

**SECTION 6-1 REVIEW****CAPTURING THE ENERGY IN LIGHT**

**VOCABULARY REVIEW** Explain the relationship between the terms in each of the following pairs of terms.

1. granum, stroma \_\_\_\_\_  
\_\_\_\_\_
2. chlorophyll *a*, accessory pigment \_\_\_\_\_  
\_\_\_\_\_
3. chemiosmosis, ATP synthase \_\_\_\_\_  
\_\_\_\_\_

**MULTIPLE CHOICE** Write the correct letter in the blank.

- \_\_\_\_\_ 1. Chlorophyll *a*

<p>a. absorbs mostly orange-red and blue-violet light.</p> <p>b. absorbs mostly green light.</p>	<p>c. is an accessory pigment.</p> <p>d. is responsible for the red color of many autumn leaves.</p>
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- \_\_\_\_\_ 2. The photosystems and electron transport chains are located in the

<p>a. outer chloroplast membrane.</p> <p>b. inner chloroplast membrane.</p>	<p>c. thylakoid membrane.</p> <p>d. stroma.</p>
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- \_\_\_\_\_ 3. Both photosystem I and photosystem II

<p>a. receive electrons from other photosystems.</p> <p>b. donate electrons to a transport chain that generates NADPH.</p>	<p>c. donate protons to each other.</p> <p>d. contain chlorophyll <i>a</i> molecules.</p>
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- \_\_\_\_\_ 4. Water participates directly in the light reactions of photosynthesis by

<p>a. donating electrons to NADPH.</p> <p>b. donating electrons to photosystem II.</p>	<p>c. accepting electrons from the electron transport chains.</p> <p>d. accepting electrons from ADP.</p>
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- \_\_\_\_\_ 5. The energy that is used to establish the proton gradient across the thylakoid membrane comes from the

<p>a. synthesis of ATP.</p> <p>b. synthesis of NADPH.</p>	<p>c. passage of electrons along the electron transport chain of photosystem II.</p> <p>d. splitting of water.</p>
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**SHORT ANSWER** Answer the questions in the space provided.

1. Why is photosynthesis referred to as a biochemical pathway? \_\_\_\_\_

\_\_\_\_\_

2. How does the structure of a chloroplast enable it to build up a concentration gradient of protons? \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

3. What are the energy-carrying end products of the light harvesting reactions? \_\_\_\_\_

4. Explain the function of accessory pigments. \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

5. **Critical Thinking** Which photosystem—I or II—most likely evolved first? Explain your reasoning.

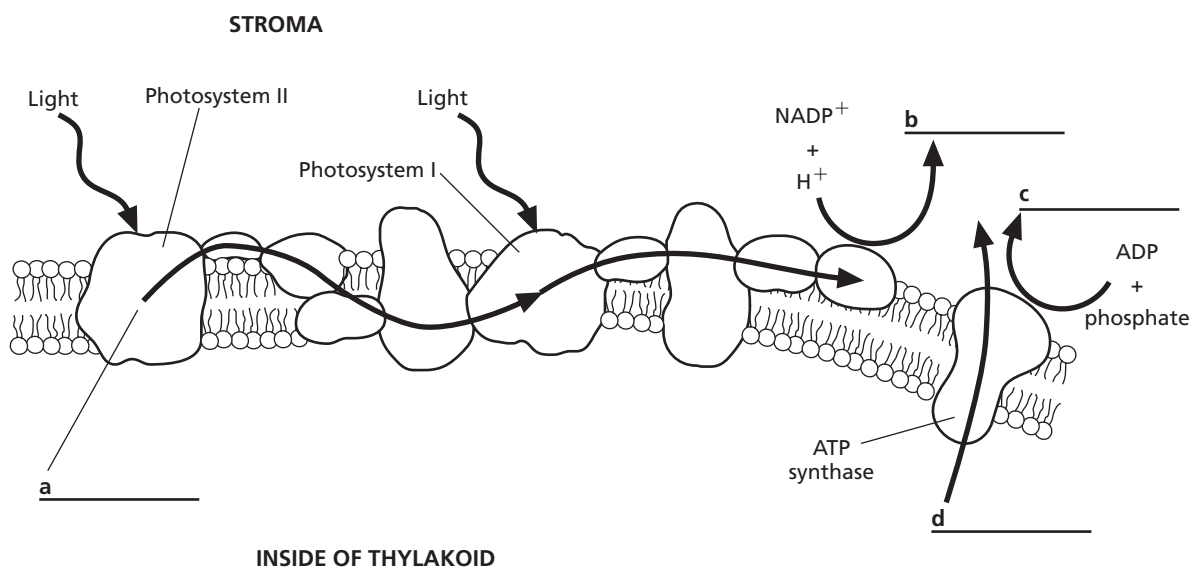
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\_\_\_\_\_

\_\_\_\_\_

**STRUCTURES AND FUNCTIONS** Label the substances represented by the letters *a–d* below.

The diagram below summarizes the light reactions of photosynthesis.



