

Learn the photosynthesis formula

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Word Count **726**

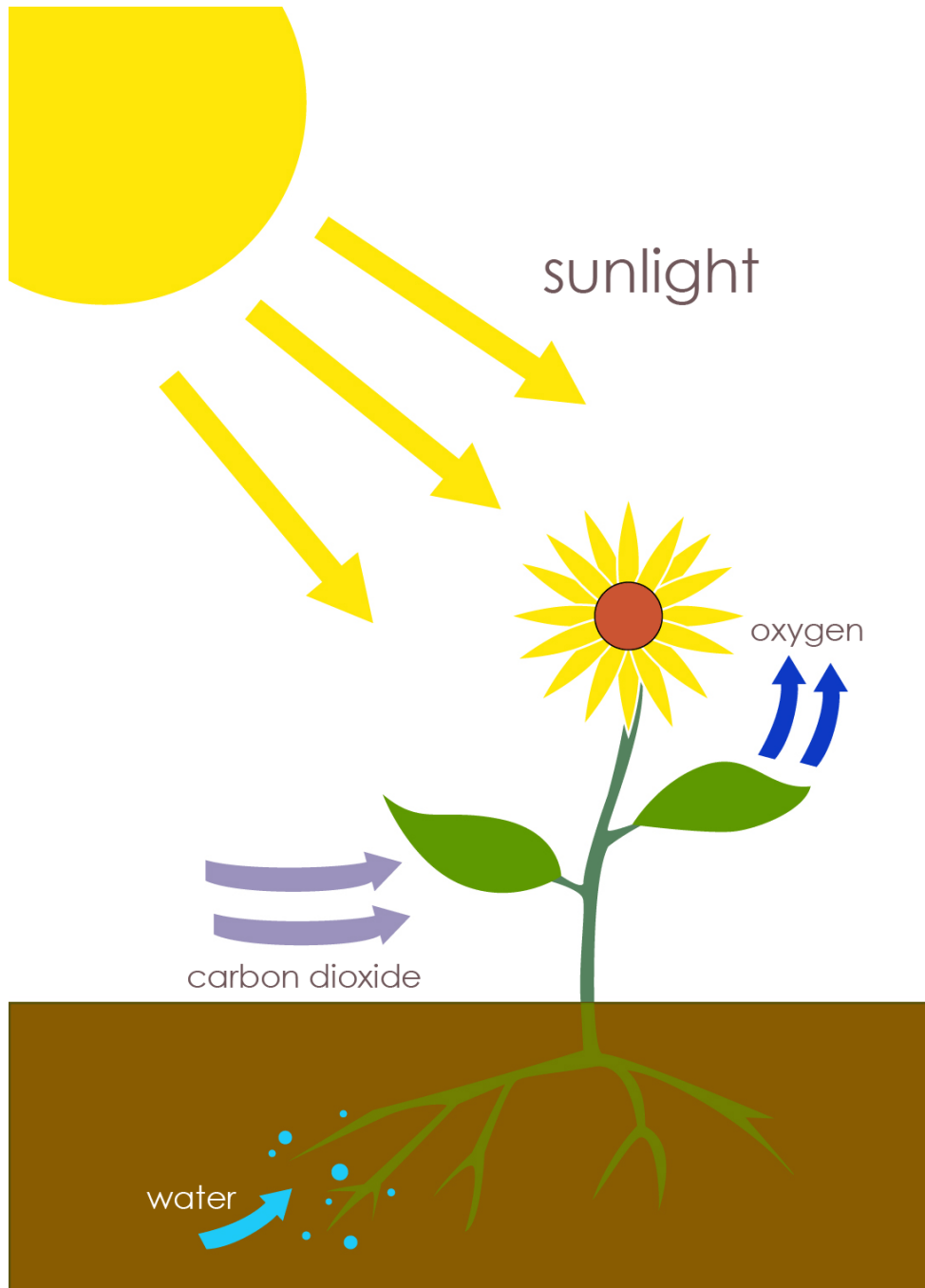
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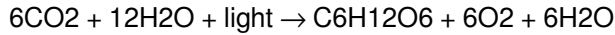
In plants, photosynthesis occurs mainly within the leaves. Photo from the public domain Photo from the public domain

Organisms need energy to survive. Some organisms are capable of absorbing energy from sunlight and using it to produce sugar and other organic compounds such as lipids and proteins. The sugars are then used to provide energy for the organism. This process, called photosynthesis, is used by photosynthetic organisms including plants, algae and cyanobacteria.

