Chapter 7

Chapter 7 Project Worksheet 1
(p. 6)
1. The students should write a few sentences that describe characteristics of living organisms. This list should touch on characteristics covered in Section 1 of the text.
2. The student should come up with two different tests to examine characteristics described in question 1. The descriptions should include how he or she would analyze possible outcomes.
3. The students should list materials that he or she needs to conduct the tests outlined in question 2. Be sure that the student knows whether such materials are available.
4. The student should make an initial hypothesis about whether or not the object is living. He or she should write a few sentences justifying his or her hypothesis.
5. If necessary, the student should modify any tests described in question 2.
6. The student should write out a clear plan for what tests he or she will conduct and how often he or she will conduct these tests.

Chapter 7 Project Worksheet 2
(p. 7)
The student’s data table should be well organized and show a regular schedule of observations.
1. The student should write several sentences describing the research, including a description of why some tests worked better than others did.
2. The student should write several sentences summarizing observations and drawing a conclusion as to whether the object is living. If living, the student should classify his or her object into a kingdom.
3. This paragraph should include the student’s plan for how to present his or her project to the class.

Section 7-1 Review and Reinforce
(p. 11)
1. All living things have cellular organization, contain similar chemicals, use energy, grow and develop, respond to their surroundings, and reproduce.
2. Redi’s experiment showed that flies do not spontaneously arise from rotting meat but are produced from the eggs of other flies.
3. Living things must satisfy basic needs for energy, water, living space, and stable internal conditions.
4. Growth is the process of becoming larger where development is the process of becoming more complex. An organism does not have to be large to be complex.
5. stimulus
6. autotrophs
7. multicellular
8. spontaneous generation
9. organisms
10. cell
11. heterotrophs
12. response
13. controlled experiment, variable
14. homeostasis
15. reproduce
16. unicellular

Section 7-1 Enrich
(p. 12)
1. The bacteria grew well under the best conditions. They had all their basic needs satisfied: energy, water, living space, and stable internal conditions.
2. The bacteria did not grow well at all. They were supplied with energy, water, and living space, but the cold growing temperature did not provide stable internal conditions.
3. The bacteria grew somewhat well. They had water, living space, and stable internal conditions, but because the agar was old, it did not have as many nutrients available to the growing bacteria. This means they did not have a good energy source.
4. The bacteria did not grow very well. They had water and stable internal conditions, but because they were allowed to grow unchecked for one month, much longer than the optimal time, the living space became overcrowded and the energy source was insufficient.
Section 7-2 Review and Reinforce  
(p. 15)
1. The air in the chamber is different from the air today because it does not contain any oxygen. Both the air in the chamber and the air we breathe today have large amounts of nitrogen. Both also contain water vapor, carbon dioxide, and methane, although they make up a smaller portion of the air we breathe today.

2. Urey and Miller's experiment simulated how lightning affected the ocean and the gases in the atmosphere of early Earth. They ran an electric current through a flask of gases and water. The current represented lightning in the atmosphere. A week later they found some small chemical units that could form the building blocks of life called proteins.

3. Scientists believe that the first organisms did not need oxygen, were unicellular and heterotrophic, and lived in the oceans.

4. Scientists think that early heterotrophs used chemicals in their surroundings for energy. As the number of heterotrophs increased, the amount of chemicals decreased. Some of these heterotrophs may have developed the ability to make their own food. These early autotrophs released oxygen as a waste product. As the autotrophs thrived, oxygen accumulated in Earth's atmosphere.

5. Fossils are traces of ancient organisms that have been preserved in rock or other substances. The earliest known fossils contain bacteria-like life forms. Hypotheses about the earliest forms of life on Earth suggest that the earliest life forms were very similar to bacteria.

Section 7-2 Enrich  
(p. 16)
Answers will vary. Answers supporting the evidence of life should include the presence of chemical building blocks, the presence of carbon and oxygen in the Martian atmosphere, and the presence of water on the Martian surface when the rock was on Mars; and the shape of the fossil-like evidence is similar to bacterial fossil remains on Earth. The fact that the fossil-like structures, the mineral deposits, and the chemical building blocks were found so close together in the rock, indicate that an organism could have formed the structure, left behind some of its chemical makeup, and also some material that formed from that makeup once the organism died.

Answers that refute the evidence of life might include that all the chemicals present could have come from nonliving sources; the structures might not be fossils but rather are artificial structures; and the fact that the rock is about as old as Mars suggests that life might have formed quickly after Mars' formation, which is not likely.

Section 7-3 Review and Reinforce  
(p. 19)
Aristotle: based classifications on observation, creating subgroups for classification
Carolus Linnaeus: devised a naming system called binomial nomenclature that gives organisms a genus name and a species name
Charles Darwin: published the theory about how species can change over time; provided evidence that certain organisms are similar because they share similar evolutionary histories

1. The modern system classifies organisms into seven levels: kingdom, phyla, class, order, family, genus, and species. The scientific name given to an organism is based on binomial nomenclature. Species with similar evolutionary histories are classified more closely together.

2. b
3. d
4. a
5. e
6. c
7. f
8. g

Section 7-3 Enrich  
(p. 20)
1. \[ 50,000 \times 163 = 8,150,000 \]
2. \[ 40\% \times \text{number of insects and related animals} = 8,150,000; \]
   \[ \text{insects and related animals} = 20,375,000 \]
3. \[ 20,375,000 \times \frac{1}{2} = 10,187,500 \]
4. \[ 10,187,500 + 20,375,000 = 30,562,500 \]
5. More species of animals live in the tropics than anywhere else. If Dr. Erwin could estimate how many species of animals there are
in the tropics, that number would be close to the number of animals on Earth.

6. Answers may vary. Samples: At several steps in his method, Dr. Erwin estimated numbers that were used in calculations. These include the number of beetles living in Luehea seemannii trees and no other kind of tree, the number of kinds of trees in the tropics, the percentage of insects and related animals that are beetles, the percentage of insects and related animals that are found in tropical trees compared to on the forest floor. The actual numbers were probably different from his estimations. Also, he estimated that each of the 50,000 kinds of tropical trees had 163 beetles species found in no other kind of tree. This might not be true.

