules**" are composed of a backbone or carbon atoms bonded to one another. Atoms of other elements such as **hydrogen (H), oxygen (O), nitrogen (N), phosphorus (P) and Sulfur (S)** may branch off of this carbon backbone. This basic structure is the foundation for the different groups of **biomolecules**: carbohydrates, lipids, proteins and nucleic acids.

Carbohydrates are used by all living things as their main source of energy. Plants and animals also use carbohydrates for structural purposes. The monomers (building blocks) of all carbohydrates are called **monosaccharides** or simple sugars.

Directions: Please read the directions and answer the following questions in regard to each model.

MODEL 1

Name	Sugar 1	Sugar 2
		
Ratio of Elements	**C _____ H _____ O _____**	**C _____ H _____ O ____**
Simplest Whole Number Ratio		

1. Use a yellow marker to mark all of the **C** (carbon) atoms in **Sugar 1**. Count and record your answer in the blank next to the **C** (carbon) in the row labeled **ratio of elements.**

2. Use a green marker to mark all of the **H** (hydrogen) atoms in **Sugar 1**. Count and record your answer in the blank next to the **H** (hydrogen) in the row labeled **ratio of elements.**

3. Use a blue marker to mark all of the **O** (oxygen) atoms in **Sugar 1.** Count and record your answer in the blank next to the **O** (oxygen) in the row labeled **ratio of elements.**

4. Repeat steps 1, 2 and 3 for **Sugar 2.**

CRITICAL THINKING QUESTIONS: *Write your answers to the following questions below.*

1. What are the only three elements that are found in monosaccharides (simple sugars)?

   _____

2. What is the simplest whole number ratio for each of the above simple sugars?

   _____

3. What is the name of the monomer of carbohydrates? _____

4. Monosaccharides (simple sugars) are called carbohydrates. Using what you have learned about the elements in monosaccharides and ratio of the elements, explain why the term carbohydrate is an appropriate term for this group of compounds.

5. What is the name of the biomolecule that is formed when 3 or more monosaccharides are combined? _____

6. List 2 **food** examples of a monosaccharide: _____

7. List 2 **food** examples of a polysaccharide: _____

   _____

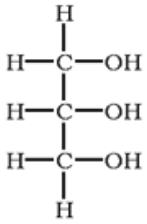
8. What function do carbohydrates provide cells? _____

   _____

Directions: Please read the directions and answer the following questions in regard to each model.

Lipids or fats are made up of a **glycerol and fatty acid tails.**

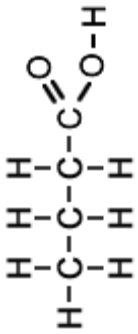
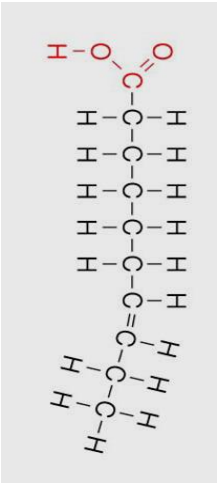
Glycerol



Lipids are produced when glycerol binds to the fatty acids. A maximu of three fatty acids can bind to one glycerol molecule to form a lipid.

Saturated fatty acid chains have all single bonds between the carbor **unsaturated** fatty acids will have 1 or more double bonds between carbons in the chain.

MODEL 2

Name	Fatty Acid 1	Fatty Acid 2
		
Ratio of Elements	**C _____ H _____ O _____**	**C _____ H _____ O ____**
Simplest Whole Number Ratio		

1. Use a yellow marker to mark all of the **C** (carbon) atoms in **Fatty Acid 1**. Count and record your answer in the blank next to the **C** (carbon) in the row labeled **ratio of elements.**

2. Use a green marker to mark all of the **H** (hydrogen) atoms in **Fatty Acid 1**. Count and record your answer in the blank next to the **H** (hydrogen) in the row labeled **ratio of elements.**

