

# Key

## Photosynthesis: Making Energy

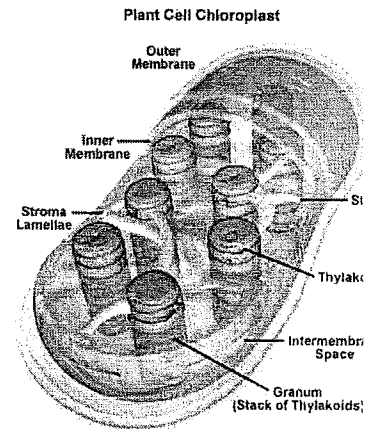
Objective: N/A

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### Chloroplasts

Photosynthesis is a process in which sunlight energy is used to make glucose. The site of photosynthesis is in the chloroplast - an organelle found in the leaves of green plants. The main functions of chloroplasts are to produce food (glucose) during photosynthesis, and to store food energy. Chloroplasts contain the pigment, *chlorophyll*. Chlorophyll absorbs most of the colors in the color spectrum, and reflects only green and yellow wavelengths of light. This is why we see leaves as green or yellow - because these colors are reflected into our eyes.



1. What is photosynthesis?

Photosynthesis is the process in which sunlight energy is used to make glucose - food for the plant.

2. Where does photosynthesis occur?

Photosynthesis occurs in the chloroplast / green plants

3. What are chloroplasts and where are they found?

They are found in plant cells.

4. What are the two main functions of chloroplasts?

Convert light to chemical energy  
absorb most colors of light - except green + yellow

5. Why do most leaves appear green?

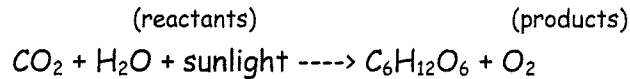
Because they reflect green

6. What is the primary pigment found in the chloroplast?

Chlorophyll

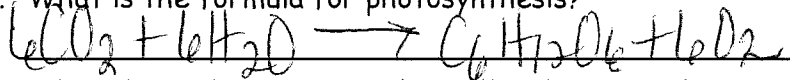
### Photosynthesis

Glucose is another name for sugar. The molecular formula for glucose is  $C_6H_{12}O_6$ . Plants make sugar by using the energy from sunlight to transform  $CO_2$  from the air with water from the ground into glucose. This process, called photosynthesis occurs in the chloroplast of the plant cell. During this process, oxygen ( $O_2$ ) is created as a waste product and is released into the air for us to breath. The formula for photosynthesis is:



This formula says that carbon dioxide + water molecules are combined with the energy from sunlight to produce sugar and oxygen. The reactants in photosynthesis (what is used) are  $\text{CO}_2$ , water and sun. The plant gets water from the ground through its roots. The plant collects carbon dioxide from the air. Much of the carbon dioxide comes from living organisms that exhale (breathe it out) it, but some also comes from factory smokestacks and car fumes.

7. What is the formula for photosynthesis?



8. What three things are used to make glucose in photosynthesis?

Carbon dioxide    Water    sunlight

9. Where does the water come from?

The roots → from the ground

10. Where does the water enter the plant?

The root hairs

11. What type of energy does the plant use to convert  $\text{CO}_2$  and  $\text{H}_2\text{O}$  into sugar?

Light energy

The products are **glucose** and **oxygen**. The glucose produced is used by the plant for energy and growth. We also use this glucose by eating plants. The oxygen produced is released into the air for us to breathe. Photosynthesis is essential for all life on earth, because it provides food and oxygen. Plants are considered autotrophs because unlike us humans, they can make their own food using this process.

12. What is produced in photosynthesis?

Glucose + Oxygen

13. What is the glucose used for?

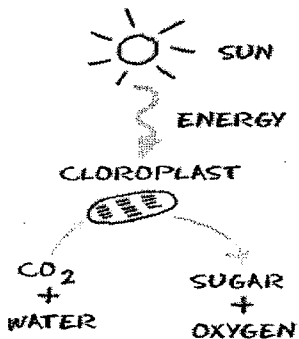
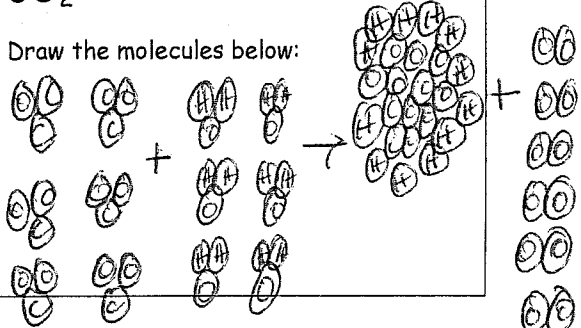
Glucose is used for food for the plant (energy + growth)

14. What is the oxygen used for?

Oxygen release for us to breathe

15. Here are three different ways to visualize the photosynthesis reaction: Is it easier for you to understand the reaction by using pictures, words, or symbols (see above)? Why?

Answers will vary

Photosynthesis in pictures	Photosynthesis in words	Photosynthesis in symbols
 <p>A diagram showing a sun with rays labeled 'SUN' and 'ENERGY' pointing to a 'CLOROPLAST'. Below the chloroplast, 'CO<sub>2</sub> + WATER' enters from the left and 'SUGAR + OXYGEN' exits to the right.</p>	<p>Carbon dioxide and water combine with sunlight to create oxygen and glucose.</p>	<p style="text-align: center;">light</p> $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$ <p>Draw the molecules below:</p>  <p>Hand-drawn ball-and-stick models representing the chemical equation. On the left, there are six CO<sub>2</sub> molecules (one large circle with two smaller circles) and six H<sub>2</sub>O molecules (one large circle with two smaller circles). An arrow points to the right, where there is one large C<sub>6</sub>H<sub>12</sub>O<sub>6</sub> molecule (a complex cluster of circles) and six O<sub>2</sub> molecules (two small circles).</p>

**Essential Question:** Describe, using scientific terms, how plants turn sunlight into energy? Make sure to refer to the chemical equation to photosynthesis and discuss the reactants and products.

The sun is the energy piece that breaks the molecular bonds and rearranges them to make the products — glucose + oxygen. No matter is lost — it's just rearranged.