Lesson 1: True or False

Write true if the statement is true or false if the statement is false.

_____ 1. An atom is smaller than an element.
_____ 2. Organic compounds are found in living organisms.
_____ 3. Proteins are made out of amino acids.
_____ 5. The DNA code carries instructions for the correct sequence of nucleic acids in a protein.
_____ 6. Sugars and phosphate groups form the middle of a nucleic acid chain.
_____ 7. DNA (and RNA) is made out of nucleotides.
_____ 8. A protein consists of one or more polypeptide chains.
_____ 9. Lipids include fats, oils, and sugars.
_____ 10. Carbohydrates are the most common type of organic compound.
_____ 11. Peanut oil is an unsaturated fatty acid.
_____ 12. Cytosine and adenine are complementary bases in DNA.
_____ 13. A double helix is like a spiral staircase.
_____ 15. Carbohydrates are made out of monosaccharides.
Lesson 2: Critical Reading

Read these passages from the text and answer the questions that follow.

The Significance of Carbon

A compound found mainly in living things is known as an organic compound. Organic compounds make up the cells and other structures of organisms and carry out life processes. Carbon is the main element in organic compounds, so carbon is essential to life on Earth. Without carbon, life as we know it could not exist. Why is carbon so basic to life? The reason is carbon’s ability to form stable bonds with many elements, including itself. This property allows carbon to form a huge variety of very large and complex molecules. In fact, there are nearly 10 million carbon-based compounds in living things! However, the millions of organic compounds can be grouped into just four major types: carbohydrates, lipids, proteins, and nucleic acids. You can compare the four types in Table below. Each type is also described below.

<table>
<thead>
<tr>
<th>Type of Compound</th>
<th>Examples</th>
<th>Elements</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrates</td>
<td>sugars, starches</td>
<td>carbon, hydrogen, oxygen</td>
<td>provides energy to cells, stores energy, forms body structures</td>
</tr>
<tr>
<td>Lipids</td>
<td>fats, oils</td>
<td>carbon, hydrogen, oxygen</td>
<td>stores energy, forms cell membranes, carries messages</td>
</tr>
<tr>
<td>Proteins</td>
<td>enzymes, antibodies</td>
<td>carbon, hydrogen, oxygen, nitrogen, sulfur</td>
<td>helps cells keep their shape, makes up muscles, speeds up chemical reactions, carries messages and materials</td>
</tr>
<tr>
<td>Nucleic Acids</td>
<td>DNA, RNA</td>
<td>carbon, hydrogen, oxygen, nitrogen, phosphorus</td>
<td>contains instructions for proteins, passes instructions from parents to offspring, helps make proteins</td>
</tr>
</tbody>
</table>

Carbohydrates

Carbohydrates are the most common type of organic compound. A carbohydrate is an organic compound such as sugar or starch, and is used to store energy. Like most organic compounds, carbohydrates are built of small, repeating units that form bonds with each other to make a larger molecule. In the case of carbohydrates, the small, repeating units are called monosaccharides.

Lipids

A lipid is an organic compound such as fat or oil. Organisms use lipids to store energy, but lipids have other important roles as well. Lipids consist of repeating units called fatty acids. There are two types of fatty acids: saturated fatty acids and unsaturated fatty acids.

Proteins

A protein is an organic compound made up of small molecules called amino acids. There are 20 different amino acids commonly found in the proteins of living things. Small proteins may contain just a few hundred amino acids, whereas large proteins may contain thousands of amino acids.

Nucleic Acids

A nucleic acid is an organic compound, such as DNA or RNA, that is built of small units called nucleotides. Many nucleotides bind together to form a chain called a polynucleotide. The nucleic acid DNA (deoxyribonucleic acid) consists of two polynucleotide chains. The nucleic acid RNA (ribonucleic acid) consists of just one polynucleotide chain.

Questions

1. List two functions of organic compounds.

2. Which two categories of organic compounds store energy? Which of these organic compounds is more common?
3. What is a main difference between DNA and RNA?

