

8.2 Photosynthesis: An Overview

Lesson Objectives

- 🔑 Explain the role of light and pigments in photosynthesis.
- 🔑 Explain the role of electron carrier molecules in photosynthesis.
- 🔑 State the overall equation for photosynthesis.

Lesson Summary

Chlorophyll and Chloroplasts In eukaryotes, photosynthesis occurs in organelles called chloroplasts. Chloroplasts house light-absorbing chemicals.

- ▶ Light is a form of energy. Sunlight is a mixture of all the different colors of visible light.
- ▶ Light-absorbing molecules called **pigments** capture the sun's energy.
- ▶ **Chlorophyll** is the principal pigment in photosynthetic organisms. Chlorophyll absorbs blue-violet and red light but reflects green light.
- ▶ Chloroplasts have a complex internal structure that includes:
 - **thylakoids**: saclike photosynthetic membranes that contain chlorophyll and other pigments and are arranged in stacks called grana.
 - **stroma**: the fluid portion outside of the thylakoids.

High-Energy Electrons The energy in light raises some of the electrons in chlorophyll to higher energy levels. These high-energy electrons are used in photosynthesis.

- ▶ Electron carriers are used to transport the electrons from chlorophyll to other molecules during photosynthesis.
- ▶ **NADP⁺** is a compound that can accept and hold 2 high-energy electrons and 1 hydrogen ion. This process converts NADP⁺ into NADPH.

An Overview of Photosynthesis Usually summarized by a simple chemical reaction, photosynthesis is a complex process that involves two interdependent sets of reactions.

- ▶ The **light-dependent reactions** require light, light-absorbing pigments, and water to form NADPH, ATP, and oxygen.
- ▶ The **light-independent reactions** do not use light energy. They use carbon dioxide from the atmosphere, NADPH, and ATP to make energy-rich carbon compounds.

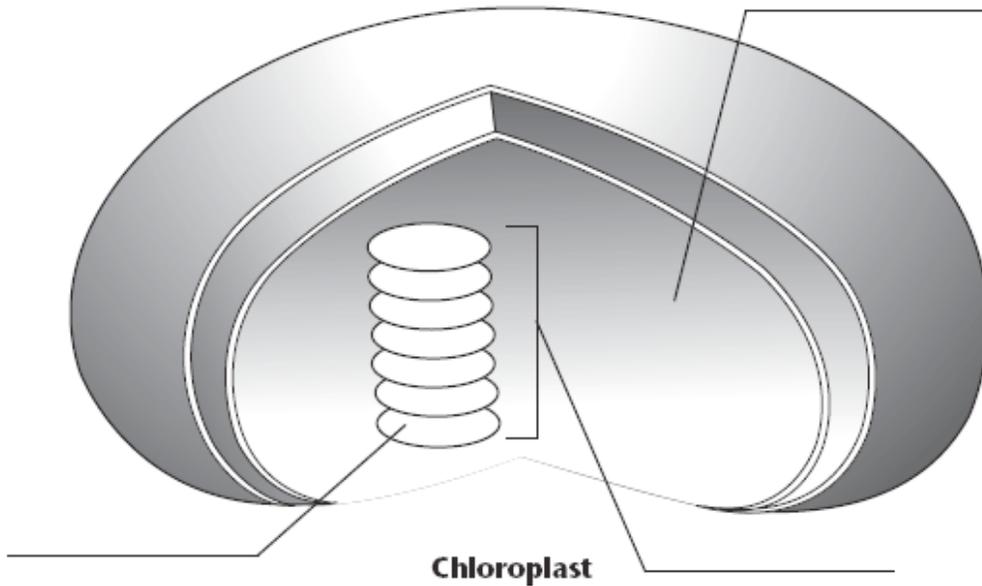
Chlorophyll and Chloroplasts

For Questions 1–6, complete each statement by writing the correct word or words.

1. The _____ of light determines its color.
2. Chemicals that absorb light are called _____.
3. Chlorophyll makes plants look green because it _____ green light.
4. Chloroplasts contain an abundance of saclike photosynthetic membranes called _____.
5. The _____ is the fluid portion of the chloroplast located outside the thylakoids.

6. The visible light absorbed by chlorophyll _____ the energy level of the chlorophyll's electrons.

7. **THINK VISUALLY** Label the internal parts of the chloroplast below.



An Overview of Photosynthesis

For Questions 11–13, write the letter of the correct answer on the line at the left.

- _____ 8. What are the reactants of the photosynthesis reaction?
- | | |
|-----------------------------|----------------------------------|
| A. chlorophyll and light | C. carbohydrates and oxygen |
| B. carbon dioxide and water | D. high-energy electrons and air |
- _____ 9. What are the products of the light-dependent reactions?
- | | |
|---------------------------|---------------------|
| A. chloroplasts and light | C. oxygen and ATP |
| B. proteins and lipids | D. water and sugars |
- _____ 10. Where do the light-independent reactions occur?
- | | |
|---------------|-----------------|
| A. stroma | C. chlorophyll |
| B. thylakoids | D. mitochondria |
11. Solar power uses cells or panels to absorb the sun's energy. That energy is then used to create electricity. How does this compare to the light dependent reactions of photosynthesis?

