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BIOLOGY

*The
Dynamics
of Life*

Reviewing Biology

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BIOLOGY: THE DYNAMICS OF LIFE



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To the Teacher

Reviewing Biology provides one page of multiple choice questions for each chapter of ***Biology: The Dynamics of Life***. The questions test students' mastery of chapter concepts. Each page of questions is followed by an Answers and Explanations page containing answers to the questions, explanations and feedback on the topic, and a text reference where additional information on the topic can be found. Students can use these pages as a self-check and guide for further study. Each question has been correlated to the National Science Education Standards. Those standards can be found at the end of each text reference on the Answers and Explanations page. A chart on pages *vi-vii* shows the complete correlation. An optional answer key master can be found on page 79.

NATIONAL SCIENCE EDUCATION STANDARDS

Science Content Standards for Grades 9–12

The *National Science Education Standards*, published by the National Research Council and representing the contributions of thousands of educators and scientists, offer a comprehensive vision of a scientifically literate society. The standards not only describe what students should know but also offer guidelines for biology teaching and assessment.

Correlations on each answer page in this booklet show the close alignment between the content standards and the review questions. Correlations are designated according to the numbering system in the table of science content standards shown below.

NATIONAL SCIENCE CONTENT STANDARDS

<p>Unifying Concepts and Processes</p> <p>UCP.1 Systems, order, and organization</p> <p>UCP.2 Evidence, models, and explanation</p> <p>UCP.3 Change, constancy, and measurement</p> <p>UCP.4 Evolution and equilibrium</p> <p>UCP.5 Form and function</p> <p>Science as Inquiry</p> <p>A.1 Abilities necessary to do scientific inquiry</p> <p>A.2 Understandings about scientific inquiry</p> <p>Physical Science</p> <p>B.1 Structure of atoms</p> <p>B.2 Structure and properties of matter</p> <p>B.3 Chemical reactions</p> <p>B.4 Motions and forces</p> <p>B.5 Conservation of energy and increase in disorder</p> <p>B.6 Interactions of energy and matter</p> <p>Life Science</p> <p>C.1 The cell</p> <p>C.2 Molecular basis of heredity</p> <p>C.3 Biological evolution</p> <p>C.4 Interdependence of organisms</p> <p>C.5 Matter, energy, and organization in living systems</p> <p>C.6 Behavior of organisms</p>	<p>Earth and Space Sciences</p> <p>D.1 Energy in the earth system</p> <p>D.2 Geochemical cycles</p> <p>D.3 Origin and evolution of the earth system</p> <p>D.4 Origin and evolution of the universe</p> <p>Science and Technology</p> <p>E.1 Abilities of technological design</p> <p>E.2 Understandings about science and technology</p> <p>Science in Personal and Social Perspectives</p> <p>F.1 Personal and community health</p> <p>F.2 Population growth</p> <p>F.3 Natural resources</p> <p>F.4 Environmental quality</p> <p>F.5 Natural and human-induced hazards</p> <p>F.6 Science and technology in local, national, and global challenges</p> <p>History and Nature of Science</p> <p>G.1 Science as a human endeavor</p> <p>G.2 Nature of scientific knowledge</p> <p>G.3 Historical perspectives</p>
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Correlation of *Reviewing Biology* to National Science Education Standards Grades 9–12

Chapter	Standard
1 Biology: The Study of Life	UCP.1–UCP.4, A.1, A.2, B.2, C.4, C.5, E.1, G.1, G.2
2 Principles of Ecology	UCP.1–UCP.3, A.2, B.1–B.3, C.1, C.4–C.6, D.2, G.2
3 Communities and Biomes	UCP.1, UCP.3, UCP.5, A.2, B.3, C.1, C.4, C.5, F.4, G.2
4 Population Biology	UCP.1–UCP.4, C.4–C.6, F.2, F.4, G.2
5 Biological Diversity and Conservation	UCP.1, UCP.2, B.3, C.4, C.5, F.2–F.5, G.2, G.3
6 The Chemistry of Life	UCP.5, A.1, A.2, B.1–B.3, B.6, C.5
7 A View of the Cell	UCP.2, UCP.4, UCP.5, A.1, B.2, C.1, C.5, E.1, E.2, G.3
8 Cellular Transport and the Cell Cycle	UCP.3–UCP.5, A.2, B.6, C.1, C.5, F.1
9 Energy in a Cell	UCP.5, B.2, B.3, B.6, C.1, C.5, G.2
10 Mendel and Meiosis	UCP.2, C.1, C.2, F.1, G.2, G.3
11 DNA and Genes	UCP.1, UCP.5, A.1, C.1, C.2, C.5, F.1, G.2
12 Patterns of Heredity and Human Genetics	UCP.2, UCP.3, C.2, C.5, F.1, G.1, G.2
13 Genetic Technology	UCP.2, C.2, E.1, E.2, G.1, G.2
14 The History of Life	UCP.2, UCP.3, B.2, C.1, C.3, C.5, D.3, E.2, G.1–G.3
15 The Theory of Evolution	UCP.2, UCP.4, UCP.5, C.3, C.4, F.2, G.3
16 Primate Evolution	UCP.1, UCP.2, UCP.4, UCP.5, A.2, C.3, C.6, E.2, G.2, G.3
17 Organizing Life’s Diversity	UCP.1, UCP.2, UCP.4, A.1, A.2, C.1, C.3, C.5, C.6, G.1–G.3
18 Viruses and Bacteria	UCP.5, C.1, C.2, C.6, F.1, F.4, G.2
19 Protists	UCP.1, UCP.5, A.1, C.5, C.6, G.2

Chapter	Standard
20 Fungi	UCP.5, C.4–C.6, G.2
21 What Is a Plant?	UCP.1, UCP.2, UCP.4, UCP.5, A.1, C.1, C.3, C.5, G.2, G.3
22 The Diversity of Plants	UCP.1, UCP.3, UCP.5, C.4–C.6, G.2
23 Plant Structure and Function	UCP.5, A.1, C.1, C.5, C.6, G.2
24 Reproduction in Plants	UCP.3, UCP.5, C.5, C.6, G.2
25 What Is an Animal?	UCP.1, UCP.3–UCP.5, A.1, A.2, C.3, C.5, G.3
26 Sponges, Cnidarians, Flatworms, and Roundworms	UCP.1, UCP.3, UCP.5, A.1, C.1, C.3, C.5, C.6, G.2
27 Mollusks and Segmented Worms	UCP.1, UCP.5, A.2, C.4–C.6, F.3, G.2
28 Arthropods	UCP.1, UCP.3, UCP.5, C.5, C.6, G.2
29 Echinoderms and Invertebrate Chordates	UCP.5, C.4–C.6, G.2
30 Fishes and Amphibians	UCP.1–UCP.3, UCP.5, A.1, C.3, C.5, C.6
31 Reptiles and Birds	UCP.2, UCP.4, UCP.5, C.3, C.5, C.6, G.2, G.3
32 Mammals	UCP.3–UCP.5, A.1, C.3, C.5, C.6, G.2, G.3
33 Animal Behavior	UCP.1, UCP.3, C.5, C.6, G.2
34 Protection, Support, and Locomotion	UCP.5, C.1, C.5, C.6, F.1, G.2
35 The Digestive and Endocrine Systems	UCP.1, UCP.5, B.3, C.1, C.5, F.1
36 The Nervous System	UCP.1, UCP.3, UCP.5, C.1, C.5, F.1, F.5
37 Respiration, Circulation, and Excretion	UCP.1, UCP.5, C.1, C.5, F.1
38 Reproduction and Development	UCP.3, UCP.5, C.1, C.5, F.1
39 Immunity from Disease	UCP.2, UCP.3, UCP.5, A.2, C.1, C.5, C.6, F.1, F.5, G.1–G.3

- 1 An organism is affected by interactions with which of the following?
- A Other organisms of the same species
 - B Other organisms of different species
 - C The natural environment
 - D All of the above
- 2 A group of organisms that can interbreed and produce fertile offspring is called a(n) —
- A family.
 - B species.
 - C organization.
 - D community.
- 3 Inside the human body, heat is constantly generated as a byproduct of chemical reactions. Humans must be able to release heat to the environment. This adaptation is necessary for maintaining —
- A energy.
 - B organization.
 - C homeostasis.
 - D locomotion.
- 4 Sugar dissolves in, or mixes completely with, water. The solubility of a substance in water is determined by measuring the maximum amount of the substance that dissolves in a given amount of water at a given temperature. Hypothesis: The solubility of sugar in water increases as the temperature of the water decreases. Identify the independent variable and the dependent variable that you would use to test this hypothesis.
- A Dependent variable—volume of water; independent variable—water temperature
 - B Dependent variable—water temperature; independent variable—amount of sugar that dissolves
 - C Dependent variable—amount of sugar that dissolves; independent variable—water temperature
 - D Dependent variable—amount of sugar that dissolves; independent variable—mineral content of the water
- 5 Which of the following tools would you need to carry out the experiment in question 4?
- A Thermometer
 - B Metric balance
 - C Graduated cylinder
 - D All of the above
- 6 A scientist performs a series of experiments to confirm an idea regarding cellular metabolism. The results of her experiments support her initial idea, and after conferring with colleagues, she discovers that evidence from many experiments has supported the same idea. This idea now can be considered a(n) —
- A theory.
 - B hypothesis.
 - C observation.
 - D control.
- 7 Which of the following procedures is considered a scientific method?
- A Collecting data
 - B Making a hypothesis
 - C Observing
 - D All of the above
- 8 To simplify the results of an experiment, many researchers hold all variables constant except for one. They then compare the results with respect to that one variable. This type of experiment is known as a —
- A variable experiment.
 - B multi-factor experiment.
 - C controlled experiment.
 - D None of the above
- 9 Which of the following units is part of the International System of Measurement (SI)?
- A Pound
 - B Inch
 - C Meter
 - D Gallon
- 10 A scientist uses graphs, tables, and charts to publish the results of his research. What type of research was he probably performing?
- A Descriptive research
 - B Quantitative research
 - C Qualitative research
 - D None of the above

1 D

Organisms depend upon other living things as well as nonliving things in the environment. *More about interactions within nature can be found on page 5 of this chapter. National Science Education Standards C.4*

2 B

A species is a group of organisms that can reproduce to create fertile offspring. *More about the reproduction of living things can be found on page 7 of this chapter. National Science Education Standards C.5*

3 C

Homeostasis is the regulation of an organism's internal environment to preserve conditions conducive to life. Temperature regulation is one form of homeostasis in human beings. *More about homeostasis can be found on page 9 of this chapter. National Science Education Standards UCP. 4, C.5*

4 C

The dependent variable is the amount of sugar that dissolves, and the independent variable is water temperature. As you lower the temperature of the water, more sugar should dissolve in the water. *More about identifying experimental variables can be found on pages 12–17 of this chapter. National Science Education Standards UCP.2, B.2, G.2*

5 D

You would need a thermometer to measure water temperature, a balance to mass the sugar, and a graduated cylinder to measure the water volume. *More about the tools of science can be found on page 14 of this chapter. National Science Education Standards UCP.3, E.1*

6 A

A theory is a hypothesis that has been supported by extensive scientific research and evidence. *More about scientific theories can be found on pages 17–18 of this chapter. National Science Education Standards UCP.2, G.2*

7 D

Scientific methods involve observing, developing hypotheses, collecting data, publishing results, and forming theories. *More about scientific methods can be found on pages 11–21 of this chapter. National Science Education Standards UCP.2, A.1*

8 C

A controlled experiment is one in which a group in which all conditions remain the same is compared to a group in which one variable has been changed. By comparing a controlled group and an experimental, or changed, group, the effect of a changed variable can be determined. *More about controlled experiments can be found on pages 13–14 of this chapter. National Science Education Standards UCP.2, UCP.3, A.2, G.2*

9 C

The SI is a decimal system consisting of meters, grams, liters, seconds, and degrees Celsius. *More about the SI can be found on pages 20–21 of this chapter. National Science Education Standards UCP.1, UCP.3, A.2*

10 B

Quantitative research results in numerical data that can be displayed easily as charts, graphs, and tables. *More about types of research can be found on pages 15 and 19 of this chapter. National Science Education Standards UCP.2, UCP.3, G.1*

- 1 Ecology is the study of relationships among —
A living things only.
B living and nonliving things.
C nonliving things only.
D None of the above
- 2 The portion of Earth that supports the existence of living things is called the —
A ecosystem.
B habitat.
C biosphere.
D niche.
- 3 Which of the following is a biotic factor that might affect the life of a water-dwelling organism?
A Temperature of the water
B Speed of water current
C Pollutants in water
D Bacterial population in water
- 4 Which level of organization encompasses all of the others?
A Ecosystem
B Community
C Population
D Division
- 5 Which of the following has NOT been described as a major kind of ecosystem?
A Terrestrial
B Aerial
C Freshwater
D Marine
- 6 Which of the following is NOT consumed by fungal decomposers?
A First-order heterotrophs
B Third-order heterotrophs
C Producers
D None of the above
- 7 Which ecological pyramid best explains why food chains are typically only three or four links long?
A Pyramid of biomass
B Pyramid of energy
C Pyramid of numbers
D None of the above
- 8 How does the amount of water on Earth change as a result of the water cycle?
A It always increases
B It alternately increases and decreases
C It remains constant
D It always decreases
- 9 In the carbon cycle, in what form are carbon atoms generally returned to the atmosphere?
A Simple sugars
B Carbon monoxide
C Methane
D Carbon dioxide
- 10 Which of the following things does NOT allow plants to obtain atmospheric nitrogen in a more usable form?
A Photosynthesis
B Lightning
C Symbiotic bacteria
D Chemical fertilizers

1 B

Ecology is defined as the study of interactions among organisms and their environments. *More about the study of ecology can be found on pages 35–36 of this chapter. National Science Education Standards C.4, G.2*

2 C

The biosphere spans the region between the upper atmosphere and the bottom of the ocean. Within this region, living things can exist; outside the biosphere, conditions are not conducive to life. *More about the biosphere can be found on page 36 of this chapter. National Science Education Standards UCP.1, C.5, G.2*

3 D

Biotic factors include all the living organisms that inhabit an environment. Bacteria are living organisms and are considered biotic factors. *More about biotic and abiotic factors can be found on pages 37–41 of this chapter. National Science Education Standards C.4*

