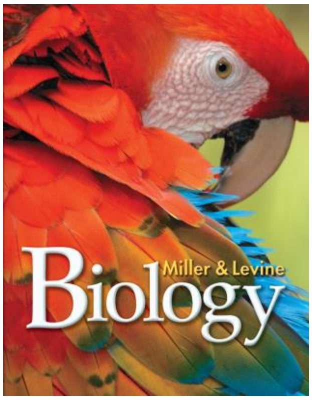


Lesson Overview

8.2 Photosynthesis:
An Overview

Lesson Overview Photosynthesis: An Overview

Chlorophyll and Chloroplasts

- What role do pigments play in the process of photosynthesis?

Lesson Overview Photosynthesis: An Overview

Chlorophyll and Chloroplasts

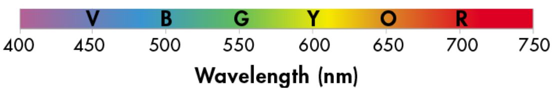
- What role do pigments play in the process of photosynthesis?
- Photosynthetic organisms capture energy from sunlight with pigments.

Lesson Overview Photosynthesis: An Overview

Light

Energy from the sun travels to Earth in the form of light.

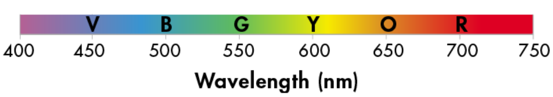
Sunlight is a mixture of different wavelengths, many of which are visible to our eyes and make up the visible spectrum.



Lesson Overview Photosynthesis: An Overview

Light

Our eyes see the different wavelengths of the visible spectrum as different colors: red, orange, yellow, green, blue, indigo, and violet.



Lesson Overview Photosynthesis: An Overview

Pigments

Plants gather the sun's energy with light-absorbing molecules called **pigments.**

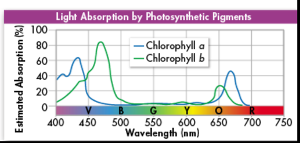
The plants' principal pigment is **chlorophyll.**

Lesson Overview Photosynthesis: An Overview

Pigments

The two types of chlorophyll found in plants, **chlorophyll *a*** and **chlorophyll *b***, absorb light very well in the blue-violet and red regions of the visible spectrum, but not in the green region, as shown in the graph.

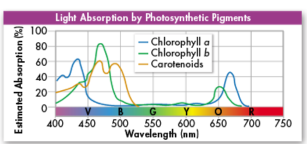
Leaves reflect green light, which is why plants look green.



Lesson Overview Photosynthesis: An Overview

Pigments

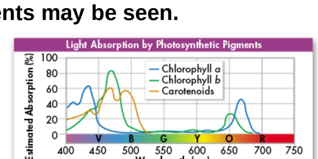
Plants also contain red and orange pigments such as carotene that absorb light in other regions of the spectrum.



Lesson Overview Photosynthesis: An Overview

Pigments

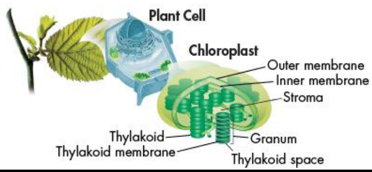
Most of the time, the green color of the chlorophyll overwhelms the other pigments, but as temperatures drop and chlorophyll molecules break down, the red and orange pigments may be seen.



Lesson Overview Photosynthesis: An Overview

Chloroplasts

- Photosynthesis takes place inside organelles called **chloroplasts**.
- Chloroplasts contain saclike photosynthetic membranes called **thylakoids**, which are interconnected and arranged in stacks known as grana.

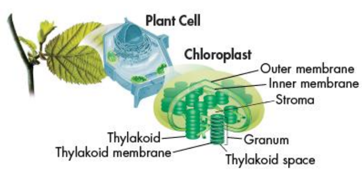


Lesson Overview Photosynthesis: An Overview

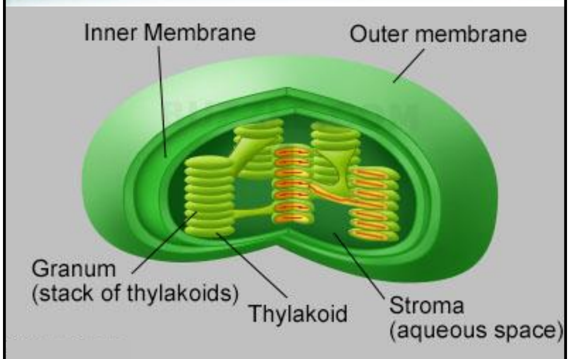
Chloroplasts

Pigments are located in the thylakoid membranes.

The fluid portion outside of the thylakoids is known as the **stroma.**



Lesson Overview Photosynthesis: An Overview



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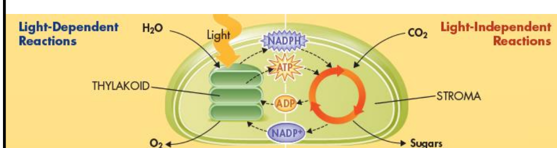
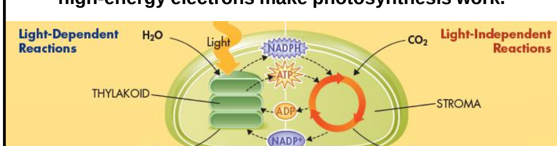


Lesson Overview Photosynthesis: An Overview

Energy Collection

Because light is a form of energy, any compound that absorbs light absorbs energy. Chlorophyll absorbs visible light especially well.