Section 7-4 Review and Reinforce (p. 23)

Archaebacteria: prokaryotes; autotrophic or heterotrophic; unicellular; unique chemical makeup

Eubacteria: prokaryotes; autotrophic or heterotrophic; unicellular; different chemical makeup than archaebacteria

Protists: eukaryotes; autotrophic or heterotrophic; unicellular or multicellular; members vary greatly

Fungi: eukaryotes; heterotrophic; unicellular or multicellular; most feed on dead or decaying organisms

Plants: eukaryotes; autotrophic; multicellular; feed almost all of the heterotrophs on Earth

Animals: eukaryotes; heterotrophic; multicellular; have different adaptations that allow them to locate, capture, eat, and digest food

1. A nucleus is a dense area in a cell that contains nucleic acids.
2. Prokaryotes are organisms whose cells lack nuclei and have their nucleic acids throughout their cells rather than contained in nuclei.
3. Eukaryotes are organisms with cells that have nuclei containing their nucleic acids.

Section 7-4 Enrich (p. 24)

1. All animals, including S. pandora, are multicellular, eukaryotic, and heterotrophic.
2. Answers may vary. Sample: I think it wasn’t discovered until recently because it is so small.

3. genus Symbion; there is only one known species, pandora, in this genus.

4. Answers may vary. Sample: They probably compared its body structures and its development to other living organisms. They also probably compared the chemical makeup of its cells to those of other species.

5. Answers may vary. In fact, S. pandora feeds by sweeping food into its mouth with its hairlike projections.

Chapter 7 Skills Lab (pp. 25-26)
For answers, see Teacher’s Edition, p. 214.

Chapter 7 Real World Lab (pp. 27-29)
For answers, see Teacher's Edition, pp. 228-229.

Chapter 8

Chapter 8 Project Worksheet 1 (p. 34)
1-5. All answers will vary and depend on the disease chosen.

Chapter 8 Project Worksheet 2 (p. 35)
1-4. All answers will vary and depend on the disease chosen.

Section 8-1 Review and Reinforce (p. 39)

1. Viruses resemble organisms because they can multiply. They are different because they are not alive: they are not cells, they do not use energy to grow, and they do not respond to their surroundings.

2. A parasite is an organism that causes harm to its host. Although nonliving, a virus also destroys the invaded host cell by multiplying until the cell bursts.

3. An active virus’s genetic material immediately takes over the cell’s functions. The cell quickly begins to produce the virus’s proteins and genetic material. Then, these parts assemble into new viruses. A hidden virus’s genetic material becomes part of the cell’s genetic material. The hidden virus does not appear to
affect the cell’s functions and may stay hidden for quite some time. Then suddenly the virus’s genetic material becomes active. From that point, it takes control of the cell’s functions the same way an active virus does.

4. Part A is the protein coat. The protein coat protects the virus and enables it to attach to a host cell by fitting into specific proteins on the host cell’s surface. Part B is the genetic material. The genetic material contains instructions for making new viruses. It takes over the host cell’s functions and directs the cell to produce the virus’s proteins and genetic material.

5. A small, nonliving particle that invades a living cell and then reproduces inside it

6. A virus that infects bacteria

7. An organism that causes harm by living on or inside another organism

8. A living thing that provides a source of energy for a virus or organism

Section 8-1 Enrich (p. 40)

1. Herpesvirus; A little less than 5 hours after infection

2. Polyomavirus, 20 hours

3. Adenovirus and polyomavirus

4. The first part of each line rises steeply. This means that each viral group multiplies very rapidly at first.

5. It means the virus’ rate of multiplication has slowed down to the point that it is nearly zero.

Section 8-2 Review and Reinforce (p. 43)

1. Bacteria are prokaryotes. Their genetic material is not contained within nuclei. All other organisms are eukaryotes and have their genetic material in the nuclei.

2. Archaeabacteria and Eubacteria; Archaeabacteria and Eubacteria are classified separately because of their chemical differences.

3. Bacteria provide fuel, food products, environmental recycling, and medicines.

4. d

5. c

6. b

7. e

8. a

Section 8-2 Enrich (p. 44)

1. All can grow without air.

2. Bacterium 1 can grow in air. Bacterium 2 cannot grow in air.

3. 1, 2, 4, 6

4. Growth at 45ºC and growth in 6.5% salt water

5. Bacterium 3 is most likely to survive since it can grow in 6.5% salt water. Evaporation will increase the saltiness of the water to a concentration above which bacteria 4, 5, and 6 cannot survive. However, the sun might warm the water to a temperature that bacteria 3 and 5 could not tolerate.

Section 8-3 Review and Reinforce (p. 47)

Contact with Infected Person

DO NOT: touch, hug, or kiss infected people

DO: wash hands after contact, use a tissue when sneezing, get vaccinated for diseases like chicken pox

Contact with Infected Object

DO NOT: eat the same food or drink the same drinks an infected person has contaminated

DO: use your own eating utensils, wash your hands often

Contact with Infected Animal

DO NOT: play with strange animals

DO: monitor your pets outside, wear long sleeves and pants when hiking

Environmental Source

DO NOT: eat food that has not been properly cooked, eat food in rusted or swollen cans, walk outside with unprotected feet

DO: properly cook and store foods, get a tetanus vaccine every 10 years

1. If a sore throat is caused by a virus, you can only treat the symptoms with medications. You can use an antibiotic to cure a sore throat caused by bacteria.
2. Antibiotics are chemicals that attack and kill bacteria. However, antibiotics are becoming less effective because many bacteria have adapted over the years and now are able to survive in their presence.

3. A vaccine puts the body on alert for a particular virus or bacterium. It stimulates the body to produce chemicals that will destroy that virus or bacterium if it enters the body.

4. Vaccine
5. Infectious diseases
6. Antibiotic
7. Toxin

Section 8-3 Enrich (p. 48)

1. The Salk and Sabin vaccines
2. 7; about 1.5; about 8
3. about 1; 1; close to 0
4. The number of cases per 100,000 people in North America has declined to almost zero. The number of cases per 100,000 people has not declined as much in South and Central America. More people have been vaccinated against polio in North America than in either South or Central America.