4. Describe a difference between large and small proteins.

5. Why is carbon considered the essential element of life?

Lesson 3: Multiple Choice

*Circle the letter of the correct choice.*

a. Water (H₂O) is a(n)
   a. element.
   b. atom.
   c. compound.
   d. carbohydrate.

b. A process that changes some chemical substances into others is a
   a. chemical bond.
   b. chemical reaction.
   c. chemical equation.
   d. chemical formula.

c. The main difference between saturated and unsaturated fatty acids is
   a. the amount of energy found in the fatty acid.
   b. saturated fatty acids are liquids.
   c. unsaturated fatty acids can be packed together very tightly.
   d. the number of hydrogen atoms bonded to the carbon atoms.

d. The function of proteins can include
   a. helping cells keep their shape.
   b. helping to destroy foreign substances.
   c. speeding up biochemical reactions.
   d. all of the above

e. The characteristics of DNA includes which of the following?
a. DNA is made of nucleotides consisting of a sugar, a phosphate group, and a carbon base.

b. DNA is made of a single polynucleotide chain, which winds into a double helix.

c. DNA is how inherited characteristics are passed from one generation to the next.

d. all of the above

f. Which category of organic compound is the major component of cell membranes?

a. carbohydrate

b. lipid

c. protein

d. nucleic acid

g. The cell wall of plants is made out of

a. starch.

b. glycogen.

c. cellulose.

d. chitin.

h. The main element of organic compounds is

a. hydrogen.

b. oxygen.

c. nitrogen.

d. carbon.

Lesson 4: Vocabulary I

Match the vocabulary word with the proper definition.

Definitions

_____ 1. an organic compound that stores energy, forms cell membranes, carries messages

_____ 2. an organic compound that contains instructions for proteins

_____ 3. an organic compound that provides energy to cells, stores energy, forms body structures

_____ 4. an organic compound that helps cells keep their shape

_____ 5. a pure substance, like carbon

_____ 6. may contain just a few simple sugars or thousands
Lesson 5: Vocabulary II

Fill in the blank with the appropriate term.

1. A substance that consists of two or more elements is a ____________.
2. The information in ____________ is passed from parents to offspring when organisms reproduce.
3. ____________ are proteins which bind to foreign substances such as bacteria and target them for destruction.
4. ____________ compounds make up the cells and other structures of organisms and carry out ____________ processes.
5. ____________ is the monosaccharide used for energy by the cells of most organisms.
6. ____________ are the most common type of organic compound.
7. ____________ is a protein that binds with oxygen molecules.
8. The shape of DNA is that of a ____________.
9. ____________ is used by plants to store energy.
10. ____________ is used by plants to form rigid walls around cells.
11. DNA contains ____________ instructions for proteins, and ____________ helps assemble the proteins.
12. Matter is anything that takes up space and has ____________.

Terms

a. amino acid
b. carbohydrate
c. DNA
d. element
e. lipid
f. matter
g. nucleotide
h. phospholipid
i. polysaccharide
j. protein
k. saturated fatty acid
l. unsaturated fatty acid
Complete the table below

<table>
<thead>
<tr>
<th>Functional group:</th>
<th>Symbol Used below:</th>
<th>Example:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol (Hydroxyl Group)</td>
<td>-OH</td>
<td></td>
</tr>
<tr>
<td>Aldehyde (Carbonyl Group)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ketone (Carbonyl Group)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carboxylic Acid (Carboxyl Group)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amine (Amino Group)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amino Acid (Amino Group + Carboxyl Group)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phosphate group</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulphhydryl group</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Circle and identify all of the functional groups seen in this ATP molecule shown below. (note: ATP is an incredibly important energy molecule that we will talk about a lot in this class. Take a couple of minutes to get to know it....).
Complete the Table
Who are the carbohydrates? Fill in the following table, identifying the carbohydrate to its described function.