4 A

The highest level of organization within the biosphere is the ecosystem. An ecosystem consists of the interactions between a community and its abiotic surroundings. *More about the levels of ecological organization can be found on pages 38–40 of this chapter. National Science Education Standards UCP.1, C.4, C.5, G.2*

5 B

Three major types of ecosystems are terrestrial, freshwater, and salt water or marine. *More about ecosystems can be found on page 41 of this chapter. National Science Education Standards UCP.1, A.2, C.5*

6 D

Bacteria and fungi are capable of decomposing all organisms after they die. Therefore, all trophic levels of organisms are consumed by decomposers. *More about how organisms obtain energy can be found on pages 47–50 of this chapter. National Science Education Standards A.2, B.3, C.6*

7 B

Pyramids of energy illustrate that the energy contained in each trophic level decreases as trophic level increases. After three or four links, little energy remains in the pyramid. *More about ecological pyramids can be found on pages 48–53 of this chapter. National Science Education Standards UCP.2, A.2, B.2, C.5*

8 C

The water cycle describes the recycling of water molecules. Water is neither created nor destroyed in the cycle. Thus, the amount of water remains constant throughout the cycle. *More about the water cycle can be found on pages 53–54 of this chapter. National Science Education Standards UCP.3, B.1, D.2*

9 D

Carbon is generally returned to the atmosphere in the form of carbon dioxide. For example, carbon dioxide is released when organisms exhale and when fossil fuels are burned. *More about the carbon cycle can be found on pages 54–55 of this chapter. National Science Education Standards A.2, B.1, D.2*

10 A

Nitrogen is converted to more usable forms by lightning and by bacteria. In addition, chemical fertilizers are composed of usable nitrogen. *More about the nitrogen cycle can be found on page 56 of this chapter. National Science Education Standards A.2, B.1, C.1, D.2*

- 1 Which of the following might be a limiting factor in an organism's survival?
- A Temperature
 - B Food availability
 - C Abundance of predators
 - D All of the above
- 2 Certain bacteria are able to thrive in extremely acidic environments where most organisms could not survive. This is an example of different organisms having different —
- A tolerances.
 - B biotic factors.
 - C abiotic factors.
 - D None of the above
- 3 Which of the following is NOT true of succession?
- A It is predictable.
 - B It is gradual.
 - C It is orderly.
 - D It is random.
- 4 Before many plants can inhabit a rocky area, soil must be present. A pioneer species must start the process of soil formation for succession to take place. Which of the following would be a pioneer species in a rocky area?
- A Insect
 - B Lichen
 - C Weed
 - D Fern
- 5 After a community is disrupted by large-scale events, such as forest fires, a new community is established through the process of —
- A primary succession.
 - B secondary succession.
 - C soil formation.
 - D None of the above
- 6 Within aquatic biomes, there are many different environments where different types of organisms thrive. In general, aquatic biomes are divided into photic and aphotic zones. Which of the following determines whether a zone is photic or aphotic?
- A Distance from land
 - B Distance from equator
 - C Water depth
 - D All of the above
- 7 Terrestrial biomes are classified based on the types of organisms that develop within them. The organisms that make up a biome share the same type of —
- A biosphere.
 - B ecosystem.
 - C pioneer community.
 - D climax community.
- 8 Permafrost is characteristic of which biome?
- A Tundra
 - B Marine
 - C Desert
 - D Taiga
- 9 Which terrestrial biome houses the greatest biodiversity?
- A Taiga
 - B Temperate forest
 - C Tropical rain forest
 - D Grassland
- 10 Small organisms that live in the photic zone of aquatic biomes are —
- A plankton.
 - B eubacteria.
 - C autotrophic.
 - D heterotrophic.

1 D

A limiting factor is anything, biotic or abiotic, that restricts an organism's ability to survive in its environment. *More about limiting factors can be found on page 65–66 of this chapter. National Science Education Standards C.4, G.2*

2 A

Organisms demonstrate a wide range of tolerance for different environmental conditions. The ability of certain bacteria to withstand extremely acidic conditions illustrates their tolerance for pH fluctuations. *More about tolerance can be found on page 66 of this chapter. National Science Education Standards A.2, C.1, C.5*

3 D

Succession is a highly ordered, predictable process of species replacement. Though it can take a great deal of time to occur, the order in which succession takes place is well understood by scientists. *More about succession can be found on pages 67–69 of this chapter. National Science Education Standards UCP.1, UCP.3, C.4, G.2*

4 B

The first species to inhabit a given area is called a pioneer species. Lichens inhabit rocky areas and when they die, their decaying bodies initiate the first patches of soil. *More about pioneer species can be found on pages 67–69 of this chapter. National Science Education Standards UCP.1, C.5, G.2*

5 B

Secondary succession describes the process of succession on land that already has soil and was previously inhabited. *More about secondary succession can be found on pages 68–69 of this chapter. National Science Education Standards UCP.1, UCP.5, F.4*

6 C

Photic and aphotic zones are defined by the ability of sunlight to penetrate an area. The deeper the water, the less likely that sunlight will penetrate it. *More about marine biomes can be found on pages 71–74 of this chapter. National Science Education Standards B.3, C.5, G.2*

7 D

Terrestrial biomes are classified by the type of climax community that is established under different environmental conditions, such as temperature and precipitation. *More about various terrestrial biomes can be found on pages 74–83 of this chapter. National Science Education Standards UCP.1, A.2, C.5, D.1*

8 A

In the tundra, only the topmost layer of soil thaws in the summer. Underneath this soil is a layer of permanently frozen ground. This is called permafrost. *More about the tundra can be found on pages 75–77 of this chapter. National Science Education Standards UCP.5, C.1, C.5, G.2*

9 C

Because of the unique combination of conditions present in the tropical rain forest, this biome offers more biodiversity than any other. *More about tropical rain forests and biodiversity can be found on pages 81–83 of this chapter. National Science Education Standards UCP.1, C.4, C.5, G.2*

10 A

Plankton are the primary organisms present in aquatic biomes. They live in the photic zone and include both autotrophs and heterotrophs. *More about plankton can be found on page 73–74 of this chapter. National Science Education Standards UCP.5, B.3, C.5, G.2*

- 1 Initially, population growth can be illustrated as a J-shaped curve. What is this type of growth called?
- A Sinusoidal
 - B Linear
 - C Exponential
 - D None of the above
- 2 A new species of mouse is introduced into an environment. These mice reproduce and the population grows. As the population grows, food resources diminish and predation by hawks increases. Eventually, the number of mice in the environment levels off so that the rate of birth equals the rate of death. What is this nearly constant number of organisms called?
- A Carrying capacity
 - B Exponential growth
 - C Linear growth
 - D None of the above
- 3 If, after the situation in question 2 is reached, scientists introduce 100 new mice from the same species into the environment, which of the following is most likely to occur in the population of mice?
- A Death rate will decrease.
 - B Death rate will increase.
 - C Exponential growth
 - D Linear growth
- 4 You are studying organisms in an artificial environment. The environment is constantly changing and is unpredictable. What life-history pattern would you expect to be most common in this environment?
- A Rapid reproduction and short life span
 - B Rapid reproduction and long life span
 - C Slow reproduction and short life span
 - D Slow reproduction and long life span
- 5 Which of the following limiting factors is NOT density-dependent?
- A Disease
 - B Drought
 - C Competition
 - D Food supply
- 6 Increased population density often leads to events that reduce the population size. Individual organisms often exhibit symptoms of stress in this situation. These symptoms include —
- A increased aggression.
 - B increased infertility.
 - C increased susceptibility to disease.
 - D All of the above
- 7 Which of the following is NOT studied by demographers?
- A Growth rate
 - B Age structure
 - C Geographic distribution
 - D None of the above
- 8 In analyzing the age structure of a population, you discover that an extraordinarily high percentage of the population is younger than the age of reproductive maturity. What kind of growth will the population probably experience in the future?
- A Growth rate will remain the same.
 - B Slow, steady growth increase
 - C Rapid growth
 - D None of the above
- 9 Drastic fluctuations above and below the carrying capacity are most likely to be seen in a population demonstrating which of the following life-history patterns?
- A Slow growth
 - B Population independent
 - C Rapid growth
 - D The pattern cannot be determined by the information given.
- 10 What are forest fires, temperature fluctuations, and floods all examples of?
- A Biotic, density-dependent factors
 - B Biotic, density-independent factors
 - C Abiotic, density-dependent factors
 - D Abiotic, density-independent factors

1 C

A J-shaped curve is indicative of exponential growth. It is characteristic of the initial growth of a population. *More about the rate of population growth can be found on pages 92–93 of this chapter. National Science Education Standards UCP.1, UCP.3, C.4, G.2*

2 A

Carrying capacity is defined as the size of the population of organisms of one species that can be supported by the environment. The mice establish an equilibrium around this number of individuals. *More about carrying capacity can be found on pages 93–94 of this chapter. National Science Education Standards UCP.3, C.4, F.2*

3 B

When the population exceeds the carrying capacity, death rate will increase until the population size decreases enough to be supported by the environment. *More about the limits of an environment can be found on pages 93–94 of this chapter. National Science Education Standards UCP.3, C.4, G.2*

4 A

In unpredictable, rapidly changing environments, organisms tend to have a life-history that is characterized by small body size, rapid maturation, early reproduction, and short life span. *More about patterns of population growth can be found on pages 93–96 of this chapter. National Science Education Standards UCP.3, C.4, C.5, F.2*

5 B

Drought is a density-independent factor because it does not depend on population size. It is equally likely to be experienced by all types of populations. *More about limiting factors of population growth can be found on page 97 of this chapter. National Science Education Standards C.4, F.2*

6 D

Stress for many organisms is characterized by increased aggression, decreased parental care, decreased fertility, and decreased resistance to disease. *More about the effects of crowding on populations can be found on page 99 of this chapter. National Science Education Standards C.6, F.2*

7 D

Demography is the study of population growth characteristics, including growth rate, age structure, and geographic distribution. *More about demography can be found on page 100 of this chapter. National Science Education Standards UCP.3, F.2*

8 C

The age structure of a population is helpful in predicting future patterns of growth. If a population is composed primarily of younger individuals, it can be expected that these individuals will soon mature and reproduce, causing a period of rapid population growth. *More about age structure can be found on pages 102–103 of this chapter. National Science Education Standards UCP.2, UCP.3, C.4*

9 C

Rapid life-histories can affect drastic fluctuations around the carrying capacity, while slow life-histories result in populations that maintain a relatively constant level near the carrying capacity. *More about patterns of population growth can be found on pages 93–96 of this chapter. National Science Education Standards UCP.3, UCP.4, F.2*

10 D

Forest fires, temperature fluctuations, and floods affect all populations, and thus they are density-independent. In addition, these are abiotic—or non-living—environmental factors. *More about limiting factors of population growth can be found on page 97 of this chapter. National Science Education Standards UCP.3, F.2, F.4*

- 1 Which country would you expect to have the greatest biodiversity?
A Ecuador
B United States
C England
D Norway
- 2 You are studying a chain of islands in the Pacific Ocean. They all have similar climates, but some are larger than others. The largest island will probably offer the most —
A biodiversity.
B niches.
C Both A and B
D Neither A nor B
- 3 Cyclosporine, an antirejection drug given to people with organ transplants, was originally isolated from —
A willow bark.
B penicillium mold.
C a soil fungus.
D rosy periwinkle.
- 4 When the number of organisms within a species drops to a level so low that extinction is possible, what is the species called?
A Endangered
B Threatened
C Degraded
D Minimal
- 5 Which of the following best describes the result of habitat fragmentation?
A Increased biodiversity
B Decreased biodiversity
C No effect on biodiversity
D Decreased water and land pollution
- 6 The different conditions that arise along the boundaries of an ecosystem are called an edge effect. Which of the following is most likely to cause an increase in the edge effect in an ecosystem?
A Habitat fragmentation
B Acid precipitation
C Habitat corridors
D All of the above
- 7 Some forms of pollution cause the soil within an ecosystem to become less fertile by removing its nutrients. Which of the following forms of pollutants is responsible for this loss of soil fertility?
A Chlorofluorocarbons
B Sulfur dioxide
C DDT
D Salt
- 8 Which of the following most seeks to preserve habitats?
A The U.S. Endangered Species Act of 1973
B The Convention of International Trade in Endangered Species
C Reintroduction programs
D Establishment of national parks
- 9 Strips of land that allow the organisms to migrate from one area to another are called —
A habitat corridors.
B habitat fragments.
C ecosystem bridges.
D environmental pathways.
- 10 Which of the following species was NOT saved from extinction by being kept in captivity?
A Ginkgo tree
B California condor
C Brown pelican
D Black-footed ferret

1 A

Biodiversity tends to increase as one moves toward the equator. The ecosystem that houses the greatest amount of biodiversity is the tropical rain forest. *More about biodiversity can be found on pages 111–112 of this chapter. National Science Education Standards UCP.2, C.5, F.3*

2 C

Larger islands contain more biodiversity because they offer more opportunities for unique niches to develop. *More about trends in biodiversity can be found on pages 112 and 117 of this chapter. National Science Education Standards C.5, F.3, G.2, G.3*

3 C

Quinine was isolated from the bark of the cinchona tree and was found to have antimalarial properties. *More about the medical importance of biodiversity can be found on page 114 of this chapter. National Science Education Standards C.5, F.5*

4 A

A species is classified as endangered when its population becomes so low that extinction is possible. *More about the loss of biodiversity can be found on pages 115–116 of this chapter. National Science Education Standards C.4, F.2*

5 B

When a habitat is fragmented, it is split into smaller islands. This results in a loss of biodiversity because smaller islands support fewer species. *More about habitat fragmentation can be found on page 117 of this chapter. National Science Education Standards UCP.1, C.5, F.4*

6 A

Habitat fragmentation creates more boundaries within an ecosystem, thus increasing the edge effect. *More about the edge effect can be found on pages 117–118 of this chapter. National Science Education Standards UCP.1, C.5, F.4*

7 B

The burning of coal releases sulfur dioxide, which results in acid precipitation. This acidic water leaches essential nutrients from the soil, decreasing its fertility. *More about habitat degradation can be found on page 118 of this chapter. National Science Education Standards B.3, C.5, F.4*

8 D

In order to protect entire ecosystems, governments create national parks, such as Yellowstone National Park. *More about preserving habitats can be found on page 122 of this chapter. National Science Education Standards C.4, C.5, F.3*

9 A

Habitat corridors connect protected areas in order to facilitate migration of organisms between them. *More about habitat preservation can be found on page 123 of this chapter. National Science Education Standards C.4, C.5, F.4*