Chapter 8 Skills Lab (pp. 49-50)

For answers, see Teacher’s Edition, p. 245.

Chapter 8 Real-World Lab (pp. 51-53)

For answers, see Teacher’s Edition, pp. 256-257.

Chapter 9

Chapter Project 9 Worksheet 1 (p. 58)

1. Answers will vary. Sample: availability of nutrients
2. Answers will vary. Sample: I predict that mushrooms will grow better in a substrate with nutrients than in a substrate without nutrients.
3. Answers will vary. Sample: In the treatment with a manipulated variable, the spores will be spread on vermiculite, which does not contain nutrients. In the treatment with the controlled variables, the spores will be spread on peat moss, which contains nutrients.
4. Answers will vary. Sample: Both containers will be kept in the dark. Both will be kept under the same constant heat source. Both will be watered the same amount by spraying each container the same number of times.
5. Answers will vary. Sample: My hypothesis would be supported if mushrooms first appeared in the container with peat moss or if more mushrooms grew in this container. It would also be supported if the mushrooms in the peat moss container were taller or had larger caps.
6. Answers will vary. Sample: My hypothesis would be shown to be incorrect if mushrooms first appeared in the container with vermiculite or if more mushrooms grew in this container. It would also be shown to be incorrect if the mushrooms in the vermiculite container were taller or had larger caps.

Chapter Project 9 Worksheet 2 (p. 59)

Part I

Students’ data will vary. Check that daily measurements are made.

Part II

Students’ graphs will vary. Graphs should be line graphs. Manipulated variables will be time or day. Responding variables will be number of mushrooms, average height of mushrooms, and/or average diameter of mushroom caps.

Section 9-1 Review and Reinforce (p. 63)

1. Flagella
2. Sporozoans
3. Funguslike
4. Slime molds
5. Plantlike
6. Green algae or diatoms
7. Green algae or diatoms
8. B
9. E
10. C
11. H
Section 9-1 Enrich (p. 64)
1. The concentration of water outside the cell is greater than the concentration of water inside the cell. As a result, water particles will diffuse into the cell.
2. Water is distributed evenly inside and outside the cell. Therefore, excess water will not build up in the cell and there is no need for a contractile vacuole.
3. Water would diffuse into the cell to balance the extra number of salt particles.
4. Fresh water, like that used in a bath, diffuses into the skin of the palms, fingers, and soles, causing it to swell and appear wrinkled.

Section 9-2 Review and Reinforce (p. 67)
1. c
2. d
3. e
4. b
5. a
6. The layer of algae on a pond’s surface prevents sunlight from reaching plants and other algae beneath the surface. These organisms die and sink to the bottom of the pond. Then, the bacteria involved in breaking down the bodies of these dead organisms increase in number. These bacteria use up the oxygen in the water. The other organisms in the water that need oxygen to survive die.
7. Answers may vary. Sample: When farmers spread fertilizer on fields, some of these chemical nutrients can run off into nearby lakes and ponds. Poorly designed or aging septic systems can leak their contents into the soil. These nutrients make their way from the soil into the water that leads into lakes and ponds.
8. An algal bloom is the rapid growth of a population of algae.
9. A red tide is a saltwater algal bloom. Red tides are dangerous when the toxins that the algae produce become concentrated in the bodies of organisms that consume the algae.
10. Eutrophication is a natural process in which nutrients such as nitrogen and phosphorus build up in a lake or pond over time and cause an increase in the growth of algae.

Section 9-2 Enrich (p. 68)
1. Lake A is more likely to experience eutrophication because its cold deep layer is more shallow. Therefore, it is more likely to run out of oxygen before the end of the summer. As a result, bacteria and other decomposers will die and nutrients will build up.
2. An algal bloom is most likely in the fall, when the mixing of lake water would bring any nutrients from the deep water to the surface, where they could nourish algae.
3. As debris slowly fills in the lake bottom, the lake's cold layer has less and less volume. This makes it more likely to experience eutrophication.

Section 9-3 Review and Reinforce (p. 71)
1. a fruiting body
2. yes
3. no
4. asexual reproduction.
5. sexual reproduction.
6. Most fungi share the following characteristics: They are eukaryotes, use spores to reproduce, and are heterotrophs that feed in a similar way.
7. Answers may vary. Sample: No, a fungus digests its food outside of its body. Its hyphae ooze digestive chemicals into the food. The chemicals break down the food, and then the hyphae absorb it.
8. Answers may vary. Sample: If fungi did not exist, dead organisms would not be decomposed as fast and their nutrients would not be recycled as fast. We would not have foods such as mushrooms and some cheeses and breads. Some diseases, such as athlete's foot, would not exist, but neither would some antibiotics. Many plants would not survive without the fungi that grow among their roots.
9. lichen
10. hypha
11. budding
12. fruiting body

**Section 9-3 Enrich**  
*(p. 72)*

1. Position of lines may vary slightly as long as all locations with the same DNA type are in the same area. Sample:

```
Type 1:  1  2  3  4  5  6
Type 2:  7  8  9 10 11 12
         13
Type 3: 14 15 16 17 18 19
         20 21
         22 23 24 25 26 27
         28 29
         30
```

2. The area of the largest fungus is 12,800 m², and the area of the smallest fungus is 4,800 m².
3. The mass of the largest fungus is 9,600 kg (0.75 kg/m² × 12,800 m²), and the mass of the smallest is 3,600 kg (0.75 kg/m² × 4,800).
4. 1,152 km ([90 m/m² × 12,800 m²] / 1,000 m/km)

**Chapter 9 Real-World Lab**  
*(pp. 73–74)*

For answers, see Teacher’s Edition, p. 283.

**Chapter 9 Skills Lab**  
*(pp. 75–77)*


**Chapter 10**

**Chapter 10 Project Worksheet 2**  
*(p. 83)*

1. Students should include information gleaned from research regarding growing requirements of mosses. Also, students will describe the setup of their terrariums such as what kind of container was used and where they acquired soil or other materials. Some students may have used gravel in the bottom of their terrariums for drainage. The brochure should include the care given the moss, including how much water the terrarium received and what the temperature and lighting conditions were. Students should also describe short term and longer term changes. Did water condense on the inside of the terrarium? Did the moss show new growth over the course of the project or were the growing conditions less than ideal?
2. Some students will decide to include their entire data table. Others may summarize their observations or make a graph to show the frequency and amount of water supplied.
3. Students should read their brochures to a friend or have a friend read it and give feedback.
4. As written, this project is geared for individual presentations in front of the class. Another option would be to have all terrariums and brochures on display so class members can observe them at convenient times before and after class.

