Name _____ Class _____ Date _____

8.3 The Process of Photosynthesis

Lesson Objectives

- Describe what happens during the light-dependent reactions.
- Describe what happens during the light-independent reactions.
- Identify factors that affect the rate at which photosynthesis occurs.

Lesson Summary

The Light-Dependent Reactions: Generating ATP and NADPH Photosynthesis begins with these reactions, which occur in thylakoid membranes.

- **Photosystems** are clusters of proteins and chlorophyll in thylakoid membranes.
- High-energy electrons form when pigments in photosystem II absorb light. The electrons pass through **electron transport chains**, a series of electron carrier proteins.
  - The movement of electrons through an electron transport chain causes a thylakoid to fill up with hydrogen ions and generates ATP and NADPH.
  - **ATP synthase** is a membrane protein through which excess hydrogen ions escape a thylakoid in a process that makes ATP.

The Light-Independent Reactions: Producing Sugars They occur in the stroma of thylakoids and are commonly called the **Calvin cycle**.

- Six carbon dioxide molecules from the atmosphere enter the Calvin cycle and combine with 5-carbon compounds already present. They produce twelve 3-carbon molecules.
- Two 3-carbon molecules are removed from the cycle. They are used by the plant to build sugars, lipids, amino acids, and other compounds.
- The remaining ten 3-carbon molecules are converted back to 5-carbon molecules and begin a new cycle.

Factors Affecting Photosynthesis Many factors influence the rate of photosynthesis.

- Temperature, light intensity, and availability of water affect photosynthesis.
- C4 and CAM plants have a modified type of photosynthesis that enables the plants to conserve water in dry climates.

The Light-Dependent Reactions: Generating ATP and NADPH

For Questions 1–5, write True if the statement is true. If the statement is false, change the underlined word or words to make the statement true.

_____ 1. Photosystems are clusters of chlorophyll and <u>proteins</u>.

_____ 2. The light-dependent reactions begin when <u>photosystem I</u> absorbs light.

_____ 3. Electrons from <u>water</u> molecules replace the ones lost by photosystem II.

_____ 4. <u>ATP</u> is the product of photosystem I.

_____ 5. ATP and NADPH are two types of <u>protein</u> carriers.

Name _____ Class _____ Date _____

6. How does ATP synthase produce ATP? _____

7. When sunlight excites electrons in chlorophyll, how do the electrons change?

8. Where do the light-dependent reactions take place? _____

9. Complete the table by summarizing what happens in each phase of the light-dependent reactions of photosynthesis.

Light-Dependent Reactions	Summary
Photosystem II	
Electron Transport Chain	
Photosystem I	
Hydrogen Ion Movement and ATP Formation	

Name _____

The Light-Independent Reactions: Producing Sugars

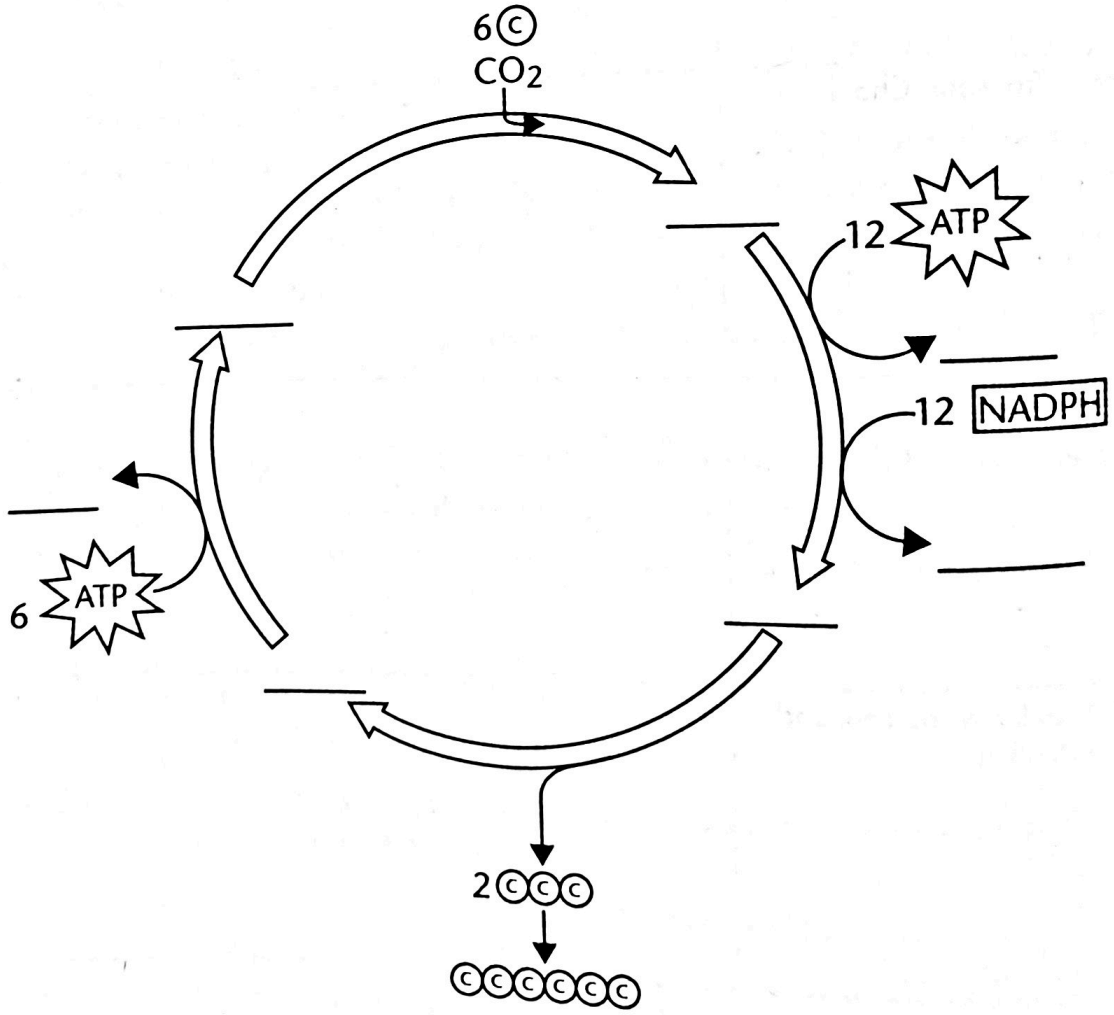
10. What does the Calvin cycle use to produce high-energy sugars?

