

**PHOTOSYNTHESIS -The Process on Which All Life Depends**

Photosynthesis is the most important of all biological processes: without it, life on Earth is not possible. Photosynthetic organisms are the only source of new food (organic molecules) and new  $O_2$  in an ecosystem. For these reasons it is fair to say that all living things on Earth depend on this process. Without photosynthesis, Earth's supplies of  $O_2$  and food would quickly be depleted, and all heterotrophs would die.

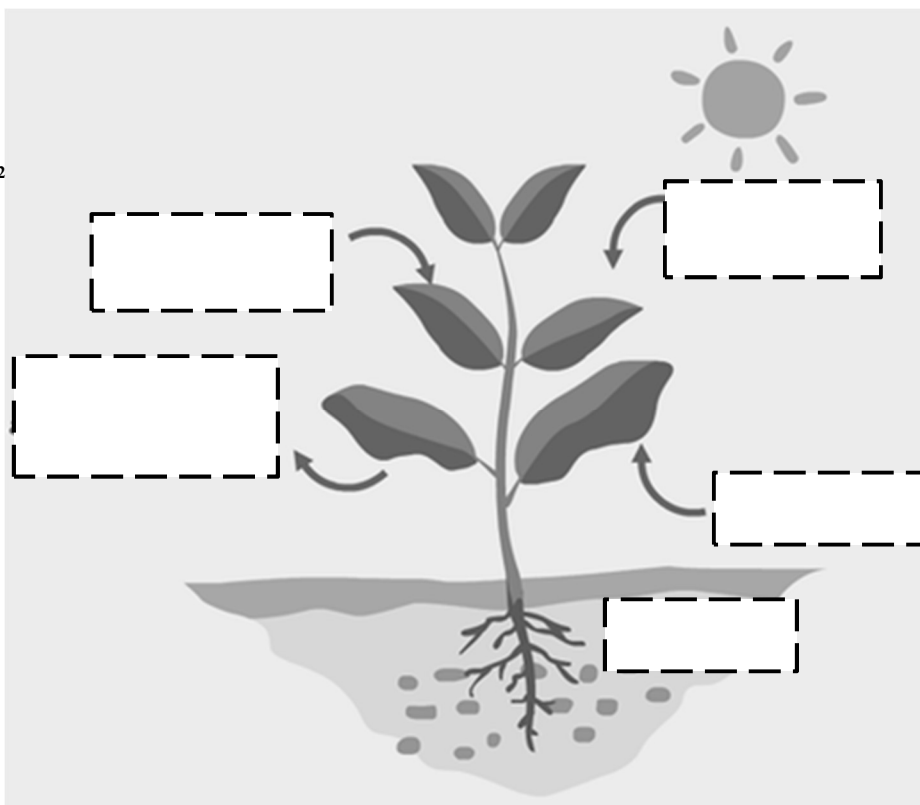
In photosynthesis, autotrophs rearrange molecules of carbon dioxide ( $CO_2$ ) and water ( $H_2O$ ) to form high-energy carbohydrate molecules (such as glucose -  $C_6H_{12}O_6$ ) and oxygen ( $O_2$ ). Carbon dioxide enters plants through openings in the underside of leaves called stomata. Water enters primarily through the roots and reaches the leaves by way of a system of tubes that run through the stem and branches of the plant.

The reactions of photosynthesis require energy, specifically energy from sunlight. Photosynthetic organisms can directly utilize the sun's energy because they contain a special green pigment called chlorophyll. Chlorophyll is a protein with the unique ability to capture the energy in sunlight and use it to power the reactions that build carbohydrates from  $CO_2$ . In this way the reactions of photosynthesis store energy from the sun in the carbohydrate molecules produced. In plants and algae chlorophyll is contained in complex organelles called chloroplasts. In photosynthetic bacteria, chlorophyll molecules are not bound in organelles, but are free in the cytoplasm.

Because plants produce their own carbohydrates (food!) they do not need to eat. However, when a plant needs ATP, it still must break down its carbohydrates in the process of cellular respiration, just as all other organisms do. Carbohydrates produced by the plant beyond what it needs for energy are used to build new tissue –in other words, to grow. In this way the energy stored in the products of photosynthesis is made available to other organisms that eat the tissue of the plant.

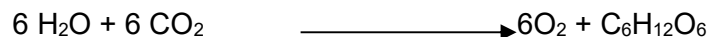
**WRITE LABELS in the correct places on the diagram:**

Water -  $H_2O$   
Oxygen -  $O_2$   
Light energy  
Glucose -  $C_6H_{12}O_6$   
Carbon dioxide -  $CO_2$



Name: \_\_\_\_\_ Period: \_\_\_\_\_ Date: \_\_\_\_\_

Overall reaction (summarizing all the reactions) of photosynthesis:



1. Study the model of energy change in chemical reactions. Based what you learned from the reading on the previous page, decide which of the two diagrams best represents the overall reaction of photosynthesis.

In the space below **draw an energy diagram for photosynthesis**. Include formulas of the actual reactants and products. Indicate the type of energy involved.

2. Explain why you chose this diagram.

3. What is chlorophyll? What is its role in photosynthesis?

4. Where does the energy go that a plant absorbs from sunlight?

5. Explain why all life on Earth depends on photosynthesis.