**Section 10-1 Review and Reinforce**  
*(p. 87)*

1. All plants produce their own food and are made up of many cells.
2. They need to get water and other materials from their surroundings, retain water, transport materials throughout the plant, support their bodies, and reproduce successfully.
3. tissue
4. vascular tissue
5. gametophyte
6. chloroplast
7. photosynthesis
8. cellulose
9. fertilization
10. cuticle
11. vacuole
12. chlorophyll
13. sporophyte
14. cell wall
15. gamete
16. zygote

**Section 10-1 Enrich**  
*(p. 88)*

1. The plant comes out of dormancy after a rain shower.
2. It loses its leaves and flowers to help conserve water.
3. Because the plant grows leaves and flowers after a rain shower, it probably absorbs a large amount of rainwater. This suggests that the plant has shallow horizontal roots.
4. It could absorb large amounts of water after a rain with its roots near the surface and could get water from deep in the earth during dry periods with its vertical roots.
5. A cuticle is a waxy, waterproof layer that covers leaves. Because desert plants must survive with very little water, they need to reduce water loss as much as possible and they are more likely to have thick cuticles.

**Section 10-2 Review and Reinforce (p. 91)**
1. true
2. absorbed
3. true
4. yellow, orange, and red
5. reflects
6. photosynthesis
7. light energy
8. sugar and oxygen

**Section 10-2 Enrich (p. 92)**
1. The peaks of the absorption spectrum indicate the colors of light that are most absorbed by chlorophyll. The low portions indicate the colors that are the least absorbed, or reflected, by chlorophyll.
2. The peaks represent the colors of light that result in the greatest rates of photosynthesis. The low points represent the colors of light that result in the lowest rates of photosynthesis.
3. Yes, the rate of photosynthesis appears to be related to the absorption of light by chlorophyll. This can be inferred by comparing the absorption spectrum of chlorophyll with the action spectrum of photosynthesis, which have similar peaks and low points.
4. It would grow very slowly because it would have a low rate of photosynthesis.
5. White light contains both red and blue light so the rate of photosynthesis will be high, probably higher than either red light or blue light alone.

**Section 10-3 Review and Reinforce (p. 95)**
1. Liverworts
2. no
3. low-growing
4. small
5. places high in moisture
6. moist soil
7. grow flat
8. b
9. d
10. d
11. b

**Section 10-3 Enrich (p. 96)**
1. The false bottom is at the bottom of the layer of water. The layer of dead moss below it is not firm. If something dense is dropped into the bog, it will fall through the false bottom to the true bottom of the bog.
2. in the dead layer of moss at the bottom of the bog
3. Their small size and low density compared to water lets them form floating mats on the surface of the water.
4. Larger lakes have waves, and rivers have currents, that would break apart the floating mats of moss.

**Section 10-4 Review and Reinforce (p. 99)**
1. structures where spores are produced
2. stem
3. frond
4. roots
5. sporophyte
6. gametophyte
7. They have vascular tissue and use spores to reproduce.
8. vascular plants
9. club mosses and horsetails

**Section 10-4 Enrich (p. 100)**
1. (1) A sporangia under normal conditions. (2) As the cells of the annulus dry out, they begin
to pull on the sporangium and the sporangium begins to tear. (3) The sporangium is torn completely open. (4) The annulus snaps back to its original position, throwing the spores.

2. It gives the spores a chance to land in a more favorable environment than their parent fern.

3. Answers may vary. Samples: Spores that are thrown do not have to rely on the wind to travel away from their parent plant. Spores that are thrown have a better chance of being caught by the wind.

4. The spores aren’t released until the annulus dries out. Therefore, dry weather precedes the release of spores.

Chapter 10 Skills Lab  
(p. 101–103)
For answers, see Teacher’s Edition, pp. 308–309.

Chapter 10 Skills Lab  
(p. 104–105)
For answers, see Teacher’s Edition, p. 319.

Chapter 11

Chapter 11 Project Worksheet 1  
(p. 110)
1. Answers will vary. Sample: I’m going to grow a pea plant. I’ve seen them sprout before, I so expect in a few days I’ll see the two little leaves growing out of the soil. Then it will put out bigger leaves. In a few weeks it will bloom.

2. Check that students’ drawings show the seed coat, embryo, and stored food. Drawings should be large enough to see details of the inside of the seed.

Students data table entries should be daily and detailed. Quantifiable observations are good, such as number of leaves and height of the plant, but qualitative observations, such as “The leaves get limp when I don’t water the plant enough” are also important.

Chapter 11 Project Worksheet 2  
(p. 111)
1. Answers will vary. Sample: The pea plant grew quickly and seemed healthy. It grew especially fast after the first two weeks, and always grew toward the window. A few flowers were produced but no seeds. I think the plant would have produced seeds if the project had gone on longer.

2. The seed leaves emerged from the ground on day 6, and I could see the first true leaves forming about day 9. Each day I could tell the plant was growing toward the light, so every couple of days I turned the tray so the plant would grow straighter. The true leaves always appeared in pairs. The first tendril appeared on day 13, after the second pair of true leaves. The first flower appeared on day 25. I pollinated the flowers on day 29.

3. I will make 3 sketches of the entire plant, one of the germinating plant, another when the plant has 4 leaves and the first tendrils, and one of the full grown plant with flowers. I will make separate drawings of the seed, a close-up of a leaf, one showing how the tendril curls around an object, and one of the flower. Each drawing will have labels for the important parts and text to explain what is happening.

Section 11-1 Review and Reinforce  
(p. 115)
1. Accept any four of the following: They all have vascular tissue, produce seeds, and have leaves, stems, and roots.