11. Why are the reactions of the Calvin cycle called light-independent reactions?

12. What makes the Calvin cycle a cycle?

13. Complete the diagram of the Calvin cycle by filling in the missing labels.

Calvin Cycle



Name _____ Class _____ Date _____

Factors Affecting Photosynthesis

14. What are three factors that affect the rate at which photosynthesis occurs?

15. Would a plant placed in an atmosphere of pure oxygen be able to conduct photosynthesis? Explain your answer.

16. Complete the table about variations of photosynthesis.

Type	Description	Examples
	Occurs in plants that have a specialized chemical pathway that allows them to capture even very low levels of carbon dioxide and pass it to the Calvin cycle.	
		pineapple trees, many desert cacti, and "ice plants"

Apply the Big Idea

17. Photosynthesis plays an important role in supplying energy to living things. Considering what the products of photosynthesis are, what is another way in which photosynthesis is vital to life?

Name _____

Chapter Vocabulary Review

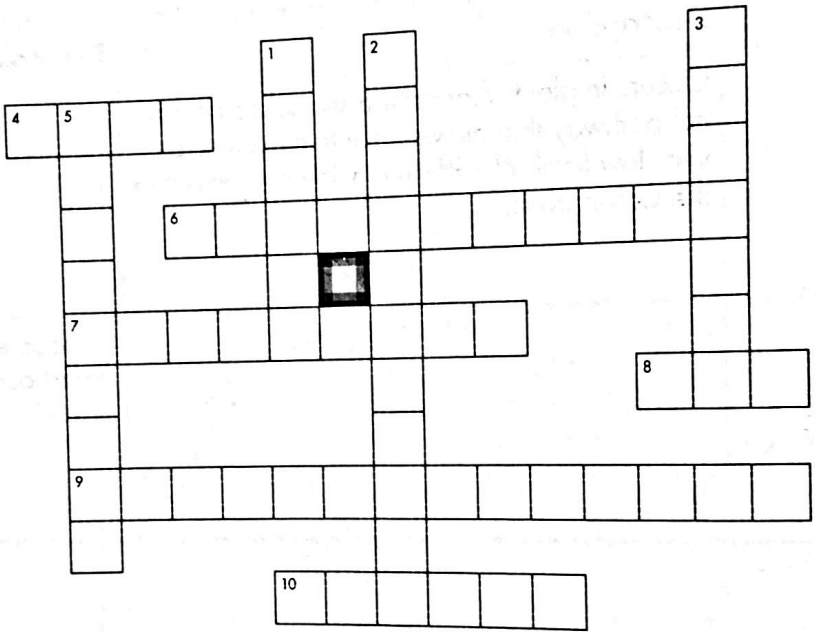
Crossword Puzzle *Complete the puzzle by entering the term that matches the description.*

Across

4. energy carrier cells use to transport high-energy electrons
6. cluster of pigments and proteins that absorbs light
7. a saclike photosynthetic membrane found in chloroplasts
8. energy carrier made as a result of photosystem II
9. process of using the sun's energy to make food
10. man who worked out the light-independent reactions

Down

1. liquid part of the inside of a chloroplast
2. chemical that absorbs light for photosynthesis
3. light-absorbing chemical
5. organism that makes its own food



For Questions 11–16, complete each statement by writing the correct word or words.

11. The light-_____ reactions occur in thylakoid membranes.
12. Carbon dioxide is used to make sugars in the light-_____ reactions.
13. The light-independent reactions are also called the _____.
14. _____ spins to provide the energy for adding a phosphate group to ADP.
15. Electron _____ move high-energy electrons between photosystems.
16. An animal that obtains food by eating other organisms is called a(n) _____.