10 C

The brown pelican was not held in captivity. Instead, the populations of brown pelicans were restored by transporting wild birds from other habitats. *More about reintroduction programs can be found on pages 124–125 of this chapter. National Science Education Standards C.4, F.5*

- 1 A particle is found to have 8 protons, 10 electrons, and 10 neutrons. What is it?
A Oxygen-20
B Oxygen-20 ion with a -2 charge
C Oxygen-18
D Oxygen-18 ion with a -2 charge
- 2 An aqueous solution of compound X has a pH of 12. Which of the following is a possible identity of compound X?
A HCl
B Na
C KOH
D H₂O
- 3 The early atmosphere lacked an ozone layer to protect early life forms from the sun's harmful UV rays. Which property of water would allow life to continue under these unfavorable conditions?
A Water is polar, allowing it to dissolve other polar substances.
B Water contains the oxygen necessary for life.
C Water expands when it freezes, which allows a protective layer of ice to form at the surface of a body of water.
D All of the above
- 4 How does temperature affect the rate of diffusion?
A An increase in temperature causes faster diffusion by increasing the speed of molecular movement.
B An increase in temperature causes faster diffusion by decreasing the speed of molecular movement.
C An increase in temperature causes slower diffusion by eliminating Brownian movement.
D An increase in temperature has no effect on the rate of diffusion.
- 5 A polymer most closely resembles —
A a circle.
B a link in a chain.
C a chain.
D an intersection.
- 6 Different organisms store glucose in various forms. You discover a new species, and upon chemical analysis find that it is comprised of significant amounts of glycogen. To which of the following organisms is this new species probably closely related?
A Fern
B Potato
C Dog
D Sea horse
- 7 Which of the following is NOT true of lipids?
A They are commonly called fats and oils.
B They are hydrophobic.
C They are good for energy storage.
D They are polar.
- 8 Which of the following is NOT true of trace elements?
A They are obtained from foods.
B They are found in very small quantities.
C They are nonessential to most organisms.
D None of the above
- 9 Which of the following can NOT occur during a chemical reaction?
A New atoms can be made.
B Bonds between atoms can be broken.
C New molecules can be made.
D Bonds between atoms can be formed.
- 10 Which of the following is true of enzymes?
A They act on nonspecific, randomly chosen substrates.
B After a reaction, they cannot be reused.
C They can speed up metabolic processes in the body.
D They cannot change shape.

1 D

A particle with 8 protons must be oxygen. Since it has two more electrons than protons, it is an ion with a -2 charge. Finally, with 8 protons and 10 neutrons, it is an isotope of oxygen with a mass number of 18. *More about atoms and isotopes can be found on pages 142–144 of this chapter. National Science Education Standards B.1*

2 C

A pH of 12 indicates that compound X is basic. Potassium hydroxide (KOH) forms hydroxide ions (OH^-) in water. Thus, KOH is also basic. *More about acids and bases can be found on pages 150–151 of this chapter. National Science Education Standards B.2*

3 C

Because ice is less dense than water, it will float on top of liquid water. Thus, a layer of ice could have protected the evolving life forms that existed in the water beneath it by screening out UV rays. *More about the properties of water can be found on pages 152–153 of this chapter. National Science Education Standards B.2, B.6*

4 A

Increasing the temperature of molecules increases the kinetic energy of those molecules. Higher kinetic energy results in more rapid molecular movement, thus increasing the rate of diffusion. *More about diffusion can be found on pages 154–156 of this chapter. National Science Education Standards A.2, B.6*

5 C

Polymers are large molecules composed of many smaller molecules. These smaller subunits are covalently bonded to form a long chain. *More about molecular chains can be found on page 158 of this chapter. National Science Education Standards B.2*

6 C

Glycogen is a polysaccharide found in the livers of mammals and used to store food. It is similar to starch but more highly branched, and it is a glucose polymer that is formed and degraded in order to regulate glucose levels. *More about carbohydrate storage can be found on pages 158–159 of this chapter. National Science Education Standards A.1, C.5*

7 D

Lipids are nonpolar, hydrophobic molecules that are important for energy storage, insulation, and protection. *More about lipids can be found on page 160 of this chapter. National Science Education Standards B.2, C.5*

8 C

Trace elements, though found at very low concentrations within an organism, are essential for many biological processes. Examples of trace elements are iron, iodine, magnesium, and fluorine. *More about trace elements can be found on page 142 of this chapter. National Science Education Standards C.5*

9 A

Chemical reactions involve the breaking and forming of interatomic bonds. Molecules can be created and degraded. Atoms, however, cannot be created or destroyed. *More about chemical reactions can be found on pages 147–148 of this chapter. National Science Education Standards B.3, C.5*

10 C

Enzymes are proteins that can change the rate of a chemical reaction. They act on specific substrates, such as sucrose, they change shape to fit with a substrate, and they can go on to carry out the same reaction again and again. *More about enzymes can be found on pages 161–163 of this chapter. National Science Education Standards UCP.5, B.3, C.5*

- 1 Which of the following structures is part of the cell's skeleton?
- A Golgi apparatus
 - B Microfilament
 - C Plasma membrane
 - D Mitochondrion
- 2 An environmental toxin is discovered that interferes with certain cellular functions. When affected cells are examined, it is observed that proteins that are normally found on the plasma membrane are instead found in the cytoplasm. Other proteins are located improperly as well. Which of the following structures is most likely affected by the toxin?
- A Lysosome
 - B Mitochondria
 - C Cell wall
 - D Golgi apparatus
- 3 Which of the following is NOT a component of the cell theory?
- A The cell is the basic unit of organization.
 - B All cells contain a nucleus that controls cell division.
 - C All organisms are made up of at least one cell.
 - D All cells come from other, preexisting cells.
- 4 Which of the following would NOT be found in a cell's plastids?
- A Chlorophyll
 - B Starch
 - C Lipids
 - D Glycogen
- 5 Proteins are assembled by which organelles?
- A Ribosomes
 - B Nuclei
 - C Lysosomes
 - D Mitochondria
- 6 Homeostasis is the process of maintaining a cell's environment. This includes the regulation of sodium ion (Na^+) concentration within the cell. If too much Na^+ is inside a cell, how will the concentration be changed?
- A More Na^+ ions will enter the cell through the plasma membrane.
 - B Excess Na^+ ions will leave the cell via osmosis.
 - C Excess Na^+ ions will be transported out through membrane protein channels.
 - D More Na^+ ions will be transported in through membrane protein channels.
- 7 Which of the following instruments allows a scientist to study intracellular structures?
- A Scanning electron microscope
 - B Light microscope
 - C Transmission electron microscope
 - D All of the above
- 8 What part of a phospholipid allows the cell membrane to interact with water in its environment?
- A Glycerol backbone, because it is polar
 - B Phosphate group, because it is polar
 - C Glycerol backbone, because it is nonpolar
 - D Phosphate group, because it is nonpolar
- 9 Which of the following organelles is involved in the digestion of other worn-out organelles?
- A Lysosome
 - B Endosome
 - C Golgi apparatus
 - D Rough endoplasmic reticulum
- 10 Which of the following cells contains a nucleus?
- A Bacterial cell
 - B Plant cell
 - C Prokaryote
 - D Virus

1 B

The Golgi apparatus modifies proteins and mitochondria transform energy, both within the cell. The plasma membrane surrounds the cell and protects it, but is not part of the cytoskeleton itself as microfilaments are. *More about the functions of cell parts can be found on pages 179–187 of this chapter. National Science Education Standards UCP.5, C.1*

2 D

The Golgi apparatus is responsible for modifying and sorting proteins so that they are sent to the proper location. Errors in protein location, therefore, might be caused by malfunction in the Golgi apparatus. *More about the Golgi apparatus can be found on page 182 of this chapter. National Science Education Standards A.1, C.1, C.5*

3 B

This was not a component of the three-part cell theory. In fact, this statement is false. Prokaryotic cells do not contain a membrane-bound nucleus. *More about the cell theory can be found on page 172 of this chapter. National Science Education Standards UCP.2, C.1, C.5, G.3*

4 D

Plastids are plant organelles that are used as storage compartments. They store starches, lipids, and pigments such as chlorophyll. Glycogen is similar to starch but is only found in animal cells. *More about plastids can be found on page 184 of this chapter. National Science Education Standards C.1, C.5*

5 A

The function of ribosomes is to make proteins from RNA. Ribosomes can be found free in the cytoplasm or attached to the endoplasmic reticulum. *More about ribosomes can be found on page 181 of this chapter. National Science Education Standards UCP.5, C.1*

6 C

In order to lower the intracellular concentration of Na⁺ ions, excess Na⁺ ions need to be exported from the cell. Since Na⁺ ions cannot pass freely through the plasma membrane, they must be transported out through membrane protein channels. *More about material transport through the plasma membrane can be found on page 178 of this chapter. National Science Education Standards UCP.4, C.1, C.5*

7 C

Light microscopes do not provide the resolution necessary to observe most organelles. Electron microscopes can magnify objects up to 500 000 times. While scanning electron microscopes are used to view the surfaces of cells, transmission electron microscopes are utilized in examining the structures within the cell. *More about microscopy can be found on pages 171–172 of this chapter. National Science Education Standards C.1, E.1, E.2*

8 B

Water is a polar molecule that can interact with and dissolve other polar substances. While the glycerol backbone of a phospholipid is nonpolar, the phosphate head is charged and polar. Therefore, these phosphate groups allow the cell membrane to interact with water. *More about the phospholipid bilayer can be found on pages 177–178 of this chapter. National Science Education Standards B.2, C.1*

9 A

Lysosomes are organelles found in eukaryotic cells and contain digestive enzymes. In addition to worn out organelles, lysosomes are involved in the digestion of food particles and engulfed viruses or bacteria. *More about lysosomes can be found on page 183 of this chapter. National Science Education Standards UCP.5, C.1*

10 B

Bacteria are prokaryotes, which do not contain membrane-bound nuclei. Viruses also do not have nuclei. Plants are eukaryotes, which do have nuclei—nuclear material contained within a membrane. *More about prokaryote and eukaryote features can be found on pages 173–174 of this chapter. National Science Education Standards C.1, C.5*

- 1 You are conducting osmosis experiments with a test tube of human cells in solution. You add a teaspoon of table salt to the test tube. According to the principles of osmosis, what can you predict will happen to the cells?
- A They will swell and burst.
 - B They will not be affected.
 - C They will shrink and shrivel.
 - D They will undergo rapid mitosis.
- 2 The solution in question 1 is —
- A hypertonic.
 - B isotonic.
 - C hypotonic.
 - D passive.
- 3 Which of the following is true of facilitated diffusion?
- A It occurs with a concentration gradient and requires transport proteins.
 - B It occurs against a concentration gradient and requires transport proteins.
 - C It occurs with a concentration gradient and does not require transport proteins.
 - D It occurs against a concentration gradient and does not require transport proteins.
- 4 By what process do cells transport wastes from within the cell to the external environment?
- A Facilitated diffusion
 - B Passive transport
 - C Endocytosis
 - D Exocytosis
- 5 Which of the following factors limits the size of a cell?
- A Surface area of plasma membrane
 - B Amount of DNA
 - C Speed of diffusion
 - D All of the above
- 6 Which of the following does NOT occur during interphase?
- A Chromosome duplication
 - B Cell division
 - C Cell metabolism
 - D Cell growth
- 7 During which phase of mitosis are sister chromatids pulled to opposite sides of the cell?
- A Prophase
 - B Metaphase
 - C Anaphase
 - D Telophase
- 8 Telophase is accompanied by the division of cytoplasm between the two daughter cells. What is this process called?
- A Prophase
 - B Cytokinesis
 - C Interphase
 - D Metaphase
- 9 In some cases, cancer can spread from one part of the body to another. What is the spread of cancer called?
- A Tumorigenesis
 - B Malignancy
 - C Metastasis
 - D Osmosis
- 10 Failure to control the cell cycle can be caused by —
- A lack of enzyme production.
 - B overproduction of enzyme.
 - C inappropriate expression of enzyme.
 - D All of the above

1 C

By adding salt to the extracellular environment, you cause cells to lose water. As a result, they shrink and shrivel. *More about osmosis can be found on pages 195–197 of this chapter. National Science Education Standards UCP.3, A.2, C.1*

2 A

When the concentration of dissolved substances is higher outside the cell, the extracellular solution is considered hypertonic. *More about osmosis and cells can be found on pages 195–197 of this chapter. National Science Education Standards A.2, C.1*

3 A

Facilitated diffusion is a form of passive transport, and thus occurs with a concentration gradient. However, facilitated diffusion requires transport proteins to pass molecules through the plasma membrane. *More about passive transport can be found on pages 198–199 of this chapter. National Science Education Standards B.6, C.1*

4 D

The expulsion of wastes occurs via exocytosis. Wastes are packaged in vacuoles within the cell and are then secreted to the extracellular environment. *More about exocytosis can be found on page 200 of this chapter. National Science Education Standards C.1, C.5*

5 D

The size of a cell is limited by the slow rate of diffusion, the limited amount of DNA in the nucleus, and the decreasing surface area-to-volume ratio. *More about cell size limitations can be found on pages 201–203 of this chapter. National Science Education Standards UCP.5, C.1*

6 B

Interphase includes the G₁, S, and G₂ phases in which the cell grows, metabolizes, and synthesizes new DNA. Cell division occurs during mitosis. *More about the cell cycle can be found on pages 204–206 of this chapter. National Science Education Standards C.1*

7 C

During anaphase, the centromeres split and sister chromatids are pulled apart. *More about mitosis can be found on pages 206–209 of this chapter. National Science Education Standards C.1*

8 B

Cytokinesis is the process of dividing the parent cell's cytoplasm between the two daughter cells. *More about cytokinesis can be found on page 209 of this chapter. National Science Education Standards C.1*

9 C

Metastasis is the systemic spread of cancerous cells. *More about cancer can be found on pages 211–213 of this chapter. National Science Education Standards C.1, C.5, F.1*

10 D

The cell cycle is regulated by a variety of enzymes. Any errors in the production or expression of these proteins can result in abnormal cell growth. *More about cell cycle control can be found on pages 211–212 of this chapter. National Science Education Standards UCP.4, C.1*

- 1 Which of the following is NOT part of a molecule of ATP?
- A Ribose sugar
 - B Adenosine
 - C Deoxyribose sugar
 - D Phosphate group
- 2 ATP stores energy for use in several cellular functions. Which of the following does NOT require the breakdown of ATP?
- A Bioluminescence
 - B Enzyme production
 - C Flagella movement
 - D Diffusion
- 3 Which of the following is a product of photosynthesis?
- A ATP
 - B Glucose
 - C Water
 - D Carbon dioxide
- 4 Chlorophyll is the primary pigment in plant chloroplasts. It absorbs all wavelengths of light, EXCEPT —
- A green.
 - B red.
 - C yellow.
 - D All of the above
- 5 Where is the electron transport chain located in the light-dependent reactions?
- A Nucleus
 - B Mitochondria
 - C Thylakoid membrane
 - D Cytoplasm
- 6 Where do the light-independent reactions of photosynthesis take place?
- A Stroma
 - B Thylakoid membrane
 - C Mitochondria
 - D Cell wall
- 7 Which of the following is a reactant in photolysis?
- A Electron
 - B Oxygen
 - C Proton
 - D Water
- 8 The Calvin cycle produces a molecule that is able to reenter the cycle as a reactant. Which of the following molecules is used as a reactant in the beginning of the Calvin cycle and is then produced at the end?
- A ATP
 - B Ribulose biphosphate
 - C Phosphoglyceric acid
 - D Carbon dioxide
- 9 Which of the following processes is anaerobic?
- A Glycolysis
 - B Citric acid cycle
 - C Electron transport chain
 - D All of the above
- 10 In the absence of oxygen, yeast cells undergo fermentation to produce —
- A lactic acid.
 - B oxygen.
 - C glucose.
 - D ethyl alcohol.