3. Use a blue marker to mark all of the **O** (oxygen) atoms in **Fatty Acid 1.** Count and record your answer in the blank next to the **O** (oxygen) in the row labeled **ratio of elements.**

4. Repeat steps 1, 2 and 3 for **Fatty Acid 2.**

CRITICAL THINKING QUESTIONS: *Write your answers to the following questions below.*

1. What elements are present in the glycerol? _____

2. Are there any elements in glycerol that are not in carbohydrates? _____

3. What are the elements that are found in fatty acids? _____

4. What is the ***simplest whole number*** ratio for each of the above fatty acids? _____

   _____

5. Compare the molecules in **MODEL 1 (Carbohydrates)** to the molecules in **MODEL 2 (Lipids)**. In what ways are the molecules **similar?** In what ways are the **different?**

SIMILAR	DIFFERENT
_____	_____
_____	_____
_____	_____

6. Using what you know about the property of water, which model (1 or 2) above would be more likely to be polar and attracted to water (hydrophilic)? _____
   Explain your answer. _____
   _____
   _____
   _____

7. Using what you know about the property of water, which model (1 or 2) would more likely be non-polar and repel the water (hydrophobic)? _____ Explain your answer.
   _____
   _____

8. List 2 ways lipids are used by cells: _____
   _____

9. What are the 2 types of fats: _____ & _____

9. List 3 examples of food that are lipids: _____
   _____

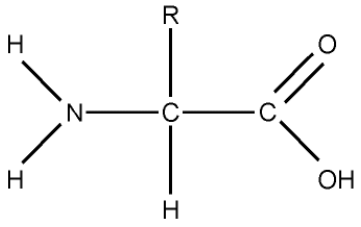
Directions: Please read the directions and answer the following questions in regard to <u>each</u> model.

Amino acids are the basic building blocks or subunits of proteins. There are twenty essential amino acids, and each one of them is a little different.

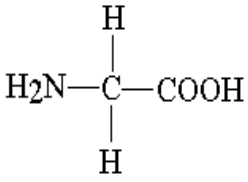
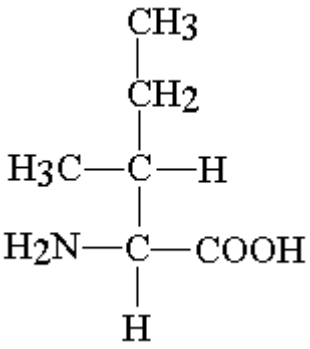
Each amino acid is composed of a "**common group**" (a central carbon with a single hydrogen, an amine group $–NH_2$ and a carboxyl group –COOH) and a "**variable group**" designated as ***R***.

It is the **variable group** or **R group** that determines the differences in properties. All organisms need some proteins, whether they are used in muscles or as simple structures in the cell membrane.

Amino acid
General Structure



MODEL 3

Name:	Amino Acid 1	Amino Acid 2
		
Ratio of Elements	**C ___ H ___ O ___ N ___**	**C ___ H ___ O ___ N ___**

1. Use a yellow marker to mark all of the **C** (carbon) atoms in **Amino Acid 1**. Count and record your answer in the blank next to the **C** (carbon) in the row labeled **ratio of elements.**

2. Use a green marker to mark all of the **H** (hydrogen) atoms in **Amino Acid 1**. Count and record your answer in the blank next to the **H** (hydrogen) in the row labeled **ratio of elements.**

3. Use a blue marker to mark all of the **O** (oxygen) atoms in **Amino Acid 1.** Count and record your answer in the blank next to the **O** (oxygen) in the row labeled **ratio of elements.**

4. Repeat steps 1, 2 and 3 for **Amino Acid 2.**

5. Use a pen or a pencil and draw a **box** around the "**common group**" of, **Amino Acid 1** and **Amino Acid 2**.

6. **Circle** and label the **R group** in each molecule.