Photosynthesis Equation



In photosynthesis, solar energy is converted to chemical energy, which is stored in the form of glucose, a sugar. Carbon dioxide, water and sunlight are used to produce glucose, oxygen and water. The chemical equation for this process is:

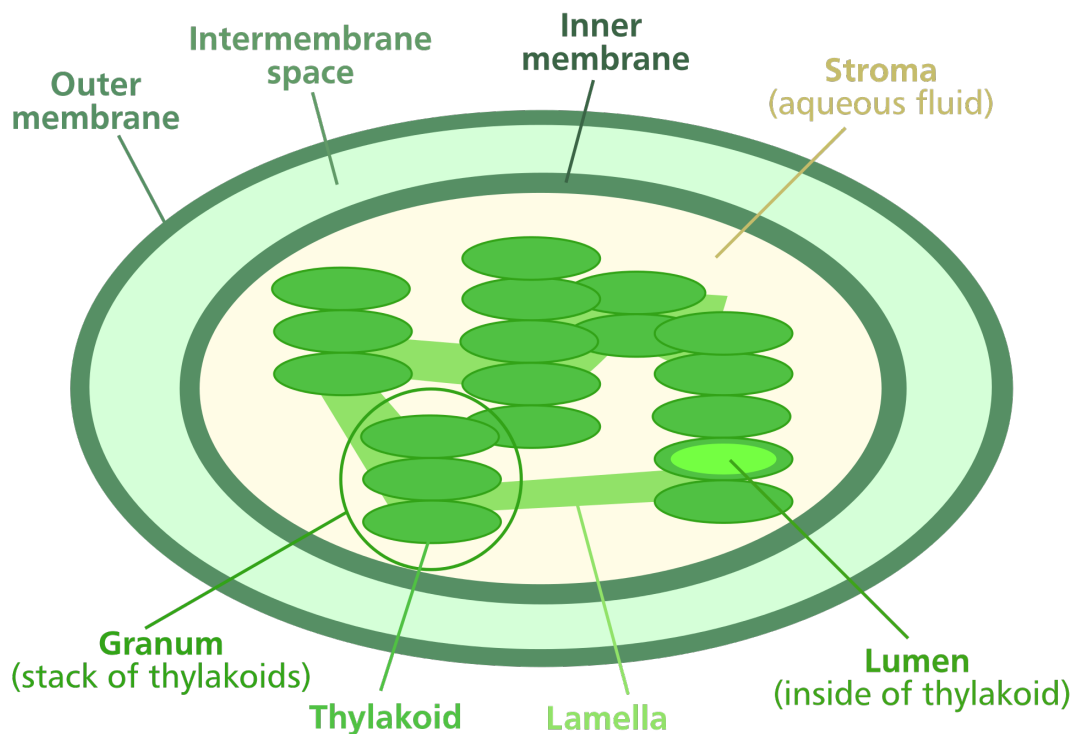


Six molecules of carbon dioxide (6CO_2) and 12 molecules of water ($12\text{H}_2\text{O}$) are consumed in the process, while glucose ($\text{C}_6\text{H}_{12}\text{O}_6$), six molecules of oxygen (6O_2), and six molecules of water ($6\text{H}_2\text{O}$) are produced.

This equation may be simplified as: $6\text{CO}_2 + 6\text{H}_2\text{O} + \text{light} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$

Photosynthesis In Plants

In plants, photosynthesis occurs mainly within the leaves. Since photosynthesis requires carbon dioxide, water and sunlight, all of these substances must be obtained by or transported to the leaves. Carbon dioxide is obtained through tiny pores in plant leaves called stomata. Oxygen is also released through the stomata. Water is obtained by the plant through the roots and delivered to the leaves through vascular plant tissue systems.



