Section Review 8-1

1. Autotrophs get energy from the sun in the form of light energy. **2.** ATP is used to store energy needed for life processes. **3.** ADP is converted to ATP by the addition of another phosphate group to an ADP molecule. **4.** When ATP is changed to ADP, a phosphate group is removed. The removal of a phosphate group releases energy to the cell. **5.** The energy stored in ATP is used for active transport and for movement within cells. **6.** They are similar in that they both depend on energy from food. However, autotrophs use the sun's energy to make their own food, while the heterotrophs obtain their energy from the foods they eat. Heterotrophs eat autotrophs or other heterotrophs. **7.** heterotroph **8.** autotroph **9.** heterotroph

Section Review 8-2

1. c **2.** b **3.** a **4.** b **5.** c **6.** $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$ or carbon dioxide + water → sugars + oxygen **7.** Light energy is transferred to the electrons in the chlorophyll molecule, raising the energy of these electrons. These high-energy electrons make photosynthesis work. **8.** The production of food will drop because plants do not absorb light well in the green region of the visible spectrum. **9.** The plant would have leaves of an orange color. The orange pigment carotene absorbs the orange wavelength of light very poorly, which makes the leaves appear orange. **10.** Students' experiments should have controls and manipulated and responding variables, and should test an effect of air pollution on photosynthesis. For example, two plants are placed in different atmospheres, one containing few pollutants and the other containing many pollutants. The students would observe the plants and record data on how the plants thrive or survive in different atmospheres.

Section Review 8-3

1. thylakoid **2.** Calvin cycle **3.** ATP, NADPH **4.** oxygen **5.** light-independent **6.** stroma **7.** Both systems are light dependent. Both systems use light energy to energize electrons. One difference is that water molecules are split in photosystem II, but not in photosystem I. In photosystem II, ADP is converted into ATP. **8.** The Calvin cycle is a light-independent reaction and does not require light. It will continue as long as there are ATP and NADPH molecules for the cycle to use. **9.** The rate of photosynthesis is affected by water, temperature, and light. Low amounts of water, low temperatures, very high temperatures, and little light will slow the rate, while adequate amounts of water, moderate temperatures, and sunny weather will increase the rate. **10.** Students should indicate that they would measure either oxygen or carbon dioxide, and that the rate of increase in oxygen or decrease in carbon dioxide would indicate the rate of photosynthesis.

Chapter Vocabulary Review

1. Adenosine triphosphate is one of the principal chemical compounds that living things use to store energy. **2.** A thylakoid is a saclike, photosynthetic membrane found in chloroplasts that contains clusters of chlorophyll. **3.** $NADP^+$ stands for nicotinamide adenine dinucleotide phosphate, a carrier molecule, which accepts and holds 2 high-energy electrons along with a hydrogen ion. **4.** ATP synthase is a protein found in the thylakoid membrane and allows H^+ ions to pass through it. ATP synthase binds ADP and a phosphate group together to produce ATP. **5.** The Calvin cycle uses ATP and NADPH from the light-dependent reactions to produce high-energy sugars. The Calvin cycle takes place in the stroma of chloroplasts and does not require light. **6.** An autotroph is an organism that makes its own food. A heterotroph is an organism that obtains energy from the food it consumes. **7.** Oxygen is produced in the light-dependent reactions of photosynthesis. **8.** Pigments are light-absorbing molecules. Chlorophyll is a pigment. **9.** The Calvin cycle does not depend on light and uses ATP and NADPH to produce high-energy sugars. The light-dependent reaction uses energy from sunlight to produce ATP, NADPH, and oxygen. **10.** Sugars are formed from carbon dioxide in the Calvin cycle. **11.** c **12.** e **13.** b **14.** a **15.** d **16.** light **17.** H_2O **18.** CO_2 **19.** O_2 **20.** sugars

Enrichment

1. Radio waves have the longest wavelength on the electromagnetic spectrum. Gamma rays have the shortest wavelength.
2. Bees can see the beginning of the ultraviolet section of the electromagnetic spectrum where the frequencies are close to those of visible light.

Graphic Organizer

1. H_2O **2.–3.** NADPH, ATP **4.** CO_2 **5.–6.** $NADP^+$, ADP + P

Design an Experiment

Analyze and Conclude 1. The uncovered leaf and the leaves covered with red and blue cellophane contained starch. The leaves covered with black paper and green cellophane contained little or no starch. Students should explain why their prediction was or was not correct. For example, if students predicted that the leaf covered in black paper would not contain starch, they should explain that the black paper prevented any light from reaching the chlorophyll, so the plant could not make starch in photosynthesis. **2.** The blue and red cellophane did not affect photosynthesis. The green cellophane reduced the amount of starch produced by the leaf. Students

should explain why their hypothesis was or was not correct. For example, if the student predicted the green cellophane would allow starch to be produced, the hypothesis would have been incorrect because the green cellophane did not allow starch to be produced based on the data from the lab.

3. Chlorophyll absorbs red and blue light, but not green light. The leaves covered by red and blue cellophane received the energy they needed for photosynthesis to occur and to produce starch. The leaf with green cellophane received little light energy that the chlorophyll could use, so it produced little starch.