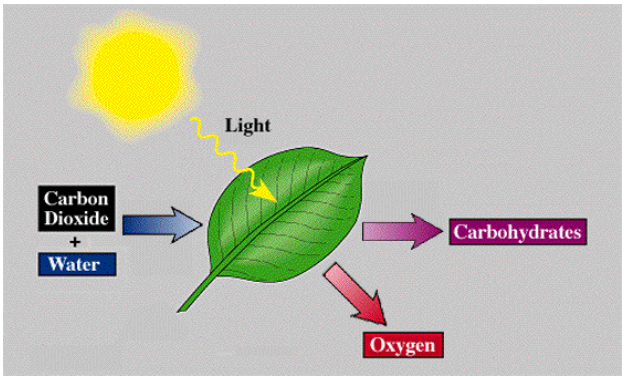
Name: _____ Date: _____

Photosynthesis

The study of energy capture and use begins with _____.

- Photosynthesis is the process in which plants use the energy of _____ to convert _____ and carbon dioxide into _____ and high-energy carbohydrates (sugars and starches).



What is the overall equation for photosynthesis?

The equation for photosynthesis is:

carbon dioxide + water $\xrightarrow{\text{light}}$ sugar + oxygen

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

Where do plants get each material needed for photosynthesis?

- Carbon dioxide – from the air that mammals _____ out (through *stomata*—tiny _____ on the leaf)
- Water – from the ground through its _____ system (*xylem*)
- Sunlight – from the _____
- Chlorophyll – made in _____

Where do the products of photosynthesis go?

- Oxygen – leaves the plant cells (through *stomata*) and goes into the _____; some oxygen also remains _____ plant cells.
- Glucose – remains inside the _____; used to make more complex carbohydrates, such as _____.

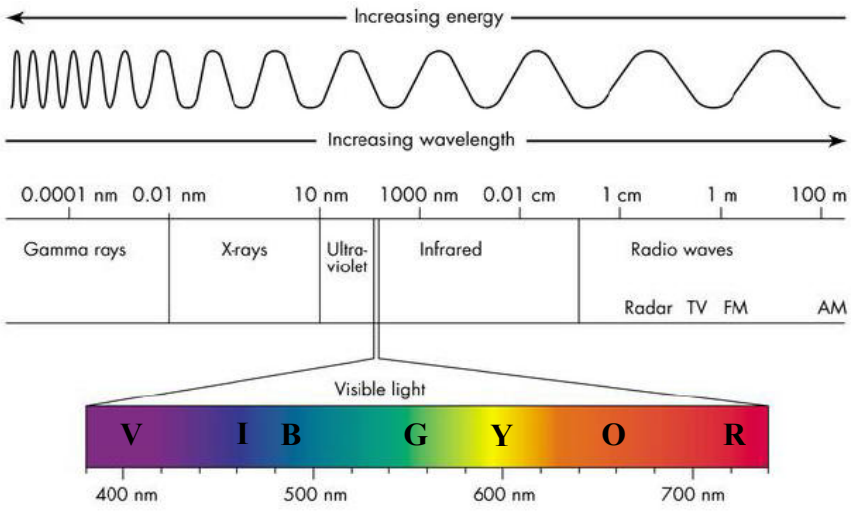
What is the role of light and chlorophyll in photosynthesis?

Light and Pigments

How do plants capture the energy of sunlight?

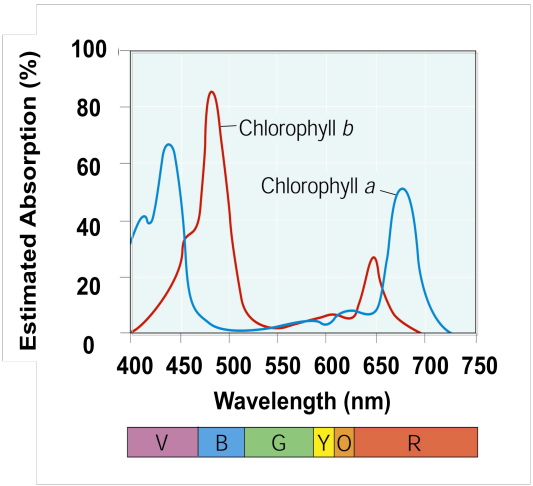
In addition to water and carbon dioxide, photosynthesis requires _____ and _____.