When chlorophyll absorbs light, a large fraction of the light energy is transferred to electrons. These high-energy electrons make photosynthesis work.



High-Energy Electrons

- What are electron carrier molecules?

High-Energy Electrons

- What are electron carrier molecules?
- **An electron carrier is a compound that can accept a pair of high-energy electrons and transfer them, along with most of their energy, to another molecule.**

High-Energy Electrons

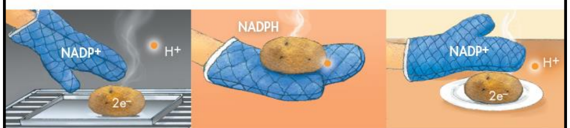
The high-energy electrons produced by chlorophyll are highly reactive and require a special "carrier."

Lesson Overview Photosynthesis: An Overview

High-Energy Electrons

Think of a high-energy electron as being similar to a hot potato. If you wanted to move the potato from one place to another, you would use an oven mitt—a carrier—to transport it.

Plants use electron carriers to transport high-energy electrons from chlorophyll to other molecules.



Lesson Overview Photosynthesis: An Overview

High-Energy Electrons

NADP$^+$ (nicotinamide adenine dinucleotide phosphate) is a carrier molecule.

NADP$^+$ accepts and holds two high-energy electrons, along with a hydrogen ion (H^+). In this way, it is converted into NADPH.

The NADPH can then carry the high-energy electrons to chemical reactions elsewhere in the cell.

Lesson Overview Photosynthesis: An Overview

An Overview of Photosynthesis

What are the reactants and products of photosynthesis?

Lesson Overview Photosynthesis: An Overview

An Overview of Photosynthesis

- What are the reactants and products of photosynthesis?
- **Photosynthesis uses the energy of sunlight to convert water and carbon dioxide (reactants) into high-energy sugars and oxygen (products).**

Lesson Overview Photosynthesis: An Overview

An Overview of Photosynthesis

Photosynthesis uses the energy of sunlight to convert water and carbon dioxide into high-energy sugars and oxygen.

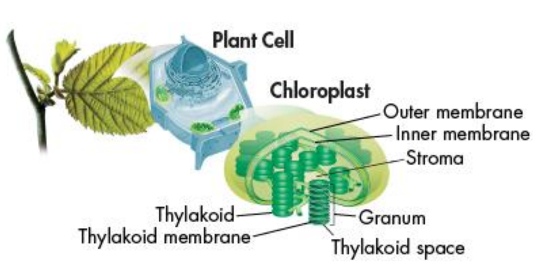
In symbols:

$$6\ CO_2 + 6\ H_2O \rightarrow C_6H_{12}O_6 + 6\ O_2$$

In words:

Carbon dioxide + Water $\xrightarrow{\text{Light}}$ Sugars + Oxygen

Lesson Overview Photosynthesis: An Overview



Lesson Overview Photosynthesis: An Overview

An Overview of Photosynthesis

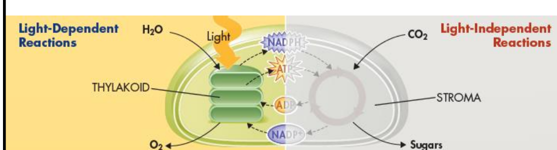
Plants use the sugars generated by photosynthesis to produce complex carbohydrates such as starches, and to provide energy for the synthesis of other compounds, including proteins and lipids.

Lesson Overview Photosynthesis: An Overview

Light-Dependent Reactions

Photosynthesis involves two sets of reactions.

The first set of reactions is known as the light-dependent reactions because they require the direct involvement of light and light-absorbing pigments.

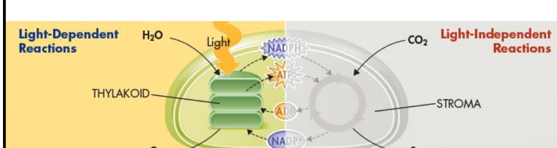


Lesson Overview Photosynthesis: An Overview

Light-Dependent Reactions

The light-dependent reactions use energy from sunlight to produce ATP and NADPH.

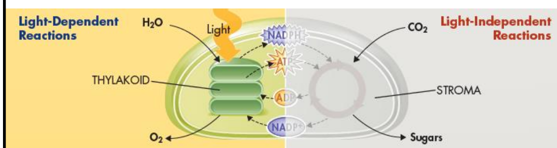
These reactions take place within the thylakoid membranes of the chloroplast.



Lesson Overview Photosynthesis: An Overview

Light-Dependent Reactions

Water is required as a source of electrons and hydrogen ions. Oxygen is released as a byproduct.

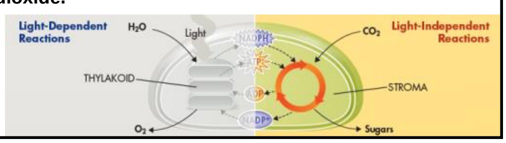


Lesson Overview Photosynthesis: An Overview

Light-Independent Reactions

Plants absorb carbon dioxide from the atmosphere and complete the process of photosynthesis by producing sugars and other carbohydrates.

During light-independent reactions, ATP and NADPH molecules produced in the light-dependent reactions are used to produce high-energy sugars from carbon dioxide.



Lesson Overview Photosynthesis: An Overview

Light-Independent Reactions

No light is required to power the light-independent reactions.

The light-independent reactions take place outside the thylakoids, in the stroma.