ANSWER IN ENGLISH

Measuring Up – Workbook - Lesson #1 “Biochemistry”

**You will learn that all living things are made up of four major kinds of molecules: carbohydrates, lipids, proteins, and nucleic acids**

These are very large molecules are called biomolecules. The play important roles in all the processes that take place in the cells of your body and of every other living thing.

The four kinds of biomolecules can be very different in structure, and it is this difference that enables them to perform different functions in the cell. The biomolecules also share one important characteristics – they all contain carbon.

**Carbohydrates** are made up of carbon, hydrogen, and oxygen in a 1:2:1 ratio. Some carbohydrates, such as simple sugars, provide quick energy. Others store energy. Carbohydrates such as cellulose provide structure.

**Lipids** are made mostly from carbon and hydrogen atoms. One important characteristic of lipids is that they do not dissolve in water, so cells can store energy as lipids. Lipids also provide insulation, and make up cell membranes. Fats, oils, and waxes re common names of some different kinds of lipids.

**Proteins** are made of carbon, hydrogen, oxygen, and nitrogen, individual units called amino acids make up protein molecules. Proteins control cell functions, defend the organism, support transport and movement, and provide structure.

**Enzymes** act as catalysts in the chemical reactions that take place in organisms. Each enzyme has a specific function, which is determined by its shape.

A **catalyst** is a substance that speeds up the rate of a chemical reaction without being used up.

**Nucleic acids** are made of long chains of individual units called nucleotides. The two types of nucleic acids are deoxyribonucleic acid (DNA) and ribonucleic acid (RNA). Nucleic acids contain the information that determines how an organism grows and develops, and they control the building of proteins in cells.

**Guided Instruction-** Directions: Read the following information and answer the questions.

When you look at all the living things around you, you might think that they are made of very different materials. But all living things are made of come common compounds. The study of the chemicals that make up living things is called *biochemistry.*

All matter, including your body, is made up of atoms. These atoms form bonds that hold them together in a group called a *molecule*. Most of the molecules that make up cells are very large molecules called *biomolecules*. The main component of a biomolecule is the carbon atom. Biomolecules are also called organic compounds.

GUIDED QUESTION (1) What is the main component of a biomolecule?

Four main types of biomolecules make up living things: carbohydrates, lipids, proteins, and nucleic acids. I addition to carbon, all biomolecules contain hydrogen and oxygen, but they are combined in different ratios. Thousands of biomolecules work together in a cell. Each type of biomolecule as a specialized function.

GUIDED QUESTION (2): What are the four major types of biomolecules in living things?

**Carbohydrates** are a familiar type of biomolecules. They are made of carbon, hydrogen, and oxygen atoms, usually in a 1:2:1 ratio. The sugars and starches you eat are two kinds of carbohydrates. The cellulose that makes p the cell walls of plants is another kind of carbohydrates. Carbohydrates are the most common source of energy in a cell. That is why athletes often eat carbohydrates before participating in a sport. Inside cells, the bonds that hold the carbohydrate molecules together are broken, and energy is released. The athlete’s body can use this energy to move muscles and perform other tasks.

GUIDED QUESTION (3): Describe the chemical structure of a **carbohydrate**.

The simplest kinds of carbohydrates are simple sugars. Simple sugars include glucose and fructose*. Glucose* is an important energy source produced during photosynthesis. The energy stored in the glucose molecules is used to start cellular respiration. *Fructose* is the sugar that is responsible for the sweet taste of many fruits. Notice in the diagram below (SEE THE WORKBOOK) that simple sugars can be linked together. For example, two glucose molecules can join to form sucrose.

You can also see that simple sugars can link together in long chains to form very complex carbohydrates, such as starches. The complex carbohydrates do not dissolve in water. That is why organisms can store energy as complex carbohydrates for later use – they will not dissolve in the cell’s water content. Animals store glucose as glycogen, and plants store it in the form of starch. Any organisms also use complex carbohydrates for structure. For example, plants make cellulose, which is the material that makes up the cell walls. Humans, and most other animals, cannot digest cellulose, but it is an important part of our diet that we call fiber.

Lipids are the fats, oils, and waxes that are found in living things. Like carbohydrates, lipids are made of carbon, oxygen and hydrogen. However, the arrangement of these atoms in lipids is different from their arrangement in carbohydrates. Many lipids contain fatty acids, which are long chains of carbon and hydrogen atoms. These chains are connected to smaller molecules called glycerol. Lipids dissolve in oil, but not in water. Lipids can store more energy than other organic compounds. Lipids also provide insulation. The layer of insulating fat beneath the skin of a polar bear is made of lipids. So is cholesterol, the fatty substance that can build up in the blood vessels of humans. Lipids area also a component of cell membranes.

GUIDED QUESTION (4): Which types of organic compound provides the best energy storage?