Energy from the sun travels to Earth in the form of _____. Sunlight, which your eyes perceive as _____ light, is actually a mixture of different _____ of light. Many of these wavelengths, which are visible to your eyes as different _____, make up the visible _____.



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

- The main pigment in plants is _____.
    - There are two types of chlorophyll:
        - chlorophyll _____
        - chlorophyll _____
- Chlorophyll absorbs light well in the _____ and _____ regions of the visible spectrum.



- Chlorophyll does not absorb light well in the _____ region of the spectrum. Green light is _____ by leaves, which is why plants look green.
    - Plants also contain red, orange, and yellow pigments, called _____, that absorb light in other regions of the spectrum.

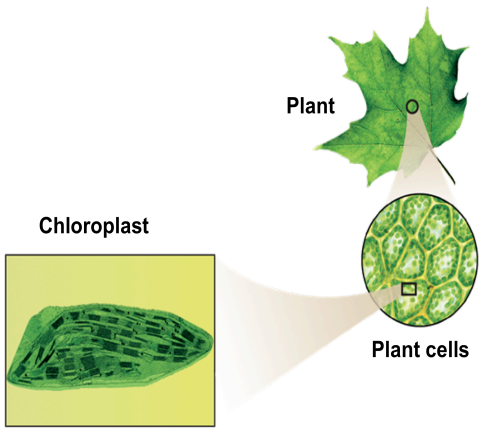
In the fall, these other pigments become visible since chlorophyll, the primary plant pigment, is not being made, and thus is not there to mask them.

Light is a form of _____, so any compound that absorbs _____ also absorbs energy from light.

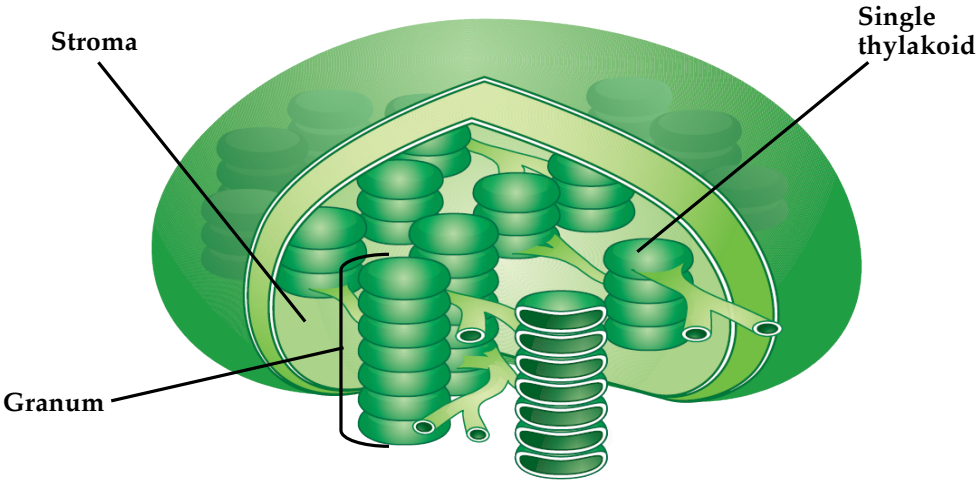
- When chlorophyll absorbs light, much of the energy is transferred directly to _____ in the chlorophyll molecule, raising the energy levels of these electrons.
    - These high-energy electrons are what make photosynthesis work.

Inside a Chloroplast

In plants, photosynthesis takes place inside _____.



- Chloroplasts contain _____ —saclike photosynthetic membranes.
- Thylakoids are arranged in stacks known as _____. A singular stack is called a _____.
- The region outside the thylakoid membranes is called the _____.