1 C

ATP, or adenosine triphosphate, is composed of adenosine, ribose, and a phosphate group. *More about the structure of ATP can be found on pages 222–223 of this chapter. National Science Education Standards UCP.5, B.2*

2 D

The energy stored in ATP is used for molecular synthesis, maintenance of homeostasis, cell movement, and bioluminescence. Diffusion does not require energy. *More about the uses of ATP can be found on page 224 of this chapter. National Science Education Standards C.1, C.5*

3 B

Photosynthesis uses carbon dioxide, water, and energy to form glucose and oxygen. *More about photosynthesis can be found on pages 225–230 of this chapter. National Science Education Standards B.3, C.5, G.2*

4 A

Chlorophyll absorbs most wavelengths of light, except green light, which it reflects. This gives leaves their green color. *More about chlorophyll can be found on page 226 of this chapter. National Science Education Standards B.6, C.1, C.5*

5 C

Energized electrons are transported by a series of proteins that are embedded in the thylakoid membrane. *More about the electron transport chain can be found on pages 226–227 of this chapter. National Science Education Standards C.1, C.5*

6 A

The light-independent reactions take place in the stroma of the chloroplast and produce carbohydrates using the products of the light-dependent reactions. *More about light-independent reactions can be found on pages 228–230 of this chapter. National Science Education Standards B.3, C.1, C.5*

7 D

Photolysis is the splitting of two molecules of water to produce oxygen and electrons. *More about photolysis can be found on page 228 of this chapter. National Science Education Standards B.3, B.6*

8 B

Ribulose biphosphate combines with carbon dioxide to start the Calvin cycle. It is then reformed at the end of the cycle and released to restart the cycle. *More about the Calvin cycle can be found on pages 228–230 of this chapter. National Science Education Standards B.3*

9 A

Glycolysis takes place in the cytoplasm of cells and can occur in the absence of oxygen. *More about glycolysis can be found on pages 231–232 of this chapter. National Science Education Standards B.3, C.1*

10 D

Under anaerobic conditions, fermentation follows glycolysis. Yeast cells perform alcoholic fermentation to produce ethyl alcohol and carbon dioxide. *More about fermentation can be found on pages 235–236 of this chapter. National Science Education Standards B.3, C.1, G.2*

- 1 The tall allele, T , is dominant to the short allele, t , in Mendel's pea plants. You examine a pea plant which exhibits a phenotype of tallness. What is its genotype?
- A Tt
 - B TT
 - C tt
 - D It cannot be determined from the information given.
- 2 You perform a monohybrid cross between two true-breeding strains of organisms with genotypes AA and aa . What do you expect the ratio of genotypes to be in the F1 generation?
- A 3:1
 - B 9:3:3:1
 - C 1:2:1
 - D 2:2
- 3 You are given a sample of unknown human cells to examine. Analysis of their nuclei revealed that each cell contains 23 chromosomes. What type of cells might these be?
- A Ova
 - B Skin cells
 - C Liver cells
 - D None of the above
- 4 During which stage of cell division does the number of chromosomes decrease from diploid ($2n$) to haploid (n)?
- A Prophase I
 - B Meiosis I
 - C Meiosis II
 - D Mitosis
- 5 Which of the following was concluded by Mendel as a result of his genetic research?
- A Genes for different traits are inherited together in pairs.
 - B Polyploidy can be beneficial in agriculture.
 - C Genes for different traits are inherited independently of one another.
 - D Meiosis occurs in two steps, meiosis I and meiosis II.
- 6 Nondisjunction can result in the formation of a zygote with three copies of a chromosome. What is this condition called?
- A Triploidy
 - B Trisomy
 - C Turner's syndrome
 - D None of the above
- 7 After performing a monohybrid cross, it is important to analyze the results with a Punnett square. Each box of a Punnett square represents —
- A a possible phenotype.
 - B a possible genotype.
 - C one individual.
 - D two possible genotypes.
- 8 During which phase of meiosis do homologous chromosomes align as tetrads in the middle of the spindle?
- A Prophase I
 - B Prophase II
 - C Metaphase I
 - D Metaphase II
- 9 A pea is heterozygous for a given trait. Which of the following is NOT true?
- A The pea resembles at least one parent for this trait.
 - B The pea has the dominant phenotype.
 - C The pea has two different alleles.
 - D The pea cannot resemble both parents.
- 10 Pairs of chromosomes having genes for the same traits are said to be —
- A homologous.
 - B analogous.
 - C homozygous.
 - D None of the above

1 D

The tallness phenotype only indicates the presence of the dominant T allele. It is impossible to determine this plant's genotype by knowing its phenotype. It can either be Tt or TT . *More about phenotypes and genotypes can be found on pages 258–259 of this chapter. National Science Education Standards UCP.2, C.2, G.2*

2 C

When a cross is performed between the genotypes AA and aa , the offspring will exhibit a 3:1 ratio of phenotypes. However, the genotypes will be in a 1:2:1 ratio ($AA:Aa:aa$). A Punnett square will aid in visualizing these results. *More about Punnett squares and monohybrid crosses can be found on pages 260–261 of this chapter. National Science Education Standards UCP.2, C.2, G.2*

3 A

The diploid ($2n$) number of chromosomes for human cells is 46. Because each of the cells had only 23 chromosomes, they must be haploid. Human gametes, such as ova or sperm, are haploid, while other cells, which have two copies of each chromosome, are diploid. *More about chromosome numbers can be found on pages 263–264 of this chapter. National Science Education Standards C.1, G.2*

4 C

Meiosis II begins with the diploid cells that resulted from meiosis I. At the end of meiosis II, each diploid cell has given rise to four haploid cells. This is a reduction division. *More about meiosis can be found on pages 265–269 of this chapter. National Science Education Standards C.1*

5 C

This is the law of independent assortment. Mendel used the results of his dihybrid crosses to justify this conclusion. *More about Mendel's work can be found on pages 253–260 of this chapter. National Science Education Standards UCP.2, C.2, G.3*

6 B

Trisomy describes the condition of having three copies of a chromosome. It results when a gamete with an extra chromosome combines with a normal gamete. *More about mistakes in meiosis can be found on pages 271–273 of this chapter. National Science Education Standards C.1, F.1*

7 B

Punnett squares illustrate all possible allele combinations that could result from a particular cross. Each box represents a possible genotype. *More about Punnett squares can be found on pages 260–262 of this chapter. National Science Education Standards UCP.2, C.2, G.2*

8 C

During metaphase I, homologous chromosomes line up on the spindle as tetrads. In metaphase II, homologous chromosomes line up randomly on the spindle. *More about the phases of meiosis can be found on pages 266–269 of this chapter. National Science Education Standards C.1, G.2*

9 D

Both of the pea's parents could have had a dominant phenotype, so as long as at least one parent possesses a recessive allele, the pea could resemble both parents. *More about phenotypes and genotypes can be found on pages 258–259 of this chapter. National Science Education Standards UCP.2, C.2, G.2*

10 A

Homologous chromosomes possess the same genes for a trait, but may have different alleles of each gene. *More about homologous chromosomes can be found on pages 264–265 of this chapter. National Science Education Standards C.1, C.2, G.2*

- 1 DNA is composed of nucleotide subunits, each of which contains a —
- A ribose molecule.
 - B phosphate group.
 - C uracil base.
 - D All of the above
- 2 The two strands of DNA in the double helix structure are held together by which of the following interactions?
- A Van der Waals forces
 - B Covalent bonds
 - C Ionic bonds
 - D Hydrogen bonds
- 3 The process of cell division requires the parent cell to synthesize more DNA molecules. These molecules are produced by which of the following mechanisms?
- A Translation
 - B Replication
 - C Transcription
 - D Mitosis
- 4 Which of the following do DNA and RNA have in common?
- A Both are double-stranded.
 - B Both contain ribose molecules.
 - C Both contain phosphate groups.
 - D Both contain thymine.
- 5 Translation is the process of synthesizing protein from RNA. Which of the following molecules transports amino acids from the cytoplasm to the ribosome for translation?
- A mRNA
 - B rRNA
 - C tRNA
 - D All of the above
- 6 There are 64 different mRNA codons in the genetic code. How many possible codons would there be if a codon consisted of only two nucleotides?
- A 64
 - B 32
 - C 16
 - D 8
- 7 In most organisms, the start of translation is signaled by an AUG codon. What is the first amino acid in most proteins?
- A Proline
 - B Leucine
 - C Isoleucine
 - D Methionine
- 8 Some mutations are more harmful than others are. Which of the following types of mutations is usually less severe?
- A Frameshift mutation
 - B Point mutation
 - C Chromosomal mutation
 - D Deletion
- 9 Some mutagens, such as the sun's UV radiation, cause mutations in somatic cells, such as dermal cells. Which of the following is NOT likely to occur as a result of such a mutation?
- A Skin cancer may develop in the exposed individual.
 - B Skin cancer may develop in the offspring of the exposed individual.
 - C Exposed skin cells may function improperly.
 - D All of the above consequences are likely.
- 10 What is the complementary mRNA sequence to the DNA sequence A-T-T-G-C-A?
- A T-A-A-C-G-T
 - B U-A-A-C-G-T
 - C U-A-A-C-G-U
 - D T-A-A-G-C-U

1 B

A DNA nucleotide is composed of deoxyribose, a nitrogen base, and a phosphate group. *More about the structure of DNA can be found on pages 283–284 of this chapter. National Science Education Standards C.2*

2 D

The two strands of a DNA double helix are connected by the nitrogen bases extending from the backbone of the chain. Hydrogen bonds form between these bases. *More about the DNA double helix can be found on page 283 of this chapter. National Science Education Standards UCP.5, C.2, C.5, G.2*

3 B

To ensure that all new cells have the appropriate amount of DNA, all parental chromosomes must be copied in a process called DNA replication. *More about DNA replication can be found on pages 284–287 of this chapter. National Science Education Standards C.1, C.2, G.2*

4 C

While RNA and DNA molecules differ in many respects, both contain phosphate groups along with their respective sugar molecules in their backbones. *More about RNA can be found on pages 288–290 of this chapter. National Science Education Standards A.1, C.2*

5 C

During the process of translation, transfer RNA (tRNA) molecules carry free amino acids in the cytoplasm to the ribosomes for incorporation into a new protein molecule. *More about translation can be found on pages 293–295 of this chapter. National Science Education Standards C.1, C.2, G.2*

6 C

Since there are four possible bases for each position in a codon, there would be 4×4 , or 4^2 , possible codons with a length of two nucleotides. Normally, there are $4 \times 4 \times 4$, or 64, possible codons. In general, there are 4^n possible codons, where n represents the length of the codon. *More about codons can be found on pages 292–295 of this chapter. National Science Education Standards C.2*

7 D

The genetic code dictates that the AUG codon codes for methionine. Therefore, the first amino acid in most proteins is methionine. *More about the genetic code can be found on pages 291–292 of this chapter. National Science Education Standards C.2, G.2*

8 B

Point mutations are usually the least severe because they disrupt only one single codon. *More about mutations can be found on pages 296–301 of this chapter. National Science Education Standards C.2, F.1*

9 B

Mutations in body, or somatic, cells are not passed on to an individual's offspring. Therefore the damaged skin cells of the parent have no effect on the skin cells of the offspring. *More about mutations in different cell types can be found on pages 296–298 of this chapter. National Science Education Standards C.1, F.1*

10 C

Since mRNA uses uracil instead of thymine, the complementary sequence of mRNA is U-A-A-C-G-U. *More about transcription can be found on pages 290–291 of this chapter. National Science Education Standards UCP.1, C.2, C.5*

- 1 You and your colleagues are constructing a pedigree for a patient with cystic fibrosis. The individual's brother has also been diagnosed with cystic fibrosis. How would this brother be represented in the pedigree?
- A Shaded circle
 - B Shaded square
 - C Unshaded circle
 - D Unshaded square
- 2 Which of the following disorders is most common among the Amish and Ashkenazic Jewish populations?
- A Phenylketonuria
 - B Cystic fibrosis
 - C Cerebral palsy
 - D Tay-Sachs disease
- 3 A man carrying the allele for Huntington's disease marries a woman who is homozygous recessive for the allele. What is the probability that their offspring will develop Huntington's disease?
- A $1/2$
 - B $1/4$
 - C $3/4$
 - D None of the above
- 4 An individual has type AB blood. His father has type A blood and his mother has type B blood. The individual's phenotype is an example of —
- A simple recessive heredity.
 - B simple dominant heredity.
 - C incomplete dominance.
 - D codominance.
- 5 A newly discovered disease is caused by an extremely rare allele of a gene on the X chromosome. The disease is 100% lethal. A female carrier of the allele decides to have children. What percentage of female embryos will die from this disease?
- A 100%
 - B 50%
 - C 0%
 - D 25%
- 6 Many traits, such as stem length, are controlled by multiple genes. This is called —
- A simple dominant inheritance.
 - B monogenic inheritance.
 - C polygenic inheritance.
 - D codominance.
- 7 Which of the following traits is mediated by X-linked inheritance?
- A Hemophilia
 - B Sickle-cell anemia
 - C Blood type
 - D None of the above
- 8 A chart of an individual's chromosome pairs is called a karyotype. Analysis of a karyotype can reveal which of the following?
- A Phenotype
 - B Genotype
 - C Trisomy
 - D All of the above
- 9 Which of the following diseases is characterized by an accumulation of phenylalanine in the body?
- A Cystic fibrosis
 - B PKU
 - C Huntington's disease
 - D Tay-Sachs disease
- 10 A couple has a child who, with respect to a specific trait, resembles neither parent. Which of the following is NOT a possible mechanism for this trait?
- A Simple recessive heredity
 - B Codominance
 - C Incomplete dominance
 - D Simple dominant heredity

