

Chemistry All Around Us!

Week 5: Grades 6-8

Day 4: Photosynthesis

Teacher/Parent Background:

Photosynthesis is the process in which plants collect radiant energy (from the Sun) and transform it into chemical energy. The chemical energy is stored in the plant as sugar and is available as food. The leaves of plants contain everything needed to absorb the rays of the Sun and start photosynthesis. This interaction between radiant energy from the Sun and matter (carbon dioxide and water) causes a chemical reaction with the result of the formation of different matter (sugar and oxygen). The radiant energy absorbed by the plant is transformed during the process of photosynthesis and is stored within the newly formed sugar as chemical energy in the plant. Fortunately for us, oxygen is also released to the atmosphere during this process. How a plant actually accomplishes this transformation is still a mystery as scientists are not able to recreate the natural process of photosynthesis using man made materials. However, what happens to the beginning substances (the reactants) and resulting substances (the products) during photosynthesis is understood, can be measured, and can be easily represented using models.

Overview:

In this activity students model the process of photosynthesis to see what happens to elements and compounds of the reactants and products as radiant energy is transformed to chemical energy.

Related Standards:

Develop and use a model to demonstrate that atoms and molecules can be combined or rearranged in chemical reactions to form new compounds with the total number of each type of atom conserved.

Key Terms:

- Radiant Energy: Energy from the sun that reaches the Earth as visible light, and ultraviolet and heat radiation.
- Chemical Energy: Energy stored in chemical bonds and released through chemical reactions.

- Photosynthesis: A chemical reaction during which plants convert radiant energy from the Sun to chemical energy.
- Chemical Reaction: A process by which two or more chemical substances interact and are chemically changed, producing different chemical substances.
- Reactants: A substance that takes part in and undergoes change during a reaction.
- Products: A substance produced during a chemical reaction.
- Molecule: The simplest unit of a chemical compound that can exist, formed when two or more atoms join together chemically.

Materials List:

- Colored Pencils/Crayons/Markers
- Scissors
- Student Resource Pages

Activity Description:

1. Provide students with the Student Resource pages and ask them to follow the instructions.

Closure:

Discuss the following with your students:

How are solar energy and the energy in glucose related in the process of photosynthesis? The radiant energy of the Sun provides the energy for the process of photosynthesis. During the reactions of photosynthesis, solar energy transfers to chemical energy and stores in the bonds of carbohydrates, such as glucose.

Do you think there is a reason to be concerned about the loss of space for photosynthetic plants to grow? Share your reasoning. There is reason for concern. Our survival is dependent on photosynthesis for food and oxygen. Without space to grow, the numbers of plants decrease. As the number of plants decrease, the amount of solar energy captured is reduced. Less captured energy means less energy stored in a useful form to us and other animals, such as food.

Extensions:

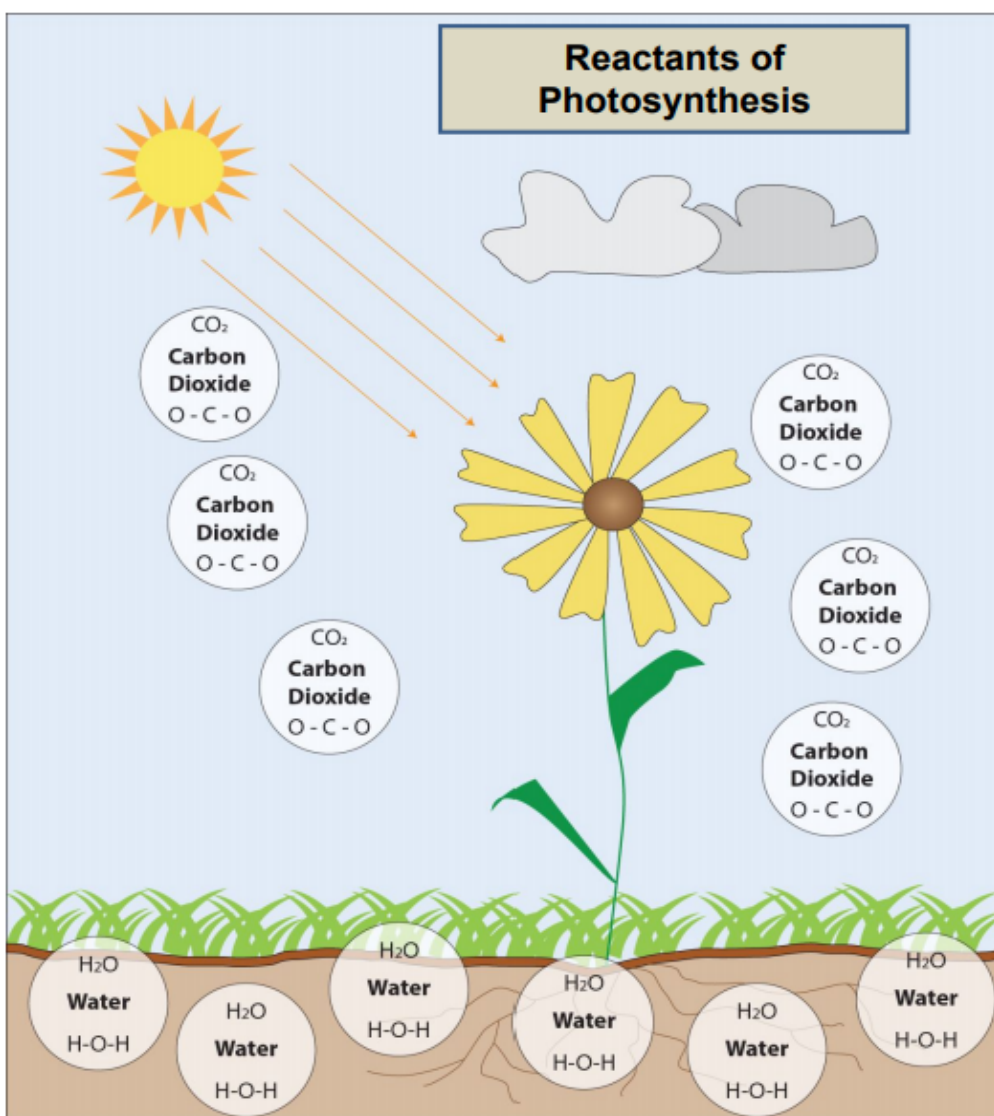
Write a Love Letter to an Autotroph: Assign each student group a specific type of autotrophic organism (plant, bacteria or protist). Instruct each group to write a "love note to the organism telling it how much it is appreciated for the energy capturing work it does.

Student Resources

PART 1: The reactants must be present and available to the plant for photosynthesis to occur. Carbon dioxide is in the atmosphere and enters the plant through structures in the leaf called stomata. Water is absorbed by the plant's roots. We'll be using paper circles to represent atoms, like in Day 3.

18 Blue = oxygen, label each with O; 6 red = carbon label each with C; 12 yellow = hydrogen label each with H. Cut all the circles out and stack them by element.

1. The paper circles represent atoms of hydrogen, carbon, and oxygen.
2. Use these atom models to build and represent water and carbon dioxide on the Reactants of Photosynthesis image. Place a stack of atoms on each circle to represent the substance. Leave stacks in place.



3. How many H, C and O atoms in total appear as any part of the reactants?
H= C= O=
4. What is the source of the carbon dioxide as a reactant in photosynthesis?

5. How does carbon dioxide enter the plant?

6. What is the source of water as a reactant in photosynthesis?

7. How does the water enter the plant?

PART 2: The sugar formed as a result of photosynthesis is called *glucose*. The product glucose is a larger molecule than either of the reactants, water and carbon dioxide. Glucose is used by the plant as its own generated food source. A by-product of the photosynthesis reaction is oxygen gas, and is released from the plant through the stomata.

1. Look at the model of glucose to the right.

2. Count the number of C atoms in the model of glucose. Take that number of C atoms from the pile of atoms on the Reactants of Photosynthesis image and place them in a stack on the side.

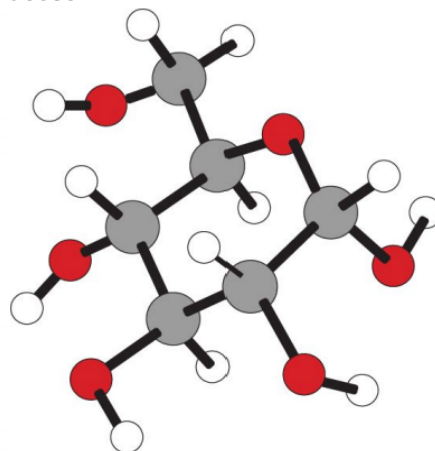
3. Count the number of H atoms in the model of glucose. Take that number of H atoms from the Reactants of Photosynthesis image and add them to the stack of C atoms.

