Chapter 8 Notes – Photosynthesis

Section 8-2 & 8-3 Photosynthesis: An Overview (p. 204-214)
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).

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

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.

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.

**Electron Carriers**

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.

\[ \text{NADP}^+ + 2e^- + H^+ \rightarrow \text{NADPH} \]
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:

<table>
<thead>
<tr>
<th>Uses</th>
<th>Produces</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADP</td>
<td>ATP</td>
</tr>
<tr>
<td>NADP(^+)</td>
<td>NADPH</td>
</tr>
<tr>
<td>H(_2)O</td>
<td>O(_2)</td>
</tr>
<tr>
<td>Sunlight</td>
<td></td>
</tr>
</tbody>
</table>

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:

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</tr>
<tr>
<td>NADPH</td>
<td>NADP(^+)</td>
</tr>
<tr>
<td>CO(_2)</td>
<td>C(<em>6)H(</em>{12})O(_6)</td>
</tr>
</tbody>
</table>

Factors Affecting Photosynthesis

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