1 B

Males are represented by squares, and individuals displaying a specific trait are indicated by shading. Therefore, a brother with cystic fibrosis would be represented as a shaded square in the pedigree. *More about pedigrees can be found on pages 309–312 of this chapter. National Science Education Standards UCP.2, C.2, F.1, G.1*

2 D

Tay-Sachs disease is a recessive disorder found predominantly among populations of Amish and Ashkenazic Jewish people. *More about Tay-Sachs disease can be found on page 312 of this chapter. National Science Education Standards C.2, F.1*

3 A

Huntington's disease is caused by a dominant allele. Therefore, an individual needs only to have one allele in order to display the phenotype. Since the mother will contribute a recessive allele, the only possibility for the offspring to inherit Huntington's disease is by getting the mutant allele from the father. There is a 50% chance of inheriting that allele from the father. *More about Huntington's disease can be found on page 314 of this chapter. National Science Education Standards C.2, F.1*

4 D

Blood type is determined by both alleles possessed by an individual. This individual inherited an A allele from his father and a B allele from his mother. Since both are expressed, giving rise to type AB blood, this is an example of codominance. *More about codominance can be found on pages 316–317 and 324–325 of this chapter. National Science Education Standards C.2*

5 C

The disease is X-linked recessive and 100% lethal. Therefore, a male cannot carry the allele. Since a female would have to inherit a diseased X chromosome from both parents, none of the woman's daughters could have the disease. *More about X-linked inheritance can be found on pages 318–320 of this chapter. National Science Education Standards C.2, F.1, G.2*

6 C

Traits that display a wide range of variation are often mediated by multiple genes. Such traits are said to be governed by polygenic inheritance. *More about polygenic inheritance can be found on page 320 of this chapter. National Science Education Standards C.2, G.2*

7 A

Hemophilia and certain forms of color blindness are inherited as X-linked characteristics. *More about X-linked traits in humans can be found on pages 318–320 and page 327 of this chapter. National Science Education Standards C.2, G.2*

8 C

A karyotype reveals the number of chromosomes in cells. Therefore, it would be useful in detecting trisomy, the condition of having three copies of a particular chromosome. *More about chromosome numbers can be found on pages 328–329 of this chapter. National Science Education Standards UCP.2, G.1*

9 B

PKU, or phenylketonuria, is a disorder in which an individual lacks the enzyme that converts phenylalanine to tyrosine. Therefore, the disease is characterized by a buildup of phenylalanine in the body. *More about PKU can be found on page 312 of this chapter. National Science Education Standards UCP.3, C.5, F.1*

10 D

If a child does not resemble either parent, the trait could not have been inherited via simple dominant heredity. *More about the different patterns of inheritance can be found throughout this chapter. National Science Education Standards C.2, G.2*

- 1 What is the process by which organisms are made to be homozygous for most traits called?
- A Hybridization
 - B Inbreeding
 - C Test crossing
 - D None of the above
- 2 In order to determine the genotype of an organism, researchers can perform a test cross between the unknown organism and an organism that is —
- A homozygous dominant.
 - B heterozygous.
 - C homozygous recessive.
 - D All of the above
- 3 You perform a test cross and conclude that the unknown genotype is homozygous dominant. What phenotypic ratio (dominant to recessive) will the offspring of the test cross show?
- A 1:0
 - B 1:1
 - C 0:1
 - D 2:1
- 4 What are the organisms that contain foreign DNA called?
- A Xenogenic
 - B Intergenic
 - C Palindromic
 - D Transgenic
- 5 Foreign pieces of DNA are transferred into organisms by being packaged into —
- A restriction enzymes.
 - B vectors.
 - C carrier enzymes.
 - D None of the above
- 6 Before two genes can be spliced together, they must both be cleaved by a —
- A restriction enzyme.
 - B gene gun.
 - C micropipette.
 - D None of the above
- 7 By what process can DNA strands of different lengths be separated out?
- A Gene splicing
 - B DNA cloning
 - C Gel electrophoresis
 - D None of the above
- 8 What is the total number of genes in an individual organism called?
- A Chromosome
 - B Linkage map
 - C Genome
 - D None of the above
- 9 In creating a linkage map, you must analyze the frequency of recombination in the genome. What would a very low frequency of cross-over indicate about two genes?
- A They are on the same chromosome but very far apart.
 - B They are on the same chromosome and very close together.
 - C They are on different chromosomes.
 - D It cannot be determined from the information given.
- 10 What is the process of analyzing the unique pattern of DNA fragments resulting from restriction enzyme cleavage called?
- A Gene splicing
 - B Gene therapy
 - C Genetic engineering
 - D DNA fingerprinting

1 B

In order to establish homozygosity among organisms, scientists develop a line of organisms by mating closely related individuals. This is called inbreeding. *More about selective breeding can be found on pages 337–338 of this chapter. National Science Education Standards C.2, G.1*

2 C

Test crosses utilize organisms that are known to be homozygous recessive in order to determine the genotype of another organism. By analyzing the resulting offspring, the unknown genotype can be found. *More about test crosses can be found on pages 339–340 of this chapter. National Science Education Standards C.2, G.1*

3 A

If the unknown genotype was homozygous dominant, then performing a test cross would yield all heterozygous offspring. The phenotypes would all appear dominant. *More about analyzing test crosses can be found on pages 339–340 of this chapter. National Science Education Standards UCP.2, C.2*

4 D

Organisms that contain and express foreign DNA are called transgenic. *More about transgenic organisms can be found on pages 341–342 of this chapter. National Science Education Standards C.2*

5 B

In order to facilitate the entry of foreign DNA into a cell, the DNA fragments are incorporated into biological or mechanical vectors. *More about vectors can be found on pages 343–344 of this chapter. National Science Education Standards C.2, E.2*

6 A

Two fragments of DNA can be joined after being cut with restriction enzymes that create sticky ends. *More about gene splicing can be found on page 342 of this chapter. National Science Education Standards C.2*

7 C

Gel electrophoresis is the process of separating DNA fragments based on differing lengths. *More about gel electrophoresis can be found on pages 345–346 of this chapter. National Science Education Standards C.2, E.2*

8 C

An organism's genome is its complete collection of genes. *More about genomes can be found on page 349 of this chapter. National Science Education Standards C.2, G.2*

9 B

Higher frequencies of crossing-over indicate greater distances between genes. Therefore, a low frequency indicates proximity. *More about linkage maps can be found on pages 349–350 of this chapter. National Science Education Standards UCP.2, C.2, E.1*

10 D

DNA samples from different individuals, when cut with restriction enzymes, will produce unique patterns after electrophoresis. This is called an individual's DNA fingerprint. *More about DNA fingerprinting can be found on pages 352–353 of this chapter. National Science Education Standards C.2, E.2*

- 1 Which of the following was NOT abundant in the Earth's early atmosphere?
 - A Water vapor
 - B Carbon dioxide
 - C Nitrogen
 - D Oxygen

- 2 When minerals in rocks fill a space left by a decayed organism, which of the following types of fossils is formed?
 - A Trace fossil
 - B Cast fossil
 - C Petrified fossil
 - D Amber-preserved fossil

- 3 When particles are compressed and hardened, which type of rock is formed?
 - A Sedimentary
 - B Metamorphic
 - C Igneous
 - D None of the above

- 4 What is the process of determining a fossil's age using chemical half-lives called?
 - A Isotopic dating
 - B Relative dating
 - C Radiometric dating
 - D None of the above

- 5 In order to determine the age of fossils that are less than 50 000 years old, scientists would most likely analyze the level of which of the following isotopes?
 - A Argon-40
 - B Carbon-14
 - C Potassium-40
 - D None of the above

- 6 What is the earliest geologic era called?
 - A Mesozoic
 - B Paleozoic
 - C Cenozoic
 - D Precambrian

- 7 Which of the following eras is divided into the Triassic, Jurassic, and Cretaceous Periods?
 - A Mesozoic
 - B Paleozoic
 - C Cenozoic
 - D Precambrian

- 8 Who conducted experiments to disprove the spontaneous generation of large organisms, such as maggots?
 - A Louis Pasteur
 - B Alexander Oparin
 - C Francesco Redi
 - D Harold Urey

- 9 The first forms of life were most likely —
 - A aerobic.
 - B prokaryotic.
 - C eukaryotic.
 - D archaeobacteria.

- 10 What provides the explanation for the presence of mitochondria in cells?
 - A Biogenesis
 - B Endosymbiosis
 - C Spontaneous generation
 - D Chemosynthesis

1 D

Free oxygen was not found in abundance in the Earth's early atmosphere. Instead, it contained carbon dioxide, water vapor, and nitrogen. *More about the earth's early atmosphere can be found on page 369 of this chapter. National Science Education Standards D.3, G.3*

2 B

A fossil cast of an organism is created when minerals fill the space left by a decayed organisms. *More about different types of fossils can be found on page 370 of this chapter. National Science Education Standards G.3*

3 A

Sedimentary rock is created when particles are compressed and hardened over time. *More about sedimentary rock can be found on page 371 of this chapter. National Science Education Standards D.3, G.3*

4 C

Radiometric dating uses the rate of decay of various radioactive isotopes to determine the actual age of a fossil. *More about determining the age of a fossil can be found on page 374 of this chapter. National Science Education Standards UCP.3, B.2, E.2, G.1*

5 B

Carbon-14 has a half-life of 5730 years and is used to determine the ages of relatively young fossils. *More about radiometric dating can be found on pages 374–375 of this chapter. National Science Education Standards UCP.3, B.2, E.2, G.1*

6 D

The Precambrian is the first geologic time period and it contains fossils dating back approximately 3.4 billion years. *More about the Geologic Time Scale can be found on pages 374–375 of this chapter. National Science Education Standards D.3, G.3*

7 A

The Mesozoic Era is divided into the Triassic, Jurassic, and Cretaceous Periods. *More about the Mesozoic era can be found on pages 377–379 of this chapter. National Science Education Standards D.3, G.3*

8 C

Francesco Redi conducted experiments that disproved the idea that maggots were produced by decaying meat. *More about spontaneous generation can be found on pages 380–381 of this chapter. National Science Education Standards UCP.2, C.5, G.1, G.3*

9 B

The first true cells were most likely anaerobic prokaryotes that evolved from protocells. *More about the evolution of cells can be found on pages 383–384 of this chapter. National Science Education Standards C.1, C.3, G.3*

10 B

The endosymbiont theory explains that mitochondria may have been incorporated into cells after a period of symbiosis between prokaryotes. *More about the endosymbiont theory can be found on pages 384–385 of this chapter. National Science Education Standards UCP.2, C.1, G.2*

- 1 Who proposed the idea that the human population grows faster than the food supply?
 - A Charles Darwin
 - B Alfred Russell Wallace
 - C Thomas Malthus
 - D Stephen J. Gould

- 2 Which of the following adaptations will probably develop most rapidly?
 - A Camouflage
 - B Drug resistance
 - C Mimicry
 - D Large teeth

- 3 What are structures that share a common evolutionary origin called?
 - A Homologous
 - B Analogous
 - C Vestigial
 - D Siblings

- 4 What are structures without a present-day function called?
 - A Homologous
 - B Analogous
 - C Vestigial
 - D Extinct

- 5 In order for evolution to occur, what must happen in a population?
 - A Genetic drift
 - B Geographic isolation
 - C Natural selection
 - D Reproductive isolation

- 6 Which of the following can disrupt genetic equilibrium?
 - A Mutation
 - B Migration
 - C Genetic drift
 - D All of the above

- 7 What type of natural selection favors average individuals in a population?
 - A Disruptive selection
 - B Stabilizing selection
 - C Directional selection
 - D Bias

- 8 The idea that speciation occurs in bursts, between long periods of genetic equilibrium is called —
 - A punctuated equilibrium.
 - B stabilizing selection.
 - C genetic drift.
 - D gradualism.