2. embryo, stored food, seed coat

3. Accept one of the following: captures the sun’s energy, carries out photosynthesis

4. a layer of cells that divide to produce new phloem and xylem

5. root

6. contains a young plant inside a protective covering

7. xylem

8. phloem

9. protects the growing tip of the root from injury

10. stomata

11. Accept one of the following: carries substances between the roots and leaves, provides support for the plant, holds up leaves so they are exposed to the sun

12. a seed leaf where food can be stored
Section 11-1 Enrich (p. 116)
1. Accept either air bubbles or gas bubbles.
2. The first leaf has stomata on one side only, while the second leaf has stomata on both sides.
3. Much of the air inside the leaf might escape through the stalk.
4. Water would be more readily lost from the upper surface of the leaves, because that is the side more exposed to sun and wind. Having few or no stomata on the upper surface of the leaves reduces the places from which water can escape, and this helps control water loss.
5. on the top—the surface that is exposed to air

Section 11-2 Review and Reinforce (p. 119)
1. needlelike
2. conifer
3. cones
4. pollen
5. egg cells
6. Answers may vary. Sample: First, pollen falls from a male cone onto a female cone. This is called pollination. In time, a sperm cell and an egg cell join together in an ovule on the female cone. After fertilization occurs, the zygote develops into the embryo part of the seed.

Section 11-2 Enrich (p. 120)
1. long, strong fibers
2. Answers may vary. Sample: You want the fibers thoroughly separated in the pulp so the finished paper will be thin and smooth, with no lumps.
3. Answers may vary. Sample: Thoroughly dry paper will be stronger than wet paper.
4. Answers may vary. Samples: flax, cotton, hemp, straw, corn stalks, bamboo, grasses

Section 11-3 Review and Reinforce (p. 123)
1. They produce flowers and fruits.
2. pollen
3. eggs
4. Pollen falls on the stigma. The sperm cell and egg cell join in the ovule. The zygote develops into an embryo.
5. Monocots are angiosperms that have only one seed leaf. Dicots produce seeds with two seed leaves.
6. stamen
7. pistil
8. ovary
9. petal
10. sepal

Section 11-3 Enrich (p. 124)
1. a mild reaction
2. the Northwest
3. The South has the highest levels of ragweed pollen, because ragweed grows best in hot climates.
4. Yes, because ragweed plants release their pollen between 6 and 10 A.M.

Section 11-4 Review and Reinforce (p. 127)
1. gravity and light
2. tropism
3. positive (to gravity)
4. positive (to light)
5. b
6. c
7. a

Section 11-4 Enrich (p. 128)
1. by digesting insects and other animals that they trap
2. The sweet, sticky liquid acts as bait to attract insects into its trap.
3. Yes, the plants still need to make food even though they digest insects to obtain nitrogen.
4. Answers may vary. Sample: Speed allows the Venus's flytrap to trap an insect by surprising it. The trap closes before the insect can fly away.
5. The sticky liquid traps the insect. Therefore, the plant can move relatively slowly to imprison and digest it.
Section 11-5 Review and Reinforce  
(p. 131)  
1. true  
2. drought  
3. true  
4. fertilizer  
5. costly  
6. a method by which plants are grown in solutions of nutrients instead of soil  
7. the process by which scientists alter an organism’s genetic material to produce an organism with qualities that people find useful  

Section 11-5 Enrich  
(p. 132)  
1. The filling is used to support the roots of the plants.  
2. Yes, because the plant will eventually use up all the nutrients in the solution.  
3. Plants must also be provided with appropriate amounts of light.  
4. Answers may vary. Sample: Yes, because plants will grow faster, saving scarce room on the ship, pesticides will not be needed, and carrying heavy soil can be avoided.  
5. Answers may vary. Sample: Special containers and supports must be purchased for every plant. Also, plants grown with hydroponics might need more care to keep the water and nutrient level right.  

Chapter 11 Real-World Lab  
(pp. 133–135)  

Chapter 11 Skills Lab  
(pp. 136–137)  
For answers, see Teacher’s Edition, p. 357.  

Chapter 12  

Chapter 12 Project Worksheet 1  
(p. 142)  
1-6. Answers will vary.  

Chapter 12 Project Worksheet 2  
(p. 143)  
1. Answers will vary.  

Section 12-1 Review and Reinforce  
(p. 147)  
1-7.  

Section 12-1 Enrich  
(p. 148)  
1. Most of the time it wasn’t moving. Its top speed was 30 kph, but it moved at this speed only for very short amounts of time.  
2. Its average speed was about 2 kph. It was active during the day. It stopped to rest only during the night. During the day it kept moving.  
3. Animal 3 was active during the day. It usually moved at low speed or not at all. Its top speed was about 10 kph. It kept up that speed for close to 2 hours. It would have traveled about 25 km.  
4. Animal 4 was active at night and slept during the day. Only animal 2 was active throughout the heat of the afternoon.  
5. a. sit-and-wait predator  
   b. herbivore or omnivore  
   c. predator that pursues its prey long distances.  
   d. sit-and-wait predator  

Section 12-2 Review and Reinforce  
(p. 151)  
1. radially symmetrical  
2. asymmetrical  
3. bilaterally symmetrical  
4. bilaterally symmetrical  
5. radially symmetrical  
6. bilaterally symmetrical
7. bilateral symmetry
8. radial symmetry
9. many
10. one

Section 12-2 Enrich (p. 152)
1. bilateral symmetry; one
2. radial symmetry; many
3. The fish is the faster swimmer. A bilaterally symmetrical animal is more streamlined and can move faster than a radially symmetrical animal.
4. The single body parts occur roughly on the line of symmetry. Each paired body part lies on one side of the line of symmetry.

Section 12-3 Review and Reinforce (p. 155)
1. Sponges filter small food particles from the water as it passes through their bodies. Also, sponge cells get oxygen from the water. Reproduction takes place in water.
2. Sponges have spikes to protect them. Some also produce poisons.
3. Sponges reproduce asexually through budding. They reproduce sexually by releasing eggs or sperm into the water.
4. A coral polyp attaches itself to a hard surface on the ocean floor. The polyp produces a hard external skeleton. After a very long time, many, many polyps living together will create a coral reef.
5. Cnidarians reproduce asexually and sexually. Asexual reproduction is by budding. The manner of sexual reproduction depends on the species. Some species have both sexes in one individual; in other species some individuals are male and others are female.
6. Students should label A as a medusa, B as a polyp. The mouth on A is at the bottom, on B at the top. The medusa is free swimming.
7. Cnidarians, which include jellyfish, hydras, and corals, are carnivores that use their stinging cells to capture prey. They live in watery environments.
8. A larva is an immature form of an animal that looks very different from an adult.