4. Count the number of O atoms in the model of glucose. Take that number of O atoms from the pile of atoms on the Reactants of Photosynthesis image and add them to the stack of C and H atoms.

5. Set your stack of C, H and O atoms on the Products of Photosynthesis image in the space labeled: glucose.

6. Take the remaining atoms from the pile of atoms on the Reactants of Photosynthesis image and distribute them equally on the spaces provided on the Products of Photosynthesis image.

Glucose



Key



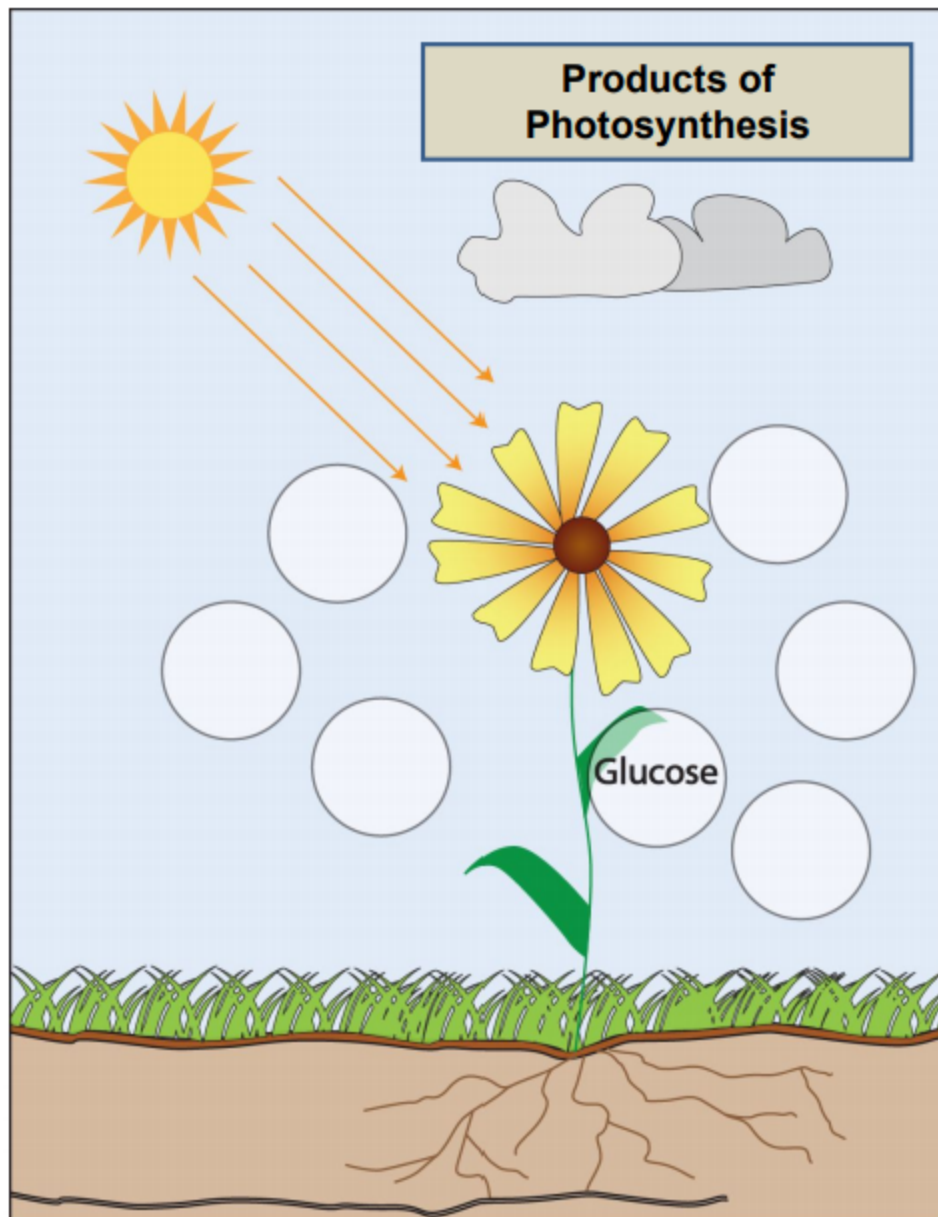
= Carbon



= Oxygen



= Hydrogen



1. How many H,C and O atoms in total appear as any part of the products?

H= C= O=

2. Were any H, C or O atoms gained or lost as a result of photosynthesis?

3. Are all of the atoms used to create the glucose?

4. Why does it make sense to call oxygen a by-product of photosynthesis?

