Name:_____ Block:_____ Date:_____ Student #: _____

Organic Molecules Worksheet

Read through each section and answer the following questions.

Organic molecules are the molecules that exist in all living things. They are life's building blocks. All things are formed from these organic molecules. There are four categories of organic molecules: Carbohydrates, lipids, proteins and nucleic acids.

1. How are organic molecules related to all living things?

_____

2. Name four categories of organic molecules that form the basis of all living things:
a. _____ b. _____ c. _____ d. _____

Organic molecules have four common characteristics. First, they are all carbon based, meaning they all contain carbon. They are formed from just a few elements that join together to form small molecules that join together, or bond, to form large molecules. The third characteristic of all organic molecules is that each is kind of organic molecule is built from a single type of building block. For example, the building block of carbohydrates is sugar, the building block of lipids is fatty acids, the building block of protein is amino acids and the building block of nucleic acids is the nucleotide. When these building blocks are joined together, they form molecule (polymer), just as bricks joined together form a wall. For example, sugars join together form a carbohydrate.

3. All of the organic molecules are based on which element? _____

4. How are the building blocks of organic molecules like bricks? _____

_____

5. What is the building block of each of the four classes of organic molecules?
   a. The building blocks of carbohydrates are _____
   b. The building blocks of lipids are _____
   c. The building blocks of proteins are _____
   d. The building blocks of nucleic acids are _____

6. What is a polymer? _____

The last common characteristic of all organic molecules is that their form determines their function. That means that their shape determines how they will behave and how they will react with other molecules. For example, the order of amino acids in a protein will determine the shape and function of the protein just as the order of words in a sentence shapes the meaning of the sentence.

7. What determines how organic molecules will look and behave?

_____

8. What are the four common characteristics of all organic molecules?

a. _____

b. _____

c. _____

d. _____

Carbohydrates: Carbohydrates are the most common organic molecule because they make up most plant matter. They are made from carbon, hydrogen and oxygen. Their building block, a single sugar, is called a monosaccharide. Sugars (monosaccharides) consist of carbon rings. When two monosaccharides, or sugars, combine, they form a disaccharide (di = two). When more than two monosaccharides join together, a polysaccharide (poly = many) is formed.

9. What are the elements contained in carbohydrates? _____

10. What is the building block of carbohydrates? _____

11. What is a monosaccharide? _____

a. What does a monosaccharide look like? _____

12. What is a disaccharide? _____

13. How does a polysaccharide differ from a disaccharide? _____

_____

There are three classes of carbohydrate polysaccharides. The first is starch. Starch is a carbohydrate used in food storage in plants. Potatoes, pasta and rice are rich in starch. Starches are very valuable because they provide a quick form of energy for the body. The second is glycogen. Glycogen is used for food storage in animals. The third is cellulose. Cellulose is used for structural support in plants (stems, leaves).

14. What are the three classes of carbohydrates?

a. _____ b. _____ c. _____

15. Which involves food storage in plants? _____

16. Which involves food storage in animals? _____

17. What is cellulose used for? _____

18. Why would an athlete have a big pasta dinner the night before a race? _____

_____

Lipids: Lipids are a class of organic molecules that includes fats and oils, and has the function of long- term storage of energy in the body. The building block of lipids is the fatty acid, which is a chain of carbons with hydrogen attached to each side. The "head" of Saturated fats have two carbons attached to each carbon (except the one at the end), are unhealthy fats usually from animal sources, and solid at room temperature. Unsaturated fats are missing at least one hydrogen, are kinked in shape, are healthy and from plant sources, and liquid at room temperature.

19. What is the building block of lipids? _____

20. Name two specific examples of lipids: _____ _____

21. Describe the structure of a fatty acid: _____

_____

22. What is a saturated fatty acid? _____

_____

Proteins: Proteins are organic molecules that form muscles, transport O2 (hemoglobin), and act as hormones and enzymes. Most importantly, proteins determine how our bodies look and function. Their building block is the amino acid. Proteins are made of amino acids linked by a peptide bond. When groups of amino acids are joined together, a protein is formed.

23. What are some of the functions of proteins? _____

_____

24. What is the building block of proteins? _____

25. What is the name of the bond that joins amino acids? _____

There are 20 different kinds of amino acids. These amino acids consist of five separate parts: a central carbon atom, a carboxyl group (-COOH), an amino group (-NH2), a hydrogen, and an "R" group. The only difference in the 20 kinds of amino acids is the "R" group. Some "R" groups are very small, others are large, and others form chains and rings. The sequence and shapes of the "R" groups control the shape and function of the protein.

26. How many different amino acids are there? _____

27. What part of the amino acid varies from one amino acid to another? _____

28. What determines the shape and function of a protein? _____

_____

Nucleic Acids: The fourth class of organic molecules is the nucleic acids. This class involves the genetic materials, DNA and RNA. DNA is the blueprint of life because it contains instructions on how to make proteins in the body. Each individual's DNA is unique, which means that each individual has a unique set of proteins; that is why each of us looks and behaves differently. RNA creates a copy of DNA because DNA can't leave the cell's nucleus, and because proteins are constructed outside of the nucleus in the cytoplasm -- the RNA is necessary to carry the instructions from DNA to the cytoplasm where the protein is made.

30. What are the two types of nucleic acids? _____

31. What is the role of DNA? _____

_____

32. How does the role of RNA differ from that of DNA? _____

_____

The monomer of nucleic acids is the nucleotide. All nucleic acids are formed from a series of these nucleotides. Nucleotides consist of three parts: a five-carbon sugar, a phosphate group and a nitrogen base.

33. What is the building block of nucleic acids? _____

34. What are the 3 parts of this monomer? a. _____ b. _____ c. _____

The structure of DNA resembles that of a twisted ladder, called a "double helix". The rails (outside) of the DNA ladder are made from alternating sugars, called deoxyribose, and phosphates (sugar-phosphate- sugar-phosphate…). The rungs (inside) of the ladder are made of four different kinds of nitrogen containing bases, with one base hanging off of the sugar portion of each rail. The four nitrogen containing bases are: Adenine (A), Thymine (T), Cytosine (C), and Guanine (G). The rails of the ladder are held together by the nitrogen containing bases: from one rail to the bases and from the bases to the other rail = to form rungs. The bases from one side of the ladder attach to the bases hanging from the other side; this keeps the ladder together. The bases attach to one another in a very specific way: Adenine always attaches to Thymine, and Cytosine always attaches to Guanine.

35. Describe the structure and shape of DNA: _____

_____

36. What are the rails of the ladder made of? _____ _____

37. What are the four different nitrogen containing bases?

a. _____ b. _____ c. _____ d. _____

38. What part of the ladder do these bases form? _____

39. Cytosine always pairs with what base? _____

RNA is very similar to DNA, except for a few differences. First, where the sugar in DNA is deoxyribose, the sugar in RNA is ribose. Second, where DNA is a double helix, RNA has just one strand. Third, where the bases in DNA are C, G, A, and T, in RNA the bases are C, G, A, and U. The U = Uracil in RNA, and takes the place of the T in DNA. Fourth, DNA cannot leave the nucleus of the cell and RNA can leave the nucleus.

40. List four differences between DNA and RNA:

a. _____

b. _____

c. _____

d. _____

41. List three similarities between DNA and RNA:

a. _____

b. _____

c. _____