Section 12-3 Enrich (p. 156)
1. A. Cnidoblast is ready for firing. Thread is coiled.
   B. Cnidocil is touched, and operculum pops open. Coiled thread begins to shoot out.
   C. Coiled thread penetrates prey and injects venom. Prey is paralyzed or killed.
   D. Tentacles pull food into mouth. Cnidarian digests food.
2. Although the jellyfish is dead, the stinging cells are still activated when a person steps on them.
3. defense

Section 12-4 Review and Reinforce (p. 159)
1. segmented worms
2. through sexual and asexual reproduction
3. true
4. true
5. segmented worms
6. true
7. one-way
8. true
9. true
10. closed
11. Bristles
12. b
13. e
14. a
15. d
16. c

Section 12-4 Enrich (p. 160)
1. about 16 cm
2. Drawing should indicate rocks 16 cm beneath surface, still in a layer.
3. About 91 years
4. Rocks continue to sink only as long as worms remove soil from beneath them and deposit it on the surface. The rocks would stop at a meter deep because there are no worms below that depth.
Chapter 12 Real-World Lab
(pp. 161–162)

Chapter 12 Skills Lab
(pp. 163–165)
For answers, see Teacher’s Edition, p. 392.

Chapter 13

Section 13-1 Review and Reinforce
(p. 175)
Gastropods: snails or slugs; gather food with radulae; large foot; none or one; one broad foot adapted for creeping
Bivalves: clams, mussels, scallops, oysters; gather food with cilia on gills; burrow with a foot; yes, two; one thin foot adapted for digging
Cephalopods: squids, octopuses, nautiluses; gather food with tentacles; jet propulsion; some do, but not all; foot adapted to form tentacles around the mouth
1. radula
2. cephalopod
3. kidneys
4. mantle
5. bivalve
6. gastropod
7. gills

Section 13-1 Enrich
(p. 176)
1. Patella: wide cone, coiling absent, three-dimensional spiral absent
2. Ectomaria: narrow cone, coiling tight, three-dimensional spiral present
3. Domatoceras: narrow cone, tight coiling, three-dimensional spiral absent
4. Buchia: This is a special case, a bivalve, but the same principles apply. The smaller shell is similar to Patella: wide cone, coiling absent, three-dimensional spiral absent. The larger shell: wide cone, very loose coiling, three-dimensional spiral absent.

Section 13-2 Review and Reinforce
(p. 179)
1. arthropods; Answers may vary. Samples: mosquito, lobster, spider
2. centipedes; Answers may vary. Sample: centipede
3. arachnids; Answers may vary. Samples: spider, mite, tick, scorpion
4. millipedes; Answers may vary. Sample: millipede
5. exoskeleton; chitin
6. antennae
7. metamorphosis
8. abdomen
9. molting

Section 13-2 Enrich
(p. 180)
1. Fork B, because it is lower on the tree
2. The most recent common ancestor of crustaceans, insects, centipedes, and millipedes
3. The most recent common ancestor of spiders, ticks, mites, and scorpions. (Also accept: the last common ancestor of arachnids.)
4. Spiders. The most recent common ancestor of mites, ticks, and spiders is at fork F. It is higher on the tree, and therefore more recent, than any of their other common ancestors.

Section 13-3 Review and Reinforce
(p. 183)
1. Three body sections; students should label the head, thorax, and abdomen on the insect.
2. 6
3. Answers will vary. Students must list two features common to most insects. Possible answers will include an exoskeleton, one or two pairs of wings, and one pair of antennae.
4. Answers may vary: Samples: A bee has a bristly tongue that laps nectar from flowers; a mosquito’s sharp mouthparts are used for jabbing and sucking blood.
5. Answers will vary. Sample: Some insects make substances that humans can use. For example, bees make honey and larvae of the silkworm moth spin fibers that can be made into silk. Bees also pollinate food crops and other plants. Some insects eat other insects that are harmful to humans.
6. Accept any of these: pesticides kill beneficial insects; they can harm other animals, such as birds; after a while, insects become resistant.
7. thorax
8. complete metamorphosis; pupa
9. gradual metamorphosis; nymph
10. camouflage

Section 13-3 Enrich (p. 184)
1. It is Müllerian mimicry.
2. It looks like the bad-tasting butterflies in Figure 1. It is Batesian mimicry.
3. Because bees and wasps share one color pattern, predators are more likely to encounter that pattern and learn to avoid those bees and wasps. It is Müllerian mimicry.
4. Predators mistake them for dangerous coral snakes and avoid them. It is Batesian mimicry.

Section 13-4 Review and Reinforce (p. 187)
1. c
2. d
3. d
4. To attract mates; also accept: to communicate.
5. Sample: Sound is produced by vibrations that create waves that move outward from the source.

Section 13-4 Enrich (p. 188)
1. and 2.

3. the louder the sound, the more females are attracted
4. the louder the sound, the more parasitic flies
5. about 93 decibels.

Section 13-5 Review and Reinforce (p. 191)
1. c
2. a
3. d
4. c
5. A sea star uses its arms and tube feet to capture its prey.
6. water vascular system
7. endoskeleton
8. echinoderm
9. regeneration

Section 13-5 Enrich (p. 192)
1. The water vascular system (the tube feet) and five-part symmetry are visible.
2. We know ancient sea lilies had endoskeletons because their fossil remains are common and consist of pieces of the endoskeleton.
3. Tube feet are visible. The sea lily uses these to filter food particles from the water. The other echinoderms pictured use them for moving about.
4. Answers may vary. Sample: The sea lily attaches to solid objects on the bottom. The sea cucumber spends its life moving about. The sea lily must have solid objects such as rocks and shells to attach to, while the sea cucumber can travel across soft mud.

Chapter 13 Skills Lab (pp. 193–194)
For answers, see Teacher’s Edition, p. 403.