CRITICAL THINKING QUESTIONS:

1. Are there any elements in an amino acid that are not in carbohydrates or lipids? _____

   If yes, what is/are they? _____

2. List 3 functions of proteins: _____

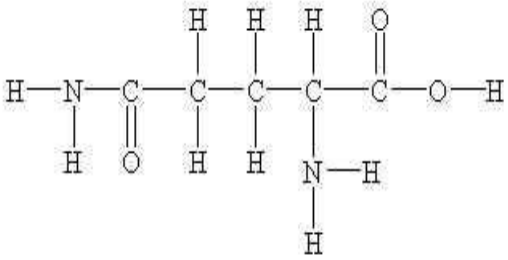
   _____

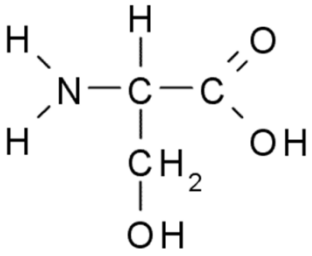
   _____

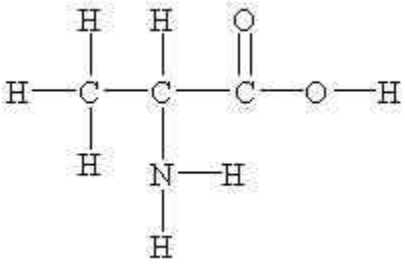
5. List 3 **food** examples of proteins: _____

   _____

Circle the R group *in each of the amino acids below and* ***draw a box around the common group.***

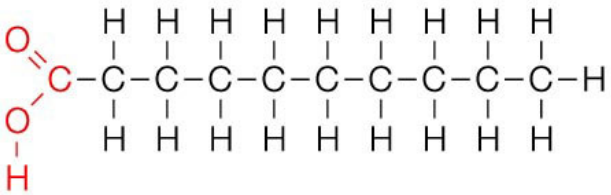






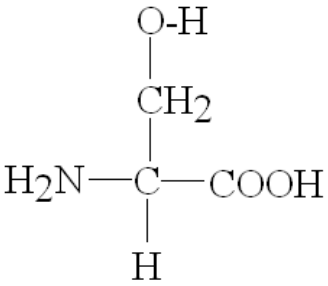
EXTENSION QUESTIONS: *Study the diagrams below. Indicate whether the diagram is an example of a carbohydrate, fatty acid or an amino acid.*

A



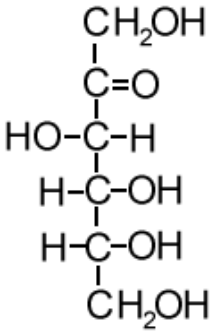
_____

B



_____

C



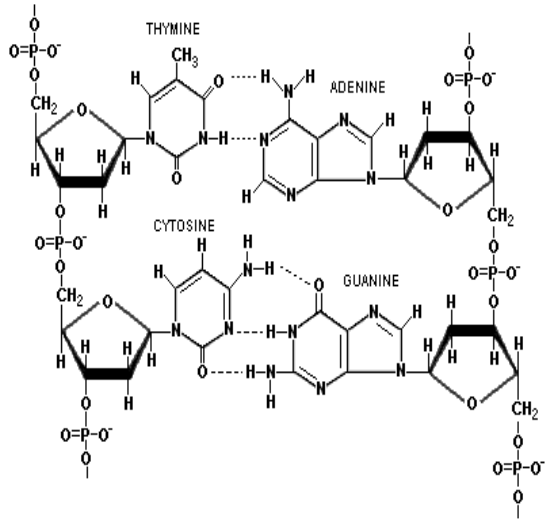
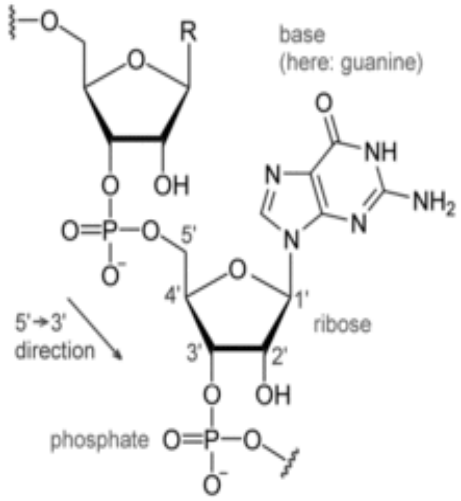
_____

Directions: Please read the directions and answer the following questions in regard to <u>each</u> model.

