The Flow of Matter and Energy in the Living World: 
Photosynthesis and Cellular Respiration
from the Biology: The Science of Life Series
Pre-Test

Directions: Answer each question TRUE OR FALSE.

1. All living things are able to capture the energy of sunlight and use it to power their life processes.

2. Many animals exhale carbon dioxide, CO$_2$, as a waste product, but plants need CO$_2$ to live.

3. The oxygen in our atmosphere comes from plants.

4. Matter is always a lot heavier than energy.

5. Matter takes up less space than energy.
atom: The smallest particle of an element.
ATP: Abbreviation for Adenosine Triphosphate, the chemical compound used by cells as a source of readily available energy.
autotroph (auto-trof): An organism that makes its own food; a food producer.
bacteria: Simple, one-celled, organisms that lack a nucleus. Bacteria are found almost everywhere on earth. Some cause disease while others are helpful. In food chains, bacteria play important roles as decomposers.
carbon dioxide: A colorless, odorless gas abbreviated by the chemical formula CO₂. (This formula shows that one molecule of CO₂ has two atoms of oxygen and one of carbon.) Animals exhale carbon dioxide because it is a by-product of cellular respiration. Plants can use the sun's energy to combine carbon dioxide with water to make sugar. This is how plants convert the energy of sunlight into chemical energy: a process called photosynthesis.
cell: The smallest structural unit or "building block" of life.
cellular respiration (sell-you-lar res-per-a-shun): Cellular respiration occurs when glucose is broken down into carbon dioxide and water, and energy, in the form of ATP, is created. Aerobic cellular respiration uses oxygen. Anaerobic cellular respiration, or fermentation, does not require oxygen (certain yeasts and some bacteria use this method of incomplete cellular respiration to release stored energy).
characteristic: A distinctive feature; a trait.
chemical: Chemicals are substances made from combinations of different elements. For example, glucose belong to a class of chemicals made from the elements carbon, oxygen, and hydrogen called sugars.
chemical bonds: The way in which atoms connect to one another. For example, in water, an atom of oxygen is joined to two atoms of hydrogen by chemical bonds. The subatomic particles called electrons are responsible for creating chemical bonds.
chemical energy: Energy stored in chemical bonds.
chemical equation: A diagram that uses chemical formulas, numbers, and other symbols to describe what happens in a chemical reaction.
complementary: Something that completes or makes perfect; two parts of a puzzle fit together to make a whole. They are complementary parts. In the same way, photosynthesis and cellular respiration are complementary to one another because the products of one reaction are the reactants of the other reaction.
DNA: The abbreviation for Deoxyribonucleic Acid, a very large molecule that stores biological instructions.
energy: The ability to do work or cause change. There are different types of energy such as light energy, heat energy, electrical energy, chemical energy, etc.
electron: Subatomic particles of an atom that are used in chemical bonding. Electrons are negatively charged and they spin around the atomic nucleus.
element: Pure forms of matter that cannot be separated chemically into other substances. There are 92 natural elements and more than ten manmade elements. Each element possesses a different number of protons, has a different weight, and different properties. Silver, gold, sulfur, carbon, oxygen, and helium are examples of elements.
food chain: A sequence of organisms through which matter and energy (in the form of food) flow within a certain community.
food producer: Photosynthetic organisms; those that are able to produce food (glucose) from carbon dioxide, water, and sunlight.

(Continued on Blackline Master 3)
**Vocabulary List and Activity (continued)**

**Fungi**: The kingdom of living things made up of organisms that include mushrooms, molds, and yeasts. In food chains, fungi often act as decomposers.

**Gas**: One of the three states of matter on earth. Gases are forms of matter that have no definite shape and can be turned into liquids under extreme pressure.

**Glucose**: The sugar, whose chemical formula is C₆H₁₂O₆, that is created by photosynthesis.

**Heterotrophs (het-er-oh-trof)**: Organisms not able to make their own food. Decomposers as well as primary, secondary and tertiary food consumers are heterotrophs.

**Homeostasis (home-ee-oh-stay-sis)**: The maintenance of a balanced internal environment.

**Hydrogen**: The simplest element of matter and the most abundant element in the universe. "H" is the symbol for hydrogen. Hydrogen gas (H₂) is a molecule made from two atoms of hydrogen chemically bonded together.