Chapter 13 Real-World Lab (pp. 195–197)
For answers, see Teacher’s Edition, pp. 418–419.
Chapter 14 Project Worksheet 1 (p. 202)
feed on other fish
get oxygen from the air
inflatable throat for loud voice
climb trees

Chapter 14 Project Worksheet 2 (p. 203)
Part I:
Answers may vary. Sample: My adaptation is the
tail fin of a barracuda, the hind leg of a bullfrog,
and the tail of an alligator. Each one is an adapta-
tion for moving the animal through the water, so
each has a flat surface with which the animal
pushes against water to move forward. Also, the
bullfrog’s leg has powerful muscles for jumping
long distances on land. The alligator’s tail is heavy
and powerful and can be used as a weapon.

Section 14-1 Review and Reinforce (p. 207)
1. Notochord, a nerve cord running down their
   back, pharyngeal slits at some life stage
2. A vertebrate is an animal with a backbone.
3. An endoskeleton supports and protects the
   body, helps give it shape, and gives muscles a
   place to attach.
4. Fish, amphibians, reptiles, mammals, birds
5. ectotherm
6. endotherm
7. ectotherm
8. ectotherm
9. endotherm
10. notochord
11. vertebra
12. cartilage
13. chordate

Section 14-1 Enrich (p. 208)
1. The turtle’s femur looks relatively thicker than
   the frog’s. The turtle’s femur seems to be an
   adaptation for supporting the greater weight
   of the turtle.
2. The endoskeleton of the fish supports the least
   amount of weight. The downward pull of
   gravity would be partially offset by the buoy-
   ancy of the body of a fish, because it lives in
   the water and not on land.
3. The turtle backbone does not allow for as
   much movement as the backbone of the fish.
   You can see that the fish backbone is divided
   into smaller and more divisions than the back-
   bone of the turtle, allowing the backbone to
   bend in more places.
4. Frogs and turtles have 4 legs. Frogs have large
   webbed feet for swimming.

Section 14-2 Review and Reinforce (p. 211)
1. To get oxygen from water
2. Both are made of cartilage.
3. jawless fishes, cartilaginous fishes (sharks and
   rays), bony fishes
4. external
5. A swim bladder helps a fish stabilize its body
   at different depths.
6. Answers may vary. Sample: limiting fishing
   through quotas; growing fish in fish farms
7. cartilaginous
8. ectotherms
9. true
10. true
11. swim bladder
12. buoyant force

Section 14-2 Enrich (p. 212)
1. lungs
2. oil
3. no control
4. swim bladder
5. The deep ocean. A fish with lungs must swim
to the surface to get air. A deep-sea fish would
not be able to do this. For a deep-sea fish, a
swim bladder would be more useful.
6. An oxygen poor pond. A fish with lungs could
live in water that did not contain very much
oxygen by gulping air at the surface.
7. Near the surface of the ocean. A fish without a method to maintain buoyancy would have to swim constantly to stay afloat.

Section 14-3 Review and Reinforce (p. 215)

1–3.

4. frogs and toads, salamanders. As adults, frogs and toads have four legs. The hind legs are adapted for jumping. They breathe with lungs and most are predators. Toads have dry, warty skins. Frogs' skins are moist and smooth. Adult frogs and toads lay eggs in water that hatch into larvae called tadpoles. Tadpoles live in water, breathe with gills, and are generally vegetarian. They gradually develop legs and lungs and become adult frogs.

An adult salamander has four legs adapted for walking, moist skin, lungs, and a tail. Salamanders are predators. Reproduction is similar to frogs and toads, but most have internal fertilization, while frogs and toads have external fertilization.

5. One reason is the loss of habitat. Another reason is that amphibians are particularly sensitive to pollution because their skins are thin and their eggs lack hard shells. Human-caused pollution is becoming more common.

6. Amphibians have strong skeletons and muscular limbs adapted for moving on land.

7. Amphibians are ectothermic vertebrates. They have three-chambered hearts. Their life cycle includes three stages—eggs laid in water hatch into swimming, gilled tadpoles which metamorphose into air-breathing adults with legs.

8. specific environment in which an animal lives

9. upper chamber of heart; receives blood

10. lower chamber of heart; pumps blood out

Section 14-3 Enrich (p. 216)

1. Enough water would have to move through the membrane for the concentration of the water on either side to be equal.

2. Water would move out of the toad into the soil.

3. If the toad were to urinate, it would: (1) lose the salts it needs to keep its water concentration lower than that of the surrounding soil, and (2) it would expel water in its urine. Both of these results would cause the toad to dry out.

Section 14-4 Review and Reinforce (p. 219)

1. C, F, H

2. G

3. D

4. A

5. B, E

6. Reptiles are ectothermic vertebrates with thick skins. They breathe with lungs and have four-chambered hearts and two-loop circulatory systems. Most lay thick-shelled eggs. The major groups of reptiles are lizards, snakes, turtles, and alligators and crocodiles. Most reptiles are predators.

7. Urine is a fluid of concentrated wastes that helps an animal reduce water loss.

Section 14-4 Enrich (p. 220)

1. Serpentine motion. The snake could push off the grass quickly. Moving like a caterpillar would be slow.

2. If the snake used serpentine motion, its head would move side to side. The snake would probably use linear motion because it would be less likely to be seen by the rabbit.

3. The snake would have to use serpentine motion because deep water wouldn't have any surface for its belly scales to grip. It could push off of water, as a fish pushes water with its fins.

Section 14-5 Review and Reinforce (p. 223)

1. Sedimentary rocks are formed when layers of sediment such as mud or sand undergo a hardening process.
2. Answers may vary. Samples: They learn about the relationships between organisms; they learn when the present-day organisms might have developed.

3. The relative age of a fossil can be determined from its position in the rock. Usually, lower layers are older. Absolute age can be determined by measuring radioactive elements that have decayed.

4. Fossil B is older because it is in older rock. This is so because the rock on top was formed from layers of sediment that were deposited later.

5. paleontologist

6. fossil

7. sedimentary rock

Section 14-5 Enrich (p. 224)

1. Yes, 410 and 470 million years.
2. The 410- and 470-million-year-old layers are both similar to layer A.
3. Layer A: 410 million years old
   Layer B: 370 million years old
   Layer C: 300 million years old
4. Layer D is younger than layer C.