Sunlight is absorbed by chlorophyll, a green pigment located in plant cell structures called chloroplasts. Chloroplasts are the sites of photosynthesis containing several structures, each having specific functions.

The outer and inner membranes are protective coverings that keep chloroplast structures enclosed. The stroma is a dense fluid within the chloroplast and the site of conversion of carbon dioxide to sugar. The thylakoid is a flattened sac-like membrane structure and the site of conversion of light energy to chemical energy.

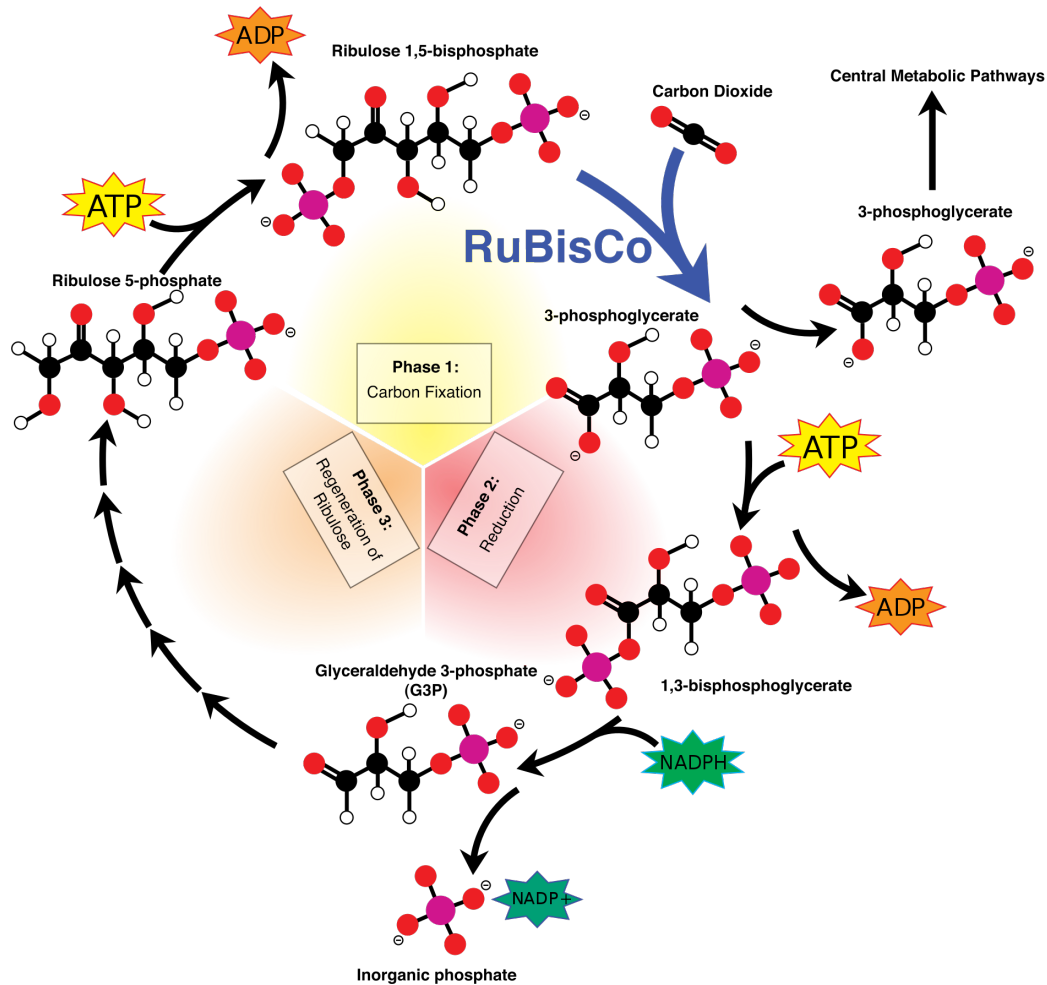
Grana are dense layered stacks of thylakoid sacs and the sites of conversion of light energy to chemical energy. Lastly, chlorophyll is a green pigment within the chloroplast that absorbs light energy.