<table>
<thead>
<tr>
<th>Carbohydrate</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most plentiful sugar in nature; transport form of carbohydrates in plants; table sugar; formed from glucose and fructose</td>
<td></td>
</tr>
<tr>
<td>Five-carbon sugar occurring in DNA.</td>
<td></td>
</tr>
<tr>
<td>Main energy source for most organisms; precursor of many organic organisms; serve as building blocks for larger carbohydrates</td>
<td></td>
</tr>
<tr>
<td>Structural material of plant cell walls; formed from glucose chains</td>
<td></td>
</tr>
<tr>
<td>Five-carbon sugar occurring in RNA</td>
<td></td>
</tr>
<tr>
<td>Sugar present in milk; formed from glucose and galactose</td>
<td></td>
</tr>
<tr>
<td>Main structural material in some external skeletons and other hard body parts of some animals and fungi</td>
<td></td>
</tr>
<tr>
<td>Animal starch, stored especially in liver and muscle tissue; formed from glucose chains</td>
<td></td>
</tr>
</tbody>
</table>

Matching
Match the major parts found in every amino acid by entering the letter of the part in the blank corresponding to the part of the molecule.

A. R group (remember: “R group” is a symbol for a characteristic arrangement of atoms that differ in number and arrangement from one amino acid to another)
B. Carboxyl group
C. Amino group
### Matching

Choose the most appropriate answer for each term.

1. ____ amino acid  
   - a. A coiled or extended pattern of protein structure caused by regular intervals of H bonds.
2. ____ peptide bond  
   - b. Three or more amino acids joined in a linear chain
3. ____ polypeptide chain  
   - c. Proteins with linear or branched oligosaccharides covalently bonded to them; found on animal cell surfaces, in cell secretion, or in blood proteins
4. ____ primary structure  
   - d. Folding of a protein through interactions among R in a polypeptide chain
5. ____ proteins  
   - e. Form when freely circulating blood proteins encounter and combine with cholesterol or phospholipids
6. ____ secondary structure  
   - f. Type of covalent bond linking one amino acid to another
7. ____ tertiary structure  
   - g. Hemoglobin, a globular protein of four chains, is an example
8. ____ dipeptide  
   - h. Breaking weak bonds in large molecules (such as protein) to change its shape so it no longer functions
9. ____ quaternary structure  
   - i. Formed when two amino acids join together
10. ____ lipoproteins  
    - j. Lowest level of protein structure; has a linear, unique sequence of amino acids
11. ____ glycoproteins  
    - k. A small organic compound having an amino group, an acid group, a hydrogen atom, and an R group
12. ____ denaturation  
    - l. The most diverse of all the large biological molecules; constructed from pools of only twenty kinds of amino acids
Labeling
Label following answers to the parts of a nucleotide shown in the diagram.

1. ___  A. A five-carbon sugar (ribose of deoxyribose)
2. ___  B. Phosphate group
3. ___  C. A nitrogen-containing base that has either a single-ring or double-ring structure

Complete the table
Complete the table below by entering the correct name of the major cellular organic compounds suggested in the “types” column (choose from carbohydrates, lipids, proteins, and nucleic acids).

<table>
<thead>
<tr>
<th>Cellular Organic Compounds</th>
<th>Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phospholipids</td>
<td></td>
</tr>
<tr>
<td>Enzymes</td>
<td></td>
</tr>
<tr>
<td>Genes</td>
<td></td>
</tr>
<tr>
<td>Glycogen, starch, cellulose, and chitin</td>
<td></td>
</tr>
<tr>
<td>Saturated and unsaturated fats</td>
<td></td>
</tr>
<tr>
<td>Sterols, oils, and waxes</td>
<td></td>
</tr>
<tr>
<td>Glucose and fructose</td>
<td></td>
</tr>
</tbody>
</table>
Matching
Match the organic molecule with its type below.

A. [Image]
B. [Image]
C. \[
\text{CH}_3 \quad \text{CH}_3 \quad \text{CH}_3
\]
\[
\text{HO-CH-O} \quad \text{CH} \quad \text{N} \quad \text{CH-} \quad \text{COOH}
\]
D. [Image]
E. [Image]
F. [Image]

1. A monosaccharide ____
2. A polysaccharide ____
3. A steroid ____
4. A polypeptide ____
5. An amino acid ____
6. A major component of cell membranes ____