- 9 Polyploidy is the condition of having a multiple of the normal set of chromosomes. What does polyploidy result in?
 - A Geographic isolation
 - B Hybridization
 - C Reproductive isolation
 - D Mutations

- 10 What is it called when unrelated species evolve similar traits?
 - A Convergent evolution
 - B Genetic drift
 - C Divergent evolution
 - D Parallelism

1 C

Thomas Malthus, an English economist, proposed the idea that the human population grows more quickly than its food supply. This was used by Darwin in proposing the concept of natural selection. *More about the study of natural selection can be found on pages 395–397 of this chapter. National Science Education Standards C.3, C.4, F.2*

2 B

Physiological adaptations, such as drug resistance and metabolic changes, arise much more quickly than structural adaptations do. *More about adaptations can be found on pages 397–399 of this chapter. National Science Education Standards C.3*

3 A

Homologous structures are those that have a common evolutionary origin. *More about anatomical adaptations can be found on pages 400–402 of this chapter. National Science Education Standards UCP.3, C.3*

4 C

Vestigial structures are body structures in present-day organisms that no longer serve their original purposes, but were probably useful in ancestors. *More about anatomical adaptations can be found on pages 401–402 of this chapter. National Science Education Standards UCP.5, C.3, G.3*

5 C

All populations must undergo natural selection in order to evolve. Speciation can occur via several different routes. *More about population genetics and evolution can be found on pages 404–412 of this chapter. National Science Education Standards UCP.4, C.3, F.2*

6 D

Genetic equilibrium can be altered by mutation, genetic drift, and migration, or gene flow. *More about genetic equilibrium can be found on pages 405–407 of this chapter. National Science Education Standards UCP.4, C.3, F.2*

7 B

Stabilizing selection is a form of natural selection in which average individuals are favored in the population. *More about the different types of natural selection can be found on page 408 of this chapter. National Science Education Standards C.3, F.2*

8 A

Punctuated equilibrium, proposed by Stephen J. Gould and Niles Eldridge, posits that speciation occurs quickly, with long period of genetic equilibrium between these bursts. *More about speciation can be found on pages 411–412 of this chapter. National Science Education Standards UCP.2, UCP.4, C.3, F.2*

9 C

Polyploidy results in reproductive isolation because polyploids cannot produce fertile offspring with a normal individual. *More about polyploidy and speciation can be found on pages 410–411 of this chapter. National Science Education Standards C.3, F.2*

10 A

Convergent evolution describes the process by which unrelated species occupy similar environments in different parts of the world. *More about the patterns of evolution can be found on pages 412–413 of this chapter. National Science Education Standards UCP.4, C.3, F.2*

- 1 While New World Monkeys have prehensile tails to aid in moving from tree to tree, orangutans do not. What adaptation do orangutans have that facilitate their partially arboreal lifestyle?
- A Increased brain to body ratio
 - B Posthensile tail
 - C Long, muscled forelimbs
 - D Binocular vision
- 2 Which of the following would you expect to gather its food at night?
- A Gibbon
 - B Lemur
 - C Chimpanzee
 - D Baboon
- 3 You are researching the anatomy of an unknown primate. You are told that it is an early hominid. Where would you expect to find the foramen magnum?
- A At the back of the skull, because early hominids walked on four legs.
 - B At the bottom of the skull, because early hominids walked on four legs.
 - C At the back of the skull, because early hominids walked upright.
 - D At the bottom of the skull, because early hominids walked upright.
- 4 Which of the following primates is most closely related to modern humans?
- A Cro-Magnon
 - B *Homo habilis*
 - C *Homo erectus*
 - D *Australopithecus afarensis*
- 5 Which of the following is the dominant sense in chimpanzees?
- A Hearing
 - B Vision
 - C Touch
 - D Smell
- 6 According to DNA analysis, which of the following primates evolved first?
- A Orangutans
 - B Chimpanzees
 - C Gibbons
 - D Gorillas
- 7 Approximately 40 000 years ago, a type of *Homo sapiens*, called Cro-Magnons, lived in Europe. These hominids had a bulge in their skulls that corresponded to an enlarged region of the brain. This region controlled which of the following functions?
- A Speech
 - B Vision
 - C Toolmaking
 - D None of the above
- 8 How did *Homo erectus* differ from modern *Homo sapiens*?
- A *Homo erectus* did not have an opposable thumb.
 - B *Homo sapiens* are bipedal primates.
 - C *Homo erectus* had a lower jaw without a chin.
 - D *Homo erectus* had a lower jaw with a chin.
- 9 According to evidence gathered from excavation sites, which type of *Homo sapiens* were the first to develop religious views?
- A Neandertal
 - B Cro-Magnon
 - C Modern *Homo sapiens*
 - D *Homo habilis*
- 10 What evidence would be most useful in differentiating between the remains of *Australopithecus afarensis* and *Homo habilis*?
- A Structure of the pelvis
 - B Position of the foramen magnum
 - C Size of the braincase
 - D Skeletal evidence would not be useful in differentiating between the two.

1 C

Orangutans are classified as apes. All apes lack tails and have long, well-developed forelimbs that allow them to climb and swing in trees without a prehensile tail. *More about apes can be found on pages 424–425 of this chapter. National Science Education Standards UCP.5, C.6, G.2*

2 B

Nocturnal animals gather food at night and rest and sleep during the day. Lemurs are strepsirrhines, as are aye-ayes. Strepsirrhines are small, nocturnal primates that live in parts of Africa and southeast Asia. *More about strepsirrhines can be found on pages 423–424 of this chapter. National Science Education Standards C.6*

3 D

The foramen magnum is the opening in the skull through which the spinal cord passes as it leaves the brain. It is found at the bottom of the skull in animals that walk upright, including early hominids. *More about early hominids can be found on pages 428–431 of this chapter. National Science Education Standards UCP.5, C.3, C.6, G.2*

4 A

Cro-Magnons were members of the *Homo sapiens* species. They existed between 35 000 and 40 000 years ago in Europe. They were nearly identical to modern humans anatomically. *More about early Homo sapiens can be found on pages 434–435 of this chapter. National Science Education Standards UCP.1, UCP.4, C.3, G.3*

5 B

Vision is the dominant sense in all primates, including chimpanzees. With eyes on the front of their heads, chimpanzees have binocular vision, which allows for a high degree of good depth perception. *More about primate characteristics can be found on page 422 of this chapter. National Science Education Standards UCP.5, G.2*

6 C

DNA evidence of modern hominoids allows scientists to create an evolutionary tree which illustrates the probable order of evolution. According to this evidence, New World monkeys were the first apes to evolve. *More about hominoid evolution can be found on page 426 of this chapter. National Science Education Standards UCP.2, UCP.4, C.3, E.2*

7 A

Examination of Cro-Magnon bones reveals a bulge in the side of the skull that corresponds to the area of the brain involved in speech. This indicates that the Cro-Magnon brain allowed for the use of language. *More about Cro-Magnons can be found on pages 434–435 of this chapter. National Science Education Standards UCP.5, C.3, G.3*

8 C

Homo erectus had a more human-like face than *Homo habilis*. However, it still had prominent browridges and a chinless lower jaw, which is different from modern humans. *More about Homo erectus can be found on pages 432–433 of this chapter. National Science Education Standards UCP.4, C.3, G.3*

9 A

Scientists have uncovered burial grounds and other evidence of religious views in the area of Neandertal excavation sites. This is the first evidence of religious views in the evolutionary history of modern humans. *More about Neandertals can be found on pages 434–435 of this chapter. National Science Education Standards C.3, C.6, G.3*

10 C

Australopithecus afarensis were bipedal hominids that walked upright like humans. Therefore, their pelvis structure and foramen magnum position would be similar to that of humans. However, they had a smaller braincase than modern humans. *More about A. afarensis can be found on pages 430–431 of this chapter. National Science Education Standards UCP.2, A.2, C.3*

- 1 Which of the following taxa contains the largest number of organisms?
A Division
B Order
C Family
D Genus
- 2 According to Linnaeus, which of the following organisms would be most closely related to the bat?
A Mosquito
B Hawk
C Squirrel
D Trout
- 3 What does a fanlike diagram show that a cladogram does not?
A Phylogenetic relationships
B Relative number of species in each group
C Anatomical features of each species
D Mode of extinction
- 4 Upon examining samples of water and mud from a nearby river, you come across an unidentified organism. Closer observation indicates that the organism is unicellular and autotrophic. In addition, you can identify a membrane-bound nucleus within the cell. To what kingdom does this organism most likely belong?
A Archaeobacteria
B Fungi
C Protist
D Eubacteria
- 5 The system of assigning two names to identify an organism is called binomial nomenclature. The first name corresponds to an organism's —
A family.
B kingdom.
C species.
D genus.
- 6 As scientists began to learn more about geologic time, they incorporated their findings in their systems of classification. The new system that accounted for an organism's evolutionary history is called —
A binomial nomenclature.
B phylogeny.
C taxonomy.
D None of the above
- 7 A pedigree differs from a cladogram in that pedigrees indicate —
A proposed ancestry.
B phylogeny of a species.
C direct ancestry from two parents.
D number of derived traits.
- 8 Organisms in Kingdom Archaeobacteria and Kingdom Eubacteria are similar in that they all are —
A prokaryotic.
B eukaryotic.
C autotrophic.
D heterotrophic.
- 9 Which of the following does NOT describe an organism found in Kingdom Plantae?
A Mobile
B Multicellular
C Photosynthetic
D Eukaryotic
- 10 Which kingdom does NOT include organisms that are producers in the environment?
A Protista
B Plantae
C Fungi
D Archaeobacteria

1 A

A division is the largest group of organisms in the plant kingdom. Other groupings below that are class, order, family, genus, and species. *More about biological classifications can be found on pages 455–459 of this chapter. National Science Education Standards UCP.1, C.5*

2 C

Linnaeus developed a classification system based on physical structural similarities between organisms. Though bats have wings with which to fly, they are different structurally from those of birds and insects. In fact, bats have many physical characteristics in common with mammals, such as squirrels. Therefore, Linnaeus would have classified bats with mammals rather than with birds and insects. *More about Linnaeus and his classification system can be found on pages 444–445 of this chapter. National Science Education Standards UCP.1, A.2, C.5*

3 B

Both cladograms and fanlike diagrams depict evolutionary relationships among groups of organisms. However, fanlike diagrams can also illustrate the time of extinction and the relative number of species in each group. *More about cladograms and fanlike diagrams can be found on pages 452–453 of this chapter. National Science Education Standards UCP.2, C.3, C.5, G.2*

4 C

A membrane-bound nucleus is only found in eukaryotic cells. Protists and fungi are unicellular or multicellular eukaryotes. However, fungi are not autotrophic. Therefore, the organism most likely belongs to Kingdom Protista. *More about protists can be found on pages 457–458 of this chapter. National Science Education Standards UCP.1, A.1, C.1, C.5, G.2*

5 D

Linnaeus identified species using binomial nomenclature. The first word identifies the organism's genus while the second describes a characteristic of the organism. *More about binomial nomenclature can be found on pages 444–445 of this chapter. National Science Education Standards UCP.1, C.5, G.2*

6 B

The evolutionary history of a species is its phylogeny. Phylogenetic analyses account for the chronological differences between various species. *More about phylogeny can be found on pages 452–456 of this chapter. National Science Education Standards UCP.1, UCP.4, C.3, C.5, G.3*

7 C

Both cladograms and pedigrees propose ancestral relationships. However, while cladograms illustrate the phylogeny of a species, pedigrees depict the direct ancestry of an individual organism from two parents. *More about cladistics can be found on pages 452–453 of this chapter. National Science Education Standards UCP.2, C.5, G.1*

8 A

Prokaryotes are organisms whose cells do not contain a membrane-bound nucleus. Prokaryotes are classified into two kingdoms, Archaeobacteria and Eubacteria. *More about prokaryotes can be found on pages 456–457 of this chapter. National Science Education Standards UCP.1, C.5, G.2*

9 A

Plants are eukaryotic, multicellular, and photosynthetic organisms. They have cell walls, but their cell walls are made of cellulose, not chitin. *More about plants can be found on pages 458–459 of this chapter. National Science Education Standards UCP.1, C.5, G.2*

10 C

Producers are organisms that are autotrophic and provide their own energy. Fungi, on the other hand, are heterotrophs that absorb nutrients from their environment. *More about Kingdom Fungi can be found on page 458 of this chapter. National Science Education Standards UCP.1, C.5, C.6, G.2*

- 1 What is the outer coat of proteins that surrounds the viral core of nucleic acids called?
- A Capsule
 - B Envelope
 - C Membrane
 - D Capsid
- 2 In which of the following viruses do tail fibers enable the attachment of the virus to the host cell?
- A Adenovirus
 - B Poliovirus
 - C Bacteriophage T4
 - D All of the above
- 3 While looking at virally infected cells under a microscope, you notice that as time progresses, cells seem to be bursting and dying. Which infectious cycle is the virus undergoing?
- A Latency cycle
 - B Lytic cycle
 - C Lysogenic cycle
 - D Binary fission
- 4 Sometimes viral DNA incorporates itself into the host's genetic material. What is the viral DNA called after this occurs?
- A Bacteriophage
 - B Provirus
 - C Adenovirus
 - D None of the above
- 5 Which of the following events might induce a virus to enter the lytic cycle after being incorporated into the host's genetic material?
- A Sleep deprivation
 - B Anxiety
 - C Sunburn
 - D All of the above
- 6 Retroviruses use an enzyme to convert their RNA into double-stranded DNA. What is this enzyme called?
- A Reverse polymerase
 - B DNA polymerase II
 - C Reverse transcriptase
 - D RNA synthetase
- 7 What cells does the human immunodeficiency virus (HIV) infect?
- A Red blood cells
 - B White blood cells
 - C Liver cells
 - D Skin cells
- 8 In which of the following environments might you find archaebacteria?
- A Sewage disposal plant
 - B Dead Sea
 - C Sulfur springs
 - D All of the above
- 9 Which of the following bacterial adaptations helps a bacterium avoid being engulfed by white blood cells?
- A Capsule
 - B Cell wall
 - C Pilus
 - D Flagella
- 10 What is another name for sexual reproduction in bacteria?
- A Binary fission
 - B Endospore synthesis
 - C Conjugation
 - D Replication

1 D

A viral capsid is a protein coat that surrounds the DNA or RNA core. *More about viral structure can be found on page 476 of this chapter. National Science Education Standards UCP.5, G.2*

2 C

Viruses that infect bacteria, called bacteriophages, attach to the surface of bacteria with a protein in its tail fibers. *More about viral attachment can be found on pages 477–479 of this chapter. National Science Education Standards UCP.5*

3 B

Viruses in the lytic cycle replicate and then burst from the cell, killing the host cell. *More about viral replication cycles can be found on pages 478–480 of this chapter. National Science Education Standards C.1, F.1*

4 B

A provirus is viral DNA that is integrated into the host cell's genome during the lysogenic cycle. *More about proviruses can be found on pages 479–480 of this chapter. National Science Education Standards C.2, G.2*

5 D

Provirus may be activated to enter the lytic cycle by physical and emotional stresses, including anxiety. *More about proviruses can be found on pages 479–480 of this chapter. National Science Education Standards C.6*

6 C

HIV and other retroviruses use reverse transcriptase to make DNA from RNA. They carry this enzyme in their capsids. *More about retroviruses can be found on page 481 of this chapter. National Science Education Standards C.2, F.1, G.2*

7 B

HIV infects white blood cells, attacking the host's immune system. *More about HIV can be found on page 482 of this chapter. National Science Education Standards C.1, F.1*

8 D

Archaea thrive in extreme environments, such as anaerobic, acidic, and salty environments. *More about archaea can be found on pages 484–485 of this chapter. National Science Education Standards C.6, F.4*

9 A

A capsule is a gelatinous structure that surrounds the cell wall of a bacterium, preventing the bacterium from being engulfed by white blood cells and allowing it to avoid the host's immune response. *More about the structure of bacteria can be found on pages 486–488 of this chapter. National Science Education Standards UCP.5, C.6*