Stages Of Photosynthesis

Photosynthesis occurs in two stages, called the light reactions and the dark reactions. The light reactions take place in the presence of light. The dark reactions do not require direct light, however dark reactions in most plants occur during the day.

Light reactions occur mostly in the thylakoid stacks of the grana. Here, sunlight is converted to chemical energy in the form of ATP (free energy containing molecule) and NADPH (high energy electron carrying molecule). Chlorophyll absorbs light energy and starts a chain of steps that result in the production of ATP, NADPH, and oxygen (through the splitting of water). Oxygen is released through the stomata. Both ATP and NADPH are used in the dark reactions to produce sugar.

Dark reactions occur in the stroma. Carbon dioxide is converted to sugar using ATP and NADPH.



This process is known as carbon fixation or the Calvin cycle. The Calvin cycle has three main stages, which are carbon fixation, reduction and regeneration. In carbon fixation, carbon dioxide is combined with a 5-carbon sugar [ribulose1,5-biphosphate (RuBP)] creating a 6-carbon sugar. In the reduction stage, ATP and NADPH produced in the light reaction stage are used to convert the 6-carbon sugar into two molecules of a 3-carbon carbohydrate, glyceraldehyde 3-phosphate. Glyceraldehyde 3-phosphate is used to make glucose and fructose. These two molecules (glucose and fructose) combine to make sucrose or sugar. In

the regeneration stage, some molecules of glyceraldehyde 3-phosphate are combined with ATP and are converted back into the 5-carbon sugar RuBP. With the cycle complete, RuBP is available to be combined with carbon dioxide to begin the cycle over again.

Photosynthesis Summary



In summary, photosynthesis is a process in which light energy is converted to chemical energy and used to produce organic compounds. In plants, photosynthesis typically occurs within the chloroplasts located in plant leaves. Photosynthesis consists of two stages, the light reactions, and the dark reactions. The light reactions convert light into energy (ATP and NADHP) and the dark reactions use the energy and carbon dioxide to produce sugar.

Quiz

- 1 Read the sentence from the section "Photosynthesis Equation."

In photosynthesis, solar energy is converted to chemical energy, which is stored in the form of glucose, a sugar.

What does the word "converted" convey in the sentence?

- (A) It conveys that this process changes the reactants into entirely new substances.
 - (B) It conveys how sunlight is used to provide energy and power for the cell.
 - (C) It conveys that not all of the compounds necessary for photosynthesis are changed in the process.
 - (D) It conveys that the substances plants take in for photosynthesis are returned to the environment after they are used.
- 2 "Photosynthesis" is a key term in the article.
- How does the author refine the meaning of this term over the course of the article?
- (A) The author refines the meaning by detailing how reactants pass through the chemical processes that give energy for plants and oxygen.
 - (B) The author refines the meaning by comparing how plant and animal cells generate energy.
 - (C) The author refines the meaning by connecting photosynthesis to the process by which blood is transported within the human body.
 - (D) The author refines the meaning through the use of diagrams detailing the absorption of carbon dioxide through plant leaves.
- 3 Which image included with the article BEST depicts the idea that photosynthesis operates as a cycle that can start over after it has completed?
- (A) top image
 - (B) image in "Photosynthesis Equation"
 - (C) image in "Photosynthesis In Plants"
 - (D) image in "Stages Of Photosynthesis"

- 4 What limitations does the text in the section "Photosynthesis In Plants" have that the image in that section does NOT have?
- (A) The text cannot show how the components are organized inside of the chloroplast while the image can.
 - (B) The text cannot list each of the organelles inside of the chloroplasts while the image can.
 - (C) The text cannot demonstrate how sunlight enters a plant cell while the image can.
 - (D) The text cannot explain the role of each organelle in the cell while the image can.