Answer the questions.

11. Where do the light-dependent reactions occur? Circle the correct answer.
thylakoids stroma
12. Where do the light-independent reactions occur? Circle the correct answer.
thylakoids stroma
13. Is the following statement true or false? In plants, photosynthesis takes place in the chloroplasts. _____
14. The function of chlorophyll is
- A. to protect a plant from losing water.
 - B. to help plants absorb oxygen.
 - C. to protect the plant cell.
 - D. to capture energy from the sun.

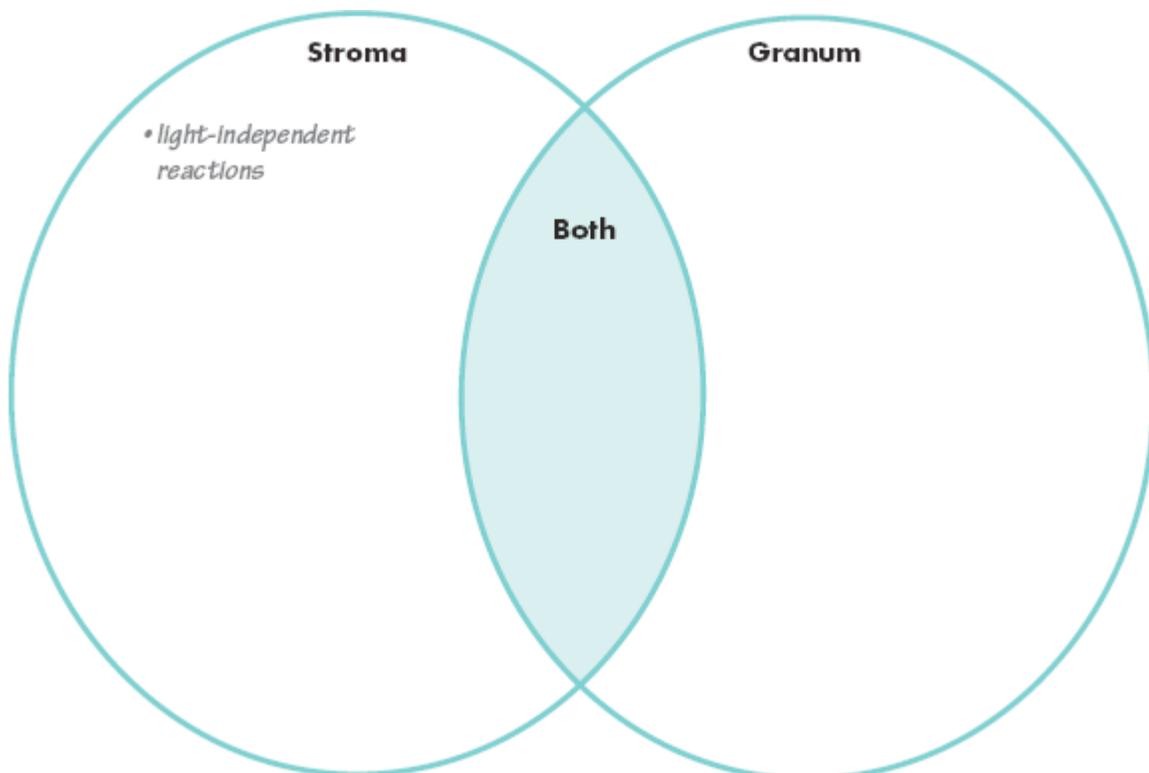
Chlorophyll and Chloroplasts

Photosynthesis in plants takes place in organelles called chloroplasts. Within each chloroplast is a fluid-filled area called the stroma. Also inside each chloroplast are many saclike membranes called thylakoids. Thylakoids are connected to each other in stacks. Each stack is a granum.

15. Complete the Venn diagram to compare the stroma and a granum in a chloroplast. Use the phrases below. One has been done for you.

- contains pigments
- fluid portion of chloroplast
- are a part of photosynthesis

- light-dependent reactions
- located within a chloroplast
- stacks of thylakoids



Answer the questions. Circle the correct answer(s).

16. Which reactions change the energy of sunlight to energy-rich carriers?

light-dependent reactions

light-independent reactions

17. Which two reactants are needed for light-dependent reactions?

carbon dioxide

light

oxygen

water

18. Which two reactants are needed for light-independent reactions?

carbon dioxide

energy-rich compounds

oxygen

stroma

19. List and define 10 new or unusual vocabulary words

1 _____

2 _____

3 _____

4 _____

5 _____

6 _____

7 _____

8 _____

9 _____

10 _____