10 C

Conjugation is the process by which bacteria transfer genetic information, resulting in a new genetic makeup. *More about bacterial reproduction can be found on pages 489–490 of this chapter. National Science Education Standards C.2, C.6*

- 1 Photosynthetic protists are called —
A algae.
B protozoa.
C funguslike.
D None of the above
- 2 Amoebas form extensions of their plasma membranes to move and feed. These extensions are called —
A vacuoles.
B flagella.
C thallus.
D pseudopodia.
- 3 In which structure does digestion occur in a paramecium?
A Oral groove
B Macronucleus
C Gullet
D Contractile vacuole
- 4 Which phylum of algae is composed only of unicellular species?
A Green algae
B Red algae
C Euglenoids
D Brown algae
- 5 Which of the following gives diatoms their unique golden-yellow color?
A Silica
B Carotenoids
C Phytoplankton
D None of the above
- 6 Which of the following pigments does NOT allow red algae to photosynthesize?
A Chlorophyll
B Carotenoids
C Phycobilins
D All of the above
- 7 Which of the following is part of a thallus?
A Stem
B Root
C Leaf
D None of the above
- 8 A mass of cytoplasm containing many diploid nuclei but no cell walls or membranes is called a —
A thallus.
B plasmodium.
C pseudopodia.
D volvox colony.
- 9 Which of the following phyla contains organisms that decompose organic materials?
A Myxomycota
B Phaeophyta
C Rhodophyta
D Bacillariophyta
- 10 Which of the following characteristics distinguishes water molds from fungi?
A Water molds are heterotrophic.
B Water molds produce flagellated reproductive cells.
C Water molds are multicellular.
D All of the above

1 A

Some protists are photosynthetic autotrophs that resemble plants. These are called algae. *More about algae can be found on pages 503 and 510–516 of this chapter. National Science Education Standards C.6*

2 D

Pseudopodia are cytoplasm-filled extensions of a plasma membrane that are used for locomotion and feeding by protozoans. *More about protozoans can be found on pages 504–505 of this chapter. National Science Education Standards UCP.5, C.6, G.2*

3 C

Digestion occurs within a food vacuole at the end of the gullet of a paramecium. *More about paramecia can be found on pages 506–508 of this chapter. National Science Education Standards C.5, G.2*

4 C

Three of the six phyla of algae are composed solely of unicellular species. These are euglenoids, diatoms, and dinoflagellates. *More about algae can be found on pages 510–516 of this chapter. National Science Education Standards UCP.1, C.5*

5 B

Diatoms are given their golden-yellow color by pigments called carotenoids. *More about diatoms can be found on pages 512–513 of this chapter. National Science Education Standards UCP.5, G.2*

6 B

Since only green, violet, and blue light penetrate deep waters where red algae lives, these organisms have chlorophyll and phycobilins for photosynthesis. *More about red algae can be found on page 514 of this chapter. National Science Education Standards C.5, C.6*

7 D

A thallus is a plant without stems, roots, or leaves. *More about red algae can be found on page 514 of this chapter. National Science Education Standards UCP.5*

8 B

A plasmodium is a mass of cytoplasm that contains many diploid nuclei but no cell walls or membranes. It is formed by plasmodial slime molds. *More about plasmodial slime molds can be found on pages 517–519 of this chapter. National Science Education Standards UCP.5, C.5*

9 A

Funguslike protists, like Myxomycota, decompose dead organic material. *More about slime molds can be found on pages 517–519 of this chapter. National Science Education Standards UCP.1, C.5, C.6*

10 B

Water molds are distinguished from fungi because they produce flagellated reproductive cells, while fungi do not. *More about water molds can be found on page 520 of this chapter. National Science Education Standards A.1, C.6*

- 1 Fungal hyphae form a network of filaments called a —
A sporangium.
B septum.
C mycelium.
D chitin.
- 2 The cell walls of fungi are composed primarily of —
A chitin.
B cellulose.
C hyphae.
D None of the above
- 3 Which of the following describes the feeding behavior of fungi that feed on dead organic matter?
A Saprophytic
B Mutualistic
C Parasitic
D None of the above
- 4 Parasitic fungi have developed specialized hyphae that penetrate host cells. These hyphae are called —
A mycelia.
B haustoria.
C sporangia.
D None of the above
- 5 Which of the following spore adaptations have fungi developed?
A Spores are protected by sporangia.
B Spores are produced in large numbers.
C Spores are small, lightweight, and easy to disperse.
D All of the above
- 6 Which of the following types of hyphae grow horizontally along a surface in order to produce a mycelium?
A Rhizoids
B Haustoria
C Stolons
D Sporangia
- 7 Which of the following is formed when *Rhizopus* reproduces sexually?
A Mycorrhizae
B Rhizoids
C Conidiophores
D Zygosporangia
- 8 Ascomycotes, called sac fungi, reproduce both sexually and asexually. Asexual spores of ascomycotes are called —
A conidiophores.
B ascospores.
C zygosporangia.
D None of the above
- 9 The undersides of some mushrooms have gills that are lined with which of the following?
A Ascus
B Basidia
C Conidium
D None of the above
- 10 Some fungi develop mutualistic relationships with plants, in which the plant's absorption is increased while the fungus receives organic nutrients. This is called a —
A mycorrhiza.
B mycelium.
C rhizoid.
D gametangium.

1 C

Hyphae elongate and form extensive networks called mycelia. *More about the structure of fungi can be found on pages 530–531 of this chapter. National Science Education Standards UCP.5, C.5*

2 A

Cell walls are composed of the carbohydrate chitin, which gives the cell strength and flexibility. *More about chitin can be found on page 531 of this chapter. National Science Education Standards UCP.5, C.5*

3 A

Saprophytes are fungi that feed by decomposing organic matter. *More about fungal feeding relationships can be found on pages 531–532 of this chapter. National Science Education Standards C.4, C.6*

4 B

Haustoria are specialized hyphae that penetrate and grow into host cells in order to absorb nutrients from the host. *More about parasitic fungi can be found on page 532 of this chapter. National Science Education Standards C.4, C.6*

5 D

Spores are advantageous for fungi. They are protected by sporangia, they are produced in great numbers, and they are easily dispersed. *More about spore reproduction can be found on pages 533–534 of this chapter. National Science Education Standards UCP.5, C.6*

6 C

Stolons are specialized hyphae that grow horizontally across a surface in order to rapidly produce a mycelium. *More about the growth of zygomycetes can be found on pages 530–531 and 535–536 of this chapter. National Science Education Standards UCP.5, C.6*

7 D

Zygosporangia are thick-walled spores that are capable of surviving unfavorable conditions. *More about zygosporangia can be found on page 536 of this chapter. National Science Education Standards UCP.5, C.6*

8 A

When ascomycetes reproduce asexually, they form conidiophores, which produce conidia, the asexual spore of this type of fungus. *More about the reproduction of ascomycetes can be found on page 537 of this chapter. National Science Education Standards C.6, G.2*

9 B

Club-shaped basidia line the gills on the underside of a mushroom cap. These are the site of basidiospore production. *More about the life of a mushroom can be found on pages 538–539 of this chapter. National Science Education Standards UCP.5*

10 A

A mycorrhiza is a mutualistic relationship between a fungus and a plant. Both organisms benefit from this symbiotic relationship. *More about mutualism in fungi can be found on pages 540–541 of this chapter. National Science Education Standards C.4, C.6*

- 1 Aquatic plants that lived in ancient oceans lacked vascular tissue. Without vascular tissue, how did these plants transport nutrients?
- A They were only one or two cells thick and could absorb water and nutrients by diffusion.
 - B They were only one or two cells thick and could absorb water and nutrients by active transport.
 - C Both A and B
 - D Neither A nor B
- 2 You have discovered a new plant species thriving in an extremely dry environment. To which of the following divisions does it most likely belong?
- A Lycophyta
 - B Coniferophyta
 - C Bryophyta
 - D Pterophyta
- 3 You bite into an orange and are surprised to find several small, hard objects inside. Curiosity drives you to examine one of them under the microscope. After breaking one open, what should you expect to find inside?
- A A waxy cuticle
 - B A plant sperm cell
 - C A plant embryo
 - D A plant egg cell
- 4 One adaptation that helped plants survive on land was the development of roots. These roots —
- A anchor plants.
 - B absorb water and nutrients.
 - C contain tissues that transport water and nutrients to the stem.
 - D All of the above
- 5 Which of the following plant divisions includes plants that reproduce by spore production?
- A Coniferophyta
 - B Bryophyta
 - C Gnetophyta
 - D Cycadophyta
- 6 Which of the following is composed of diploid cells?
- A Sporophyte
 - B Spore
 - C Gametophyte
 - D Gamete
- 7 It has been proposed that plants evolved from filamentous green algae. Which of the following statements provides evidence of an evolutionary relationship between modern plants and green algae?
- A Both have cell walls.
 - B Both use chlorophyll for photosynthesis.
 - C Both store glucose as starch.
 - D All of the above
- 8 The Ginkgophyta division of seed plants has only one living species, *Ginkgo biloba*. Which of the following is true of *Ginkgo biloba*?
- A They have large, elongated leaves.
 - B They have separate female and male trees.
 - C They are vulnerable to air pollution and insects.
 - D The seeds they produce have a pleasant smell.
- 9 Which of the following plant divisions probably evolved first?
- A Psilophyta
 - B Lycophyta
 - C Cycadophyta
 - D Anthophyta
- 10 Which of the following is NOT true of anthophytes?
- A They produce fruit.
 - B They produce seeds.
 - C They are nonvascular.
 - D They can be either monocots or dicots.

1 A

Because ancient plants lived in moist environments, water and nutrients entered the plants' cells via diffusion. *More about vascular tissue can be found on pages 561–562 of this chapter. National Science Education Standards UCP.5, A.1, C.5*

2 B

Coniferophyta are vascular seed plants. Vascular plants are more suited to dry environments. Also, seeds help prevent the developing embryo from drying out in dry environments. *More about seed plants can be found on pages 567–569 of this chapter. National Science Education Standards UCP.1, A.1, C.5*

3 C

The hard objects found within a fruit are seeds. Seeds are produced by certain plants for reproduction. They consist of an embryonic plant, a supply of food and nutrients, and a protective coat. *More about seeds can be found on page 562 of this chapter. National Science Education Standards UCP.5, A.1*

4 D

Roots absorb water and nutrients and contain tissues that transport them to the stem. In addition, roots anchor land plants. *More about roots can be found on page 561 of this chapter. National Science Education Standards UCP.5*

5 B

Non-seed plants produce hard-walled reproductive cells, called spores. Bryophytes are non-seed, nonvascular plants, and their spores are formed in capsules. *More about non-seed plants can be found on pages 565–567 of this chapter. National Science Education Standards UCP.1, C.5*

6 A

All the cells of the sporophyte are diploid; it produces haploid spores via meiosis. *More about the alternation of gametophyte and sporophyte generations can be found on pages 562–563 of this chapter. National Science Education Standards C.1, C.5*

7 D

Modern plants and green algae all have cellulose-containing cell walls, chlorophyll for photosynthesis, and starch, which suggests a close evolutionary relationship. *More about the origins of plants can be found on page 559 of this chapter. National Science Education Standards UCP.2, UCP.4, C.3, G.3*

8 B

The *Ginkgo biloba* is a distinctive tree with small, fan-shaped leaves and separate males and females. The seeds give off an unpleasant smell, and they are generally resistant to insects and air pollution. *More information about divisions of seed plants can be found on pages 568–569 of this chapter. National Science Education Standards UCP.5, C.5*

9 A

The oldest plant fossils belong to the division of psilophytes. *More about the origins of plants can be found on pages 559–560 of this chapter. National Science Education Standards UCP.1, UCP.4, C.3, C.5, G.3*

10 C

Anthophytes, or flowering plants, are vascular, seed plants. They produce a fruit that protects the seeds and aids in their dispersal. *More about anthophytes can be found on pages 568–569 of this chapter. National Science Education Standards UCP.5, C.5, G.2*

- 1 Liverworts, like all plants, exhibit a life cycle that includes the alternation of generations between a gametophyte and a sporophyte. Which of these generations is dominant in liverworts?
- A Diploid sporophyte, as in all nonvascular plants.
 - B Diploid sporophyte, as in all vascular plants.
 - C Haploid gametophyte, as in all nonvascular plants.
 - D Haploid gametophyte, as in all vascular plants.
- 2 Which of the following characteristics is found in both vascular and nonvascular plants?
- A Cell walls containing cellulose
 - B Alternation of generations
 - C Chlorophyll used for photosynthesis
 - D All of the above
- 3 Seed plants are able to grow in a greater diversity of habitats than non-seed and nonvascular plants. Which of the following statements is a factor for this phenomenon?
- A Seed plants grow taller than non-seed and nonvascular plants and therefore receive more adequate sunlight.
 - B Seed plants do not require a continuous film of water for fertilization.
 - C Seed plants transport water from their roots to their stems more quickly than non-seed and nonvascular plants.
 - D None of the above
- 4 Which of the following adaptations helps to prevent water loss in conifers?
- A Cutin coating on the leaves
 - B Thick epidermal cell walls
 - C Both A and B
 - D Neither A nor B
- 5 Which structure anchors mosses to soil?
- A Rhizoid
 - B Antheridium
 - C Strobilus
 - D Prothallus
- 6 The sporophytes of some vascular plants form a cluster of leaves that protect developing spores. This cluster of leaves is called a(n) —
- A rhizoid.
 - B antheridium.
 - C strobilus.
 - D prothallus.
- 7 Ferns, like all plants, store glucose in the form of starch. Many ferns store starch in a large underground stem called a —
- A sporangium.
 - B rhizoid.
 - C frond.
 - D rhizome.
- 8 Deciduous plants lose all of their leaves each year. When this occurs, photosynthesis is no longer possible. How do deciduous plants survive without their leaves?
- A They become heterotrophs.
 - B They become dormant and metabolism slows.
 - C The roots become photosynthetic.
 - D All of the above
- 9 The ovary of an anthophyte flower develops into a fruit after fertilization. Which of the following is an advantage of fruit production?
- A Fruit can provide a mechanism for seed dispersal.
 - B The more colorful a fruit, the more nutrients it contains.
 - C The developing embryo absorbs nutrients from the fruit.
 - D All of the above
- 10 Which of the following anthophytes is a perennial?
- A Corn
 - B Carrot
 - C Maple
 - D Wheat