Proteins are made of smaller molecules called *amino acids*. The amino acids contain carbon, hydrogen, oxygen, nitrogen, and sometimes sulfur. There are twenty different amino acids that make up proteins. All amino acids are almost identical in the areas where they join together. However, each amino acid is different in a part of the molecule known as the R-group. The R-groups of amino acids give them many of their different properties. Some are polar, and others are nonpolar. Some amino acids are electrically charged, while others are not charged. Amino acids can also be acidic or basic. The amino acids are liked together in long chains that fold into three-dimensional shapes. The picture of a protein molecules on the next page (SEE THE WORKBOOK) shows just one of the many shapes that protein molecules might take. The shapes of protein molecules are determined by the type, number, and order of amino acids.

GUIDED QUESTION (5): What smaller units make up proteins?

GUIDED QUESTION (6): In what way do amino acids differ from one another?

The chemical properties and functions of a protein depend on the structure of its molecule. Proteins called *antibodies* protect your body from infection. In your blood, proteins called *hemoglobin* carry oxygen from your lungs to body cells. Proteins in muscles enable muscle tissue to contract. Hair and nails are made up of a protein that provides structure.

Enzymes and hormones are important proteins that control the chemical reactions that go on in cells. Every cell has thousands of chemical reactions happening at the same time. Together, these reactions are called *metabolism*. Protein molecules called **enzyme**s regulate the chemical reactions. The enzymes work as **catalysts**, meaning they speed up the reactions without being used up Enzymes lower the energy that a chemical reaction needs to get started.

Each kind of enzyme has a particular shape. An enzyme’s specific shape enables it to locate the primary molecules involved in the chemical reaction. These molecules are called the *substrate*. Enzymes bind with the substrate at the enzyme’s active site. Each enzyme is for a specific reaction so a particular substrate fits only with a specific active site. Once the enzyme and the substrate bind, the enzyme moves the substrate by changing shape so the reaction can happen. After the reaction is complete, the enzyme returns to its original shape.

GUIDED QUESTION (7): What determines an **enzyme’s** function?

**Nucleic acids** are made of one or two long chains of nucleotides. As you can see below (SEE THE WORKBOOK), each nucleotide is made of a nitrogen base, a five-carbon sugar, and a phosphate. The two types of nucleic acids are deoxyribonucleic acid (DNA) and ribonucleic acid (RNA). The nucleotides in DNA and RNA are grouped into genes, which contain instruction for the maintenance, growth, and reproduction of a cell. A DNA molecule is called a double helix because of its spiral shape. DNA controls the building of proteins in cells, which is known as protein synthesis. RNA is involved in copying genes used as instructions to turn amino acids into proteins.

GUIDED QUESTION (8): What important function do **nucleic acids** have in a cell?

SHORT ANSWER QUESTIONS: Directions – Answer the following questions

1. Describe the structure of a nucleotide.
2. How does the structure of a starch differ from that of a simple sugar?
3. Water makes up about 60% of the human body. What are complex carbohydrates better for storing energy than simple sugars are?
4. What kind of biomolecule can store more energy than the others?

APPLY THE TEKS: Directions – Read the paragraph, study the diagram, and answer the questions.

Sucrase is an enzyme found in the human intestine. It catalyzes the breakdown of table sugar, also known as sucrose. The sucrose binds to the active site of the enzyme, and the enzyme’s configuration changes so that the bridge between the two simple sugars as exposed to water molecules. This exposure allows the bridge between the two sugars to break. Two simple sugars, glucose and fructose, result, and the enzyme returns to its original shape. (See diagram in workbook page 6)

1. What kind of molecule is an enzyme?
2. Why are enzymes important in a cell?
3. How is the original sugar, sucrose, different from the resulting sugars, glucose and fructose?
4. Changing the temperature affects the shape of an enzyme. How might an increase in temperature affect the enzyme’s function in the cell?
5. What is the function of sucrase in the breakdown of table sugar?

STAAR PRACTICE: Directions – Read each question and choose the best answer.

1. A protein-digesting enzyme mixes with cholesterol in the digestive tract. What effect does the enzyme have on the cholesterol?
   1. Breaks the cholesterol to amino acids
   2. Breaks the cholesterol into simple sugars
   3. Converts the cholesterol to energy
   4. No effect
2. What do all lipids have in common?
   1. They produce quick energy
   2. They are saturated with hydrogen
   3. They don’t dissolve in water
   4. Their compositions differ only by R-groups
3. Enzymes speed up a chemical reaction by –
   1. Lowering the amount of energy it needs to get started
   2. Reducing complex carbohydrates
   3. Changing the shape of the substrate
   4. Producing heat
4. DNA and RNA are composed of units that are made up of –
   1. Two long chains of nucleotides
   2. Chains of simple sugars
   3. Twisted chains of amino acids
   4. Three very long carbon-hydrogen chains attached to a glycerol molecule
5. Which of the following is an amino acid?
   1. C27H45OH
   2. C12H22O11
   3. C11H12N2O2
   4. C40H80NO8P