**Liquid**: A form of matter that flows and can be poured. Liquids take on the shapes of their containers.

**Matter**: One of the two basic ingredients of the universe. Matter has mass (similar to weight) and occupies space.

**Metabolism**: The sum of all the chemical processes that take place in an organism.

**Molecule**: A chemical substance formed when the atoms of one or more elements are bonded together.

**Neutron**: Uncharged subatomic particles found in the nuclei of all atoms but hydrogen.

**Organism**: A living thing.

**Photosynthesis**: The biochemical process carried out by plants and certain other organisms that possess chlorophyll whereby sunlight is trapped, and carbon dioxide and water react to form energy-rich glucose and oxygen.

**Primary consumer**: In a food chain, primary consumers are organisms that survive on a diet of plants or other photosynthetic organisms.

**Products**: The things that are produced by chemical reactions.

**Proton**: A positively charged subatomic particle found in the nuclei of atoms.

**Reactants**: The things that are reacting with one another in a chemical reaction.

**Secondary consumer**: Organisms in food chains that eat primary consumers.

**Solid**: One of the three states of matter on earth. Solids have definite shape.

**Species**: A group of similar organisms that interbreed in nature.

**States of matter**: Depending on the temperature and atmospheric pressure, matter can be either solid, liquid or gas. In stars, a fourth state of matter exists, called plasma.

**Subatomic particles**: The particles that make up atoms: protons, neutrons and electrons. Different elements of matter possess different properties due to the fact that each element possesses different numbers of subatomic particles.

**Sugars**: A certain class of energy-rich chemical compounds made from the elements carbon, hydrogen and oxygen. Chemically speaking, there are many different kinds of sugars.

**Tertiary consumers (ter-she-airy)**: In food chains, these organisms eat the secondary consumers.

**Thermonuclear reactions**: Unlike chemical reactions which rearrange chemical bonds of molecules, thermonuclear reactions are reactions that take place in gases at a heat of several million degrees. Thermo-nuclear reactions occur in stars and during the explosions of hydrogen bombs. They cause new elements to be formed and old elements to be destroyed. Nuclear reactions bring about new arrangements of subatomic particles and this is what causes the new elements to be formed.

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**Vocabulary Activity**

Using the Vocabulary List, fill in the blanks with the correct word or words:

1. The smallest particle of the element iron is called an ______________ of iron.
2. When iron reacts with oxygen, the product of the reaction is iron oxide (rust), which is called a ______________ ____________, because it contains two different elements.
3. The biochemical process known as __________ produces energy-rich glucose and oxygen.
4. One ______________ of carbon dioxide is made from one atom of carbon and two atoms of oxygen.
5. In food chains, the main decomposers are ______________ and ______________.

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ACROSS:
1. In a food chain, the ____________ consumers eat the food producers.

2. In cellular respiration, the sugar called ____________ is broken down in order to create energy-rich ATP.

3. Water, H₂O, is an example of a chemical ____________ because it is made from both hydrogen and oxygen.

4. Silver and gold, like hydrogen and oxygen, are the pure types of matter known as ____________.

5. The light trapping molecule found in plants is called _____________.

DOWN
1. In cellular respiration, ____________ dioxide, water, and ATP are produced.

2. In food chains, the ____________, organisms such as bacteria and fungi, break down dead material into nutrients for plants.

3. ____________ are made from protons, neutrons, and electrons.

4. Sunlight ends up being turned into stored chemical energy by the important biological process called _____________.

5. Solid, gas, and ____________ are the three states of matter on earth.
Post-Test

Directions: Answer the following questions as directed by your teacher. Use the back of this sheet if necessary.

1. Write out the basic equation for photosynthesis and a paragraph describing what happens during photosynthesis.

2. Write out the basic equation for cellular respiration and a paragraph describing what happens during cellular respiration.

3. Define the following words or terms:
   a. atom-
   b. element-
   c. chemical reactions-
   d. molecule-
   e. subatomic particles-
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Video Quiz

Directions: Answer the following questions either True or False.

1. TRUE OR FALSE? Elements are pure types of matter. _____

2. TRUE OR FALSE? Atoms are made from molecules. _____

3. TRUE OR FALSE? Chlorophyll is needed for cellular respiration. _____

4. TRUE OR FALSE? Matter and energy flow through food chains. _____

5. TRUE OR FALSE? Chemical compounds contain at least two types of atoms. _____