Nucleic acids include DNA and RNA. The **monome**r of a nucleic acid is called a **nucleotide** and is composed of a pentose (5 sided sugar), a nitrogen base and a phosphate group (-PO4). The sugar found in DNA is called **Dexoyribose**, while the sugar found in RNA is called **Ribose. DNA** stores genetic information, while **RNA** copies and transmits the genetic information.

Nucleotide

MODEL 4

Name	DNA	RNA
		
Ratio of Elements	**C____ H ____ O ____ N ____ P ____**	**C ___ H ___ O ___ N ___ P___**

1. Use a yellow marker to mark all of the **C** (carbon) atoms in **DNA**. Count and record your answer in the blank next to the **C** (carbon) in the row labeled **ratio of elements.**

2. Use a green marker to mark all of the **H** (hydrogen) atoms in **DNA**. Count and record your answer in the blank next to the **H** (hydrogen) in the row labeled **ratio of elements.**

3. Use a blue marker to mark all of the **O** (oxygen) atoms in **DNA.** Count and record your answer in the blank next to the **O** (oxygen) in the row labeled **ratio of elements.**

4. Repeat steps 1, 2 and 3 for **RNA.**

CRITICAL THINKING QUESTIONS:

1. Are there any **elements** in the nucleic acid structures that are **not** in the other three models? _____ If yes, what is/are they? _____

2. List the 3 parts that make a nucleotide: _____
   _____

3. What is the function of DNA? _____

4. What is the function of RNA? _____

5. What is the name of the 5 sided sugar found in DNA? _____
6. What is the name of the 5 sided sugar found in RNA? _____

All living things contain the element _____. **Carbon** is unique because:

1. _____
2. _____
3. _____

_____ are "**giant molecules**" formed by many smaller _____.

Small molecules that join to make larger molecules are called _____.

Monomers join together to form _____.

This process is called _____.

There are 4 major macromolecule groups found in all living things:

1. _____
2. _____
3. _____
4. _____

CARBOHYDRATES: Used as the _____ _____ of _____ by all living things.

Contain the elements: _____, _____ & _____ (CHO) in a 1:2:1 ratio.

Broken down as _____ for cells to carry out cellular activities or processes such as _____ and _____.

The **monomer** (or building block) is called a _____ which means one sugar unit. Examples of **monosaccharides** are: Glucose, _____ and _____. List 3 examples of foods that are monosaccharides: _____, _____, and _____

When **2 monosaccharides** are joined together they form a polymer called a _____.

List 2 examples: _____ and _____.

When **3 or more monosaccharides** are joined together they form a polymer called a _____.

The term "**POLY**" means _____.

List four food examples of polysaccharides: _____, _____ _____ and _____.

Many animals store excess sugar as _____ to be used when needed by muscles or when experiencing a low blood sugar.

Plants store excess sugar as _____. _____ is another important polysaccharide found in plants which give plants rigidity and flexibility.

LIPIDS: (fats, waxes, oils and steroids) Used to _____.

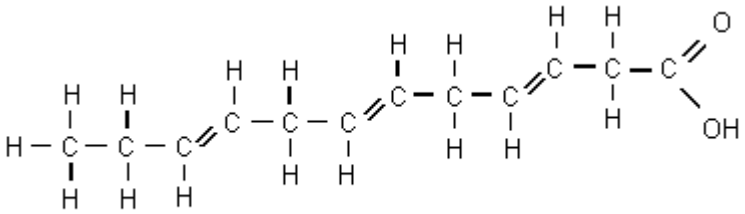
Contain the elements _____, _____ & _____ (CHO),

but NOT in a 1:2:1 ratio. Lipids are _____ which means they do not dissolve in water.

