

Chapter 8 Reading Guide – ANSWER KEY

- As a review, define the terms **autotroph** and **heterotroph**. Keep in mind that plants have mitochondria and chloroplasts and do both cellular respiration and photosynthesis! **Autotrophs are able to sustain themselves without eating other living organisms or material derived from living organisms. Autotrophs make their own "food" through either photosynthesis (solar energy → glucose) or chemosynthesis (inorganic materials such as methane and hydrogen sulfide → organic molecules). Autotrophs are also known as producers. Heterotrophs must consume other organisms for energy. Decomposers (some bacteria and fungi) are considered heterotrophs.**
- Draw a picture of a chloroplast and label the **stroma**, **thylakoid**, **thylakoid space**, **inner membrane**, and **outer membrane**.



- Use both chemical symbols and words to write out the formula for photosynthesis. $6\text{CO}_2 + 6\text{H}_2\text{O} + \text{Light Energy} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$. Carbon dioxide reacts with water and energy from the sun to produce glucose and oxygen. Photosynthesis is another example of a redox reaction where carbon dioxide is reduced to glucose and water is oxidized to oxygen. The electrons increase in potential energy as they move from water to sugar (endergonic). The energy is provided by the sun.
- Photosynthesis is not a single process, but two processes, each with multiple steps.
 - Explain what occurs in the **light reactions** stage of photosynthesis. Be sure to use **NADP+** and **photophosphorylation** in your discussion. **The light reactions occur in the thylakoid membranes of the chloroplasts. During the light reactions, water is split which provides a source of electrons and H⁺ ions (protons). When water is split, oxygen gas is released as a byproduct. Light absorption by chlorophyll transfer electrons and H⁺ to an electron carrier called NADP+. The light reactions also generate ATP, using chemiosmosis to power the addition of a phosphate to ADP. This is called photophosphorylation. At the end of the light reactions, light energy is converted into chemical energy store in ATP and NADPH. (No sugar yet!)**
 - Explain the **Calvin cycle**, utilizing the term **carbon fixation** in your discussion. **The Calvin cycle occurs in the stroma of the chloroplasts. The Calvin cycle begins with the incorporation of carbon dioxide from the air into organic molecules already present in the chloroplast. This is known as carbon fixation. The Calvin cycle then reduces the fixed carbon into carbohydrates by adding electrons provided NADPH. Chemical energy is supplied by ATP. The end result of the Calvin cycle is carbohydrate molecules called G3P which consist of 3 carbons each. G3P molecules are used to produce glucose.**

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Michael Brown



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