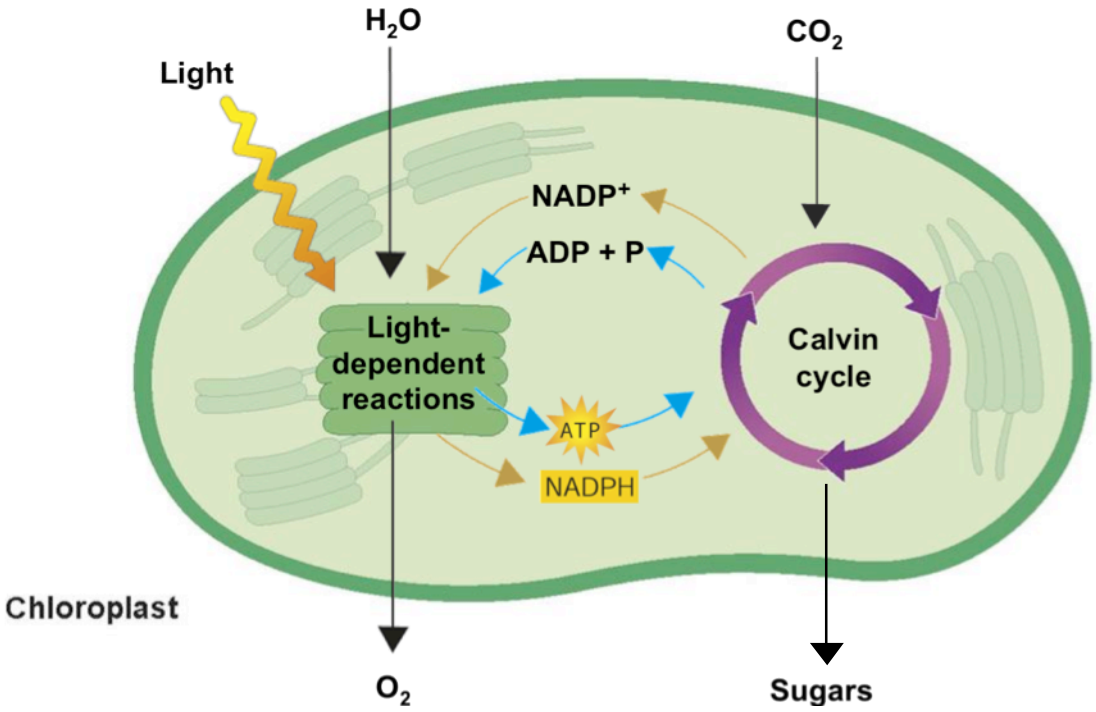
Overview of Photosynthesis

The process of photosynthesis occurs in two stages:

1. The _____ reactions – takes place within the _____ membranes.
2. The _____ _____ - takes place in the _____.

The two sets of photosynthetic reactions work together:

- The light-dependent reactions trap _____ energy in _____ form.
- The Calvin cycle uses that chemical energy to produce high-energy _____ from carbon dioxide and water.



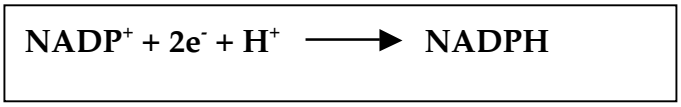
<u>Electron Carriers</u>

Remember how we said that when light strikes a chlorophyll molecule, it excites _____?

- Cells need a way to transport these high-energy electrons from _____ to other molecules.
- Cells use electron _____ to transport these electrons.

An electron carrier involved in photosynthesis is called _____.

- NADP+ transports electrons to different parts of the _____.
    - $NADP^+$ accepts and holds _____ high-energy electrons (e^-) along with a _____ ion (H^+). This converts the $NADP^+$ into NADPH.



Light-Dependent Reactions

What happens in the light-dependent reactions?

In the presence of _____, the light-dependent reactions produce _____ gas and convert ADP and $NADP^+$ into the energy carriers _____ and _____.

Summary of the light-dependent reactions:

Uses	Produces
ADP	ATP
$NADP^+$	NADPH
H_2O	O_2
Sunlight	

The Calvin Cycle

What is the Calvin cycle?

The Calvin cycle uses _____ and _____ from the light-dependent reactions to produce high-energy _____.

- Because the Calvin cycle does not require light, these reactions are also called the light _____ reactions.

Summary of the Calvin cycle:

Uses	Produces
ATP	ADP
NADPH	$NADP^+$
CO_2	$C_6H_{12}O_6$

Factors Affecting Photosynthesis

Many factors affect the rate of photosynthesis, including: _____, _____, and intensity of _____.