The monomer (or building block) is a _____ which consists of a glycerol molecule combined with three fatty acid tails. List 3 food examples of lipids: _____, _____ and _____.

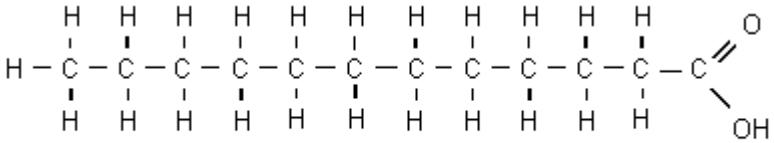
There are 2 types of lipids: _____ and _____.

Unsaturated fats usually contain at least _____ double carbon bond and is found in a _____ state when at room temperature. Examples of unsaturated fats are : _____.



Unsaturated Fatty Acid

Saturated fats do **not** contain any _____ _____ bonds and are usually _____ when at room temperature. Examples of saturated fats are: _____

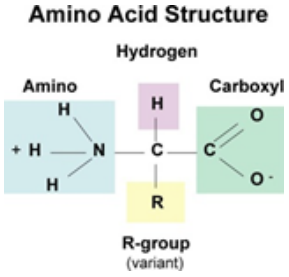


Saturated Fatty Acid

Some lipids make up important parts of the biological membrane (cells and organelles). These lipids are called _____. Lipids also form waterproof coverings for plants.

PROTEINS: Used to form bones and muscles, transport substances into and out of cells, help the immune system to fight diseases, control the rate of chemical reactions and regulate cell processes. Proteins contain the elements Carbon, Hydrogen, Oxygen and _____ & some contain _____. (CHON and S)

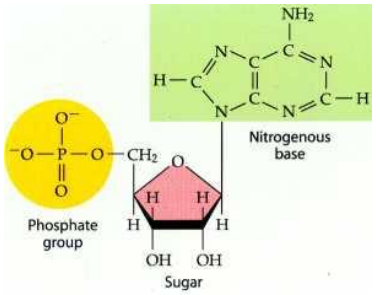
The **monomer** or building block is a(n) _____ _____. There are more than _____ **different but essential** amino acids found in nature. When 2 or3 amino acids are combined, they form what is called a _____ chain. When 3 or more amino acids are combined, they form what is called a _____ chain.



The portion of an amino acid that is different is a side chain called the **R group**. It is what makes each amino acid unique in its structure and function. List 4 food examples of proteins: _____, _____, _____ & _____. Some proteins act as biological catalysts called _____. A **catalyst** is a substance that _____ chemical reactions that take place in the cell. All enzymes are _____ and each enzyme is _____ to each chemical reaction that takes place. An example of a chemical reaction is: _____

NUCLEIC ACIDS: Used to _____ and _____ genetic information. There are two types of nucleic acids which are _____ and _____. Nucleic Acids contain the elements Carbon, Hydrogen, Oxygen, Nitrogen and _____ (CHONP).

The monomer or building block is called a _____.



A nucleotide contains 3 parts: (1). _____ (2). _____ and (3). _____

DNA is _____ stranded and called a _____ or_____. It is located in the _____ . DNA contains the 4 nitrogen bases: **Adenine, Thymine, Cytosine and Guanine**.

RNA is _____ stranded and contains the 4 nitrogen bases: **Adenine, Uracil, Cytosine and Guanine.** RNA is found in both the _____ and the _____ of all cells.

VOCABULARY WORDS for BIOMOLECULE UNIT: Write a definition of each word and then use it in a sentence. Underline the vocabulary word in the sentence.

Vocabulary Word	Definition	Sentence
1. monomer	The small single unit of a biomolecule – the building block of a macromolecule.	When two or more <u>monomers</u> are joined together, a larger molecule is made.
2. polymer		
3. monosaccharide		
4. peptide		
5. triglyceride		
6. nucleotide		
7. enzyme		
8. catalyst		