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- Carrier proteins bind to a molecule of the substance on one side of the membrane, change shape, transport the molecule across the membrane, and release the molecule on the other side.
- The stimuli are stretching of the cell membrane, electrical signals, and chemicals in the cytosol or external environment.
- Both involve the binding of a specific substance to a particular kind of protein and a change in shape of the protein as the process (transport or chemical reaction) proceeds. After the process is completed, the protein is unchanged.

#### STRUCTURES AND FUNCTIONS

- a, hypotonic; b, hypertonic; c, isotonic; d, hypertonic; e, isotonic; f, hypotonic

## Section 5-2

### VOCABULARY REVIEW

- Active transport is the movement of materials across a membrane from an area of lower concentration to an area of higher concentration.
- Endocytosis is the process by which cells ingest external fluid, macromolecules, and large particles.
- A vesicle is a membrane-bound organelle that pinches off from the cell membrane during endocytosis or fuses with the cell membrane during exocytosis.
- Phagocytosis is a type of endocytosis in which cells ingest large particles or whole cells.

#### MULTIPLE CHOICE

- b
- a
- c
- b
- d

#### SHORT ANSWER

- The mechanism uses energy to move  $\text{Na}^+$  and  $\text{K}^+$  up their concentration gradients.
- The phagocyte forms a pouch in its cell membrane and engulfs bacteria in the pouch. It then pinches off the pouch to form a vesicle. Lysosomes fuse with the vesicle, and lysosomal enzymes destroy the bacteria it contains.
- Proteins are made on ribosomes and packaged into vesicles by the Golgi apparatus. The vesicles move to the cell membrane and fuse with it, releasing the proteins from the cell through exocytosis.
- The interior of the lipid bilayer is nonpolar and therefore would repel ions, which are attracted to polar environments.

#### STRUCTURES AND FUNCTIONS

- The correct order is d, c, f, b, a, e. **2.**  $\text{Na}^+$  ions are released on the external side of the cell membrane. **3.**  $\text{K}^+$  ions are released on the cytosolic side of the cell membrane.

## Section 6-1

### VOCABULARY REVIEW

- Grana are stacks of thylakoids inside a chloroplast; the stroma is the solution that surrounds the thylakoids.
- Accessory pigments assist chlorophyll *a* in capturing light energy during photosynthesis.
- Chemiosmosis is the process by which ATP is made during photosynthesis. The production of ATP is catalyzed by the enzyme ATP synthase.

#### MULTIPLE CHOICE

- a
- c
- d
- b
- c

#### SHORT ANSWER

- Photosynthesis involves many chemical reactions linked such that the product of one reaction is consumed in the next reaction.
- Chloroplasts have an inner membrane system consisting of thylakoids. The pumping of protons into the thylakoids builds up a proton concentration gradient across the thylakoid membrane.
- The energy-carrying products are ATP and NADPH.
- They help chlorophyll *a* capture light energy by absorbing energy in wavelengths that chlorophyll *a* cannot absorb. This enables the photosynthetic cell to capture more of the energy in light.
- Photosystem II most likely evolved first, because it replaces electrons lost from chlorophyll *a* with electrons from water. Since photosystem I accepts electrons from photosystem II, it probably evolved after photosystem II.

#### STRUCTURES AND FUNCTIONS

- a, electrons; b, NADPH; c, ATP; d,  $\text{H}^+$

## Section 6-2

### VOCABULARY REVIEW

- The Calvin cycle is a biochemical pathway that produces organic compounds from carbon dioxide during photosynthesis.
- Carbon fixation is the incorporation of carbon dioxide into organic compounds.
- A stoma is a small pore on the surface of a plant through which water,  $\text{O}_2$ ,  $\text{CO}_2$ , and other gases enter or leave the plant.
- The  $\text{C}_4$  pathway is a carbon fixation pathway in which  $\text{CO}_2$  is incorporated into four-carbon compounds.
- CAM is a carbon fixation pathway in which  $\text{CO}_2$  is incorporated into organic compounds at night and released to enter the Calvin cycle during the day.

#### MULTIPLE CHOICE

- a
- c
- d
- b
- d

#### SHORT ANSWER

- In each turn of the cycle, three molecules of ATP and two molecules of NADPH are used.
- $\text{CO}_2 + \text{H}_2\text{O} + \text{light energy} \rightarrow (\text{CH}_2\text{O}) + \text{O}_2$
- CAM plants open their stomata at night, whereas  $\text{C}_3$  and  $\text{C}_4$  plants open their stomata during the day.
- Increasing the temperature initially accelerates the various chemical reactions involved in photosynthesis. At higher temperatures, many of the enzymes that catalyze these reactions become ineffective, and the stomata begin to close.
- The stomata would open. That would allow more  $\text{CO}_2$  to enter the leaf from the surrounding air, stimulating photosynthesis.

#### STRUCTURES AND FUNCTIONS

- Clockwise from the top: 1  $\text{CO}_2$ , 2 PGA, 2 ATP, 2 ADP, 2 NADPH, 2  $\text{NADP}^+$ , 2 PGAL, 1 ATP, 1 ADP, 1 RuBP