Chapter 14 Real-World Lab (pp. 225–226)
For answers, see Teacher’s Edition, p. 444.

Chapter 14 Skills Lab (pp. 227–229)

Chapter 15

Chapter 15 Project Worksheet 1 (p. 234)
1. Answers may vary. Examples of birds with widespread distribution in the U.S. include house sparrow, cardinal, blue jay, starling, house wren, and mourning dove.
2–5. Answers will vary.

Chapter 15 Project Worksheet 2 (p. 235)
1–3. Answers will vary.

Section 15-1 Review and Reinforce (p. 239)

1. Answers may vary. Samples: endothermic, feathers, four-chambered heart, lay eggs
2. Answers may vary. Samples: wings, feathers, hollow bones, strong chest muscles, air sacs
3. Steering and balancing in flight (contour feathers); keeping warm (down feathers)
4. The heart has four chambers—two atria and two ventricles. The circulatory system has two loops. One loop carries blood from the heart to the lungs. The other loop carries blood from the heart to the rest of the body.
5. Answers may vary. Samples: A woodpecker’s bill enables it to find insects by chiseling holes into trees. The bill of a spoonbill enables it to feed on small animals in water.

Section 15-1 Enrich (p. 240)

1. Answers may vary. Sample:

<table>
<thead>
<tr>
<th>Bird</th>
<th>Feet shape</th>
<th>Wing size and shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>anhinga</td>
<td>webbed</td>
<td>large</td>
</tr>
<tr>
<td>turkey vulture</td>
<td></td>
<td>large and wide*</td>
</tr>
<tr>
<td>chimney swift pileated woodpecker evening grosbeak</td>
<td>small*</td>
<td>small and narrow medium</td>
</tr>
<tr>
<td>evening grosbeak</td>
<td>small</td>
<td>medium</td>
</tr>
</tbody>
</table>

*This information can't be determined from the drawing.
2. Answers may vary. Students’ inferences should be supported by an observed characteristic. Sample answers: A. The Anhinga lives in or near water because it has webbed feet. B. The turkey vulture glides and soars because it has large and heavy wings. C. The chimney swift mostly flaps when flying because it has small wings. D. The pileated woodpecker eats insects that it finds through digging into dead wood with its long, narrow, and strong bill. E. The evening grosbeak eats seeds with its heavy, powerful bill.

Section 15-2 Review and Reinforce (p. 243)
1. Lower air pressure

2. Air molecules pushing
3. The faster air moves, the less pressure it exerts.
4. Flapping uses a lot of energy. Gliding and soaring don’t use much energy.
5. A fast-flying bird. Since fast-moving air exerts less pressure than air that is moving slowly, the air above the wing exerts less pressure than the air beneath the wing, producing lift. The faster air moves the less pressure it exerts. The difference in air pressure between the top and bottom of the wing is greater when the bird flies faster than when it flies slower, so lift is greater.
6. An upward force that causes a bird or other object to rise; caused by lower air pressure on top of a wing than beneath the wing.

Section 15-2 Enrich (p. 244)
1. The “A” side faced down. Yes, it faced down on the upstroke, too.
2. The “A” side faced down. No, on the backward stroke, the “B” side faced down.
3. Answers may vary. Sample: Hovering would allow the hummingbird to feed in midair and quickly fly between flowers to feed. If a hummingbird couldn’t hover, it might have to land on the flower to feed, but that might cause the bird and flower to fall from the bird’s weight.

Section 15-3 Review and Reinforce (p. 247)
1. Answers may vary. Samples: endothermic, hair, four-chambered heart, young fed on mother’s milk
2. It is probably cold.
3. The lungs
4. Answers may vary. Sample: Mammals have a four-chambered heart and a two-loop circulatory system.
5. Answers may vary. Sample: You can infer what it eats.
6. Canine
7. Incisor
8. Molar/premolar
9. diaphragm
10. mammary gland
11. mammal

Section 15-3 Enrich (p. 248)

<table>
<thead>
<tr>
<th>Nostril?</th>
<th>Eye?</th>
<th>Extra opening?</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>B</td>
<td>yes</td>
<td>no</td>
</tr>
<tr>
<td>C</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

1. Specimens A and C are mammals or “mammal-like reptiles,” because they have the extra opening. Specimen 2 does not look like a close relative of mammals.
2. In specimens A and C, there are big differences in the shapes of the teeth in different parts of the mouth. Incisors, canines, and teeth that could be either molars or premolars are visible. Specimen B doesn’t have that characteristic— the teeth are all the same shape.

Note: For the information of interested students, the animals figured are:
Fig. 1. Dimetrodon, a “mammal-like reptile”
Fig. 2.A Ptilocerus, an extinct tree shrew, a mammal
Fig. 2.B Palaeothyris, an extinct reptile
Fig. 2.C Thrinaxodon, an extinct “mammal-like reptile.”
Section 15-4 Review and Reinforce  
(p. 251)

1. placenta  
2. monotreme  
3. placental mammal  
4. gestation period  
5. marsupial

Section 15-4 Enrich  
(p. 252)

1. Ratios of out-lever arms to in-lever arms
   - Figure 2 — 19 : 4 = 4.75
   - Figure 3 — 13 : 4 = 3.25
   - Figure 4 — 18 : 3 = 6
   - Figure 5 — 17 : 4 = 4.25
   (Accept any reasonable approximation.)

2. The animal in Figure 2 is probably faster because its out-lever arm/in-lever arm ratio is greater.

3. The animal in Figure 4 is probably faster because its out-lever arm/in-lever arm ratio is greater.

4. The animal in Figure 5 is probably more powerful because its out-lever arm/in-lever arm ratio is smaller.

5. In Figures 2 and 3, the in-lever arms and out-lever arms are on opposite sides of the fulcrum. In Figures 4 and 5, they are on the same side.

Chapter 15 Skills Lab  
(pp. 253–255)
For answers, see Teacher’s Edition, pp. 474–475.

Chapter 15 Real-World Lab  
(pp. 256–257)
For answers, see Teacher’s Edition, p. 489.