1 C

Liverworts, or hepaticophytes, are nonvascular plants. While in vascular plants the sporophyte generation is dominant, nonvascular plants have a dominant gametophyte generation. *More about alternation of generations can be found on page 578 of this chapter. National Science Education Standards C.5*

2 D

All plants have these three characteristics. Therefore, it is believed that both vascular and nonvascular plants evolved from a common ancestor, which also possessed these three traits. *More about the characteristics of vascular and nonvascular plants can be found on pages 577–578 and 581–582 of this chapter. National Science Education Standards UCP.1, C.5*

3 B

Seed plants do not require a continuous film of water to transport sperm to an egg. Therefore, seed plants are able to reproduce in areas with a limited water supply as well as in moist habitats. *More about the characteristics of seed plants can be found on pages 588–589 of this chapter. National Science Education Standards C.5, C.6*

4 C

Many conifers have needlelike leaves that are retained all year long. In order to minimize water loss, these needles are coated with cutin, a waterproof, waxy material, and their epidermal cell walls are extremely thick. *More about conifers can be found on pages 591–593 of this chapter. National Science Education Standards UCP.5, C.5, G.2*

5 A

Rhizoids are colorless, multicellular structures found in mosses. They are used to anchor the stems of the plants into the soil. *More about mosses can be found on page 579 of this chapter. National Science Education Standards UCP.5, G.2*

6 C

The sporophytes of many non-seed vascular plants have leaves that are adapted to protect developing spores. These leaves form a compact cluster called a strobilus. *More about non-seed vascular plants can be found on pages 581–587 of this chapter. National Science Education Standards UCP.5, G.2*

7 D

Ferns store starch in a thick, underground stem, called a rhizome. It is composed of many starch-filled cells. *More about fern structures can be found on pages 585–586 of this chapter. National Science Education Standards UCP.5, C.5, G.2*

8 B

Deciduous plants lose all of their leaves when water is not readily accessible. This prevents excess water loss from leaf surfaces. Since leaves are the site for photosynthesis, deciduous plants are unable to perform photosynthesis without the leaves. Therefore, after shedding its leaves, a deciduous plant becomes dormant, and its metabolism and growth slow. *More about deciduous plants can be found on page 592 of this chapter. National Science Education Standards UCP.3, C.6, G.2*

9 A

A fruit encloses and protects the seeds of an anthophyte and often aids in dispersal. In animal-dispersed seeds, animals may eat a fruit and pass undigested seeds through the digestive tract. *More about fruit production can be found on page 594 of this chapter. National Science Education Standards UCP.5, C.4*

10 C

Anthophytes may be annuals, biennials, or perennials. Perennials have the longest life span, and maple trees are woody perennials. *More about the life spans of anthophytes can be found on pages 595–596 of this chapter. National Science Education Standards C.6*

- 1 Which of the following is characteristic of plant cells but not animal cells?
- A Central vacuole
 - B Chloroplasts
 - C Cell walls
 - D All of the above
- 2 Which cell type would most likely be involved in food production?
- A Parenchyma
 - B Collenchyma
 - C Sclerenchyma
 - D Trichomes
- 3 What cells are responsible for opening and closing stomata?
- A Stone cells
 - B Guard cells
 - C Fiber cells
 - D Trichomes
- 4 Cells produced by the vascular cambium increase the diameter of a plant's stem. What is this type of growth called?
- A Primary growth
 - B Secondary growth
 - C Tertiary growth
 - D None of the above
- 5 Phloem cells are —
- A dead at maturity and are used to transport water from the roots to the rest of the plant.
 - B dead at maturity and are used to transport sugars throughout the plant.
 - C alive at maturity and are used to transport water from the roots to the rest of the plant.
 - D alive at maturity and are used to transport sugars throughout the plant.
- 6 Which of the following is a region of actively dividing cells in a plant?
- A Cork cambium
 - B Apical meristem
 - C Vascular cambium
 - D All of the above
- 7 In which type of roots do xylem tissues alternate with phloem tissues?
- A Monocot
 - B Dicot
 - C Both A and B
 - D Neither A nor B
- 8 In which type of tissue does photosynthesis take place in a leaf?
- A Meristematic
 - B Dermal
 - C Mesophyll
 - D Vascular
- 9 Which plant hormone is produced in the apical meristem and inhibits the growth of side branches?
- A Ethylene
 - B Auxin
 - C Cytokinin
 - D None of the above
- 10 A plant is placed near a window, and after a few weeks, you notice that the stem begins to bend toward the window. Which tropic response is the plant exhibiting?
- A Phototropism
 - B Gravitropism
 - C Thigmotropism
 - D None of the above

- 1 D**
Unlike animal cells, plant cells have cell walls, central vacuoles, and chloroplasts. *More about plant cells can be found on page 605 of this chapter. National Science Education Standards C.1, C.5*
- 2 A**
Parenchyma cells are involved in storage and food production. They contain chloroplasts, which are the sites for photosynthesis. *More about parenchyma can be found on page 606 of this chapter. National Science Education Standards C.1*
- 3 B**
Guard cells control the opening and closing of stomata to regulate the evaporation of water from the leaf. *More about dermal tissues can be found on page 607 of this chapter. National Science Education Standards UCP.5, C.1*
- 4 B**
Secondary growth describes the increase in a stem's diameter, while primary growth describes the increase in a plant's height. *More about plant growth can be found on page 616 of this chapter. National Science Education Standards C.6, G.2*
- 5 D**
Phloem is composed of tubular living cells that transport sugars throughout the plant. *More about vascular tissues can be found on pages 608–610 of this chapter. National Science Education Standards UCP.5, C.1, C.5*
- 6 D**
Meristems are regions of actively dividing cells. Apical and root meristems increase the length of shoots and roots. Vascular and cork cambium are two types of lateral meristems. Lateral meristems cause the plant to increase in diameter. *More about meristematic tissues can be found on page 611 of this chapter. National Science Education Standards C.1, C.6, G.2*
- 7 A**
Monocot roots have alternating xylem tissues and phloem tissues, while dicot roots contain a central core of xylem and phloem. *More about the structure of roots can be found on pages 613–614 of this chapter. National Science Education Standards C.5*
- 8 C**
Mesophyll is the photosynthetic tissue of a leaf. *More about the structure of leaves can be found on pages 618–619 of this chapter. National Science Education Standards C.5*
- 9 B**
Auxins are produced in the apical meristem. They induce cell division and elongation, while inhibiting the production of side branches. *More about plant hormones can be found on pages 622–623 of this chapter. National Science Education Standards C.6, G.2*
- 10 A**
Phototropism is the growth of a plant toward light. Since sunlight enters through the window, a phototropic response will cause the plant to grow toward the window. *More about the tropic responses in plants can be found on pages 624–625 of this chapter. National Science Education Standards A.1, C.6*

- 1 Liverworts produce gemmae, which grow into new plants. What is this process called?
- A Fertilization
 - B Vegetative reproduction
 - C Meiosis
 - D None of the above
- 2 Mosses form a small green filament of cells that develops into a gametophyte. What is this structure called?
- A Archegonium
 - B Protonema
 - C Antheridium
 - D Megaspore
- 3 Ferns and mosses both undergo alternation of generations. However, unlike mosses, the dominant stage of the fern life cycle is the —
- A sporophyte.
 - B gametophyte.
 - C gemmae.
 - D There is no dominant stage.
- 4 In conifers, what is the small opening at one end of the ovule called?
- A Microspore
 - B Antheridium
 - C Cotyledon
 - D Micropyle
- 5 Which of the following structures is part of a flower?
- A Sepal
 - B Pistil
 - C Petal
 - D All of the above
- 6 Ovaries are located at the base of which of the following structures?
- A Anther
 - B Stamen
 - C Pistil
 - D Sepal
- 7 Which of the following factors controls photoperiodism in flowering plants?
- A Night length
 - B Water supply
 - C Temperature
 - D Gravity
- 8 In anthophytes, what structures form male gametophytes?
- A Tube cells
 - B Megaspores
 - C Microspores
 - D None of the above
- 9 Anthophyte seeds contain a food storage tissue called the —
- A micropyle.
 - B endosperm.
 - C exosperm.
 - D None of the above
- 10 Changes in which of the following might induce seed germination?
- A Water level
 - B Temperature
 - C Oxygen level
 - D All of the above

1 B

Gemmae are asexual reproductive structures produced by liverworts. In a process called vegetative reproduction, these gemmae fall off and develop into new liverwort plants. *More about asexual reproduction can be found on pages 634–635 of this chapter. National Science Education Standards C.6*

2 B

A protonema is a small green filament of cells that develop into a male or female moss gametophyte. *More about the life cycle of mosses can be found on pages 635–636 of this chapter. National Science Education Standards C.6*

3 A

Most plants, including ferns, undergo alternation of generations in which the sporophyte is the dominant stage in the life cycle. *More about the life cycle of ferns can be found on pages 636–637 of this chapter. National Science Education Standards C.6*

4 D

A micropyle is the small opening at one end of the ovule by which sperm enters the ovule through the pollen tube. *More about the life cycle of conifers can be found on pages 638–640 of this chapter. National Science Education Standards UCP.5, G.2*

5 D

A complete flower is composed of four different organs: sepals, petals, stamens, and pistils. *More about the parts of a flower can be found on page 665 of this chapter. National Science Education Standards C.5*

6 C

The ovary is located at the base of a flower's pistil. Inside the ovary, ovules produce egg cells. *More about the structure of flowers can be found on pages 641–643 of this chapter. National Science Education Standards UCP.5*

7 A

Photoperiodism is a flowering response to the relative lengths of day and night. *More about photoperiodism can be found on pages 643–645 of this chapter. National Science Education Standards C.6*

8 C

Male gametophytes are formed from microspores in the anther. A microspore's nucleus divides and a structure called a pollen grain—the male gametophyte—is formed. *More about gametophyte development can be found on pages 646–648 of this chapter. National Science Education Standards UCP.5*

9 B

Endosperm is food storage tissue found in anthophyte seeds. It nourishes and supports the developing embryo. *More about endosperm can be found on page 651 of this chapter. National Science Education Standards C.5*

10 D

Germination is the development of a new plant from an embryo. The initiation of germination requires sufficient amounts of water and oxygen, as well as favorable temperatures. Some plant seeds have additional requirements for germination. *More about seed germination can be found on pages 653–655 of this chapter. National Science Education Standards UCP.3, C.6*

- 1 You are able to observe the formation and development of the embryo of an unknown species under the microscope. You note that the opening of the gastrula develops into the mouth of the developing animal. To which of the following is this unknown species most closely related?
- A Earthworm
 - B Eagle
 - C Shark
 - D Human
- 2 A section of the outer surface of a human gastrula is removed and allowed to grow in culture. Which of the following will form from this section?
- A Muscle
 - B Intestinal lining
 - C Skin
 - D All of the above
- 3 In comparing coelomates and acoelomates, you would expect to find more complex animals to be —
- A Acoelomates, because they have less wasted space within their body structure.
 - B Acoelomates, because they have more mesodermal tissue.
 - C Coelomates, because they are able to store more nutrient-rich fluid inside their bodies.
 - D Coelomates, because they have protected space for specialized organs within their bodies.
- 4 As an embryo develops into a blastula, how does the amount of cytoplasm change?
- A It increases because the number of cells increases.
 - B It does not change because in every round of division, each cell divides into two smaller cells.
 - C It does not change because as new cells are formed, the embryo sheds older cells into its extracellular environment.
 - D None of the above
- 5 It is suggested that the animal kingdom evolved from colonial protists during which geological time?
- A Mesozoic Era
 - B Jurassic Period
 - C Triassic Period
 - D Precambrian
- 6 A pseudocoelom is partly lined by tissue derived from which of the following?
- A Mesoderm
 - B Endoderm
 - C Ectoderm
 - D All of the above
- 7 As a human develops from a zygote to an adult, which of the following structures is NOT formed?
- A Gastrula
 - B Juvenile
 - C Larva
 - D Blastula
- 8 A human fetus receives nutrients from its mother through an umbilical cord. To which surface of the fetus's body does the umbilical cord connect?
- A Ventral
 - B Dorsal
 - C Posterior
 - D None of the above
- 9 Which body plan would be most advantageous for an animal that needs to detect the presence of potential prey in all directions?
- A Radial symmetry
 - B Bilateral symmetry
 - C Asymmetry
 - D All are equally advantageous
- 10 New species are frequently discovered in tropical rain forests due to that habitat's tremendous biodiversity. Suppose a new organism is found that exhibits bilateral symmetry, heterotrophism, and has an exoskeleton. Would you classify this organism as a vertebrate?
- A Yes, bilateral symmetry and heterotrophism are unique to vertebrates.
 - B Yes, only vertebrates are found in the tropical rainforest.
 - C No, exoskeletons are never found in vertebrates.
 - D No, vertebrates exhibit radial symmetry.

1 A

Because the opening of the gastrula becomes the animal's mouth, the animal must be a protostome. The earthworm is a protostome, while eagles, sharks, and humans are deuterostomes. *More about protostomes and deuterostomes can be found on page 677 of this chapter. National Science Education Standards UCP.5, A.1, C.5*

2 C

The outer surface of a gastrula is made up of ectodermal cells, which give rise to skin and nervous tissue. *More about gastrulation can be found on pages 676–678 of this chapter. National Science Education Standards A.1, C.5*

3 D

The coelom is a fluid-filled body cavity. It provides space and protection for the development of complex organs within the body. *More about the coelom can be found on pages 683–684 of this chapter. National Science Education Standards UCP.5, C.5*

4 B

During the formation of a blastula, the amount of cytoplasm does not change. Instead, the cytoplasm is divided among smaller and smaller cells. *More about embryonic development can be found on page 678 of this chapter. National Science Education Standards UCP.3*

5 D

The animal kingdom is thought to have originated with protists that formed colonies. The evolution of the first animals probably occurred during the Precambrian. *More about the origins of animals can be found on page 685 of this chapter. National Science Education Standards UCP.4, C.3, G.3*

6 B

A pseudocoelom is a fluid-filled cavity that develops between the endoderm and mesoderm of an organism. *More about pseudocoelomate body plans can be found on pages 682–683 of this chapter. National Science Education Standards C.5*

7 C

Most animals, including humans, pass through a juvenile stage which resembles a smaller version of the adult. All animal embryos pass through blastula and gastrula stages. However, insects and echinoderms also develop into larvae, which do not resemble the adult animal. *More about growth and development can be found on pages 676–679 of this chapter. National Science Education Standards UCP.3, C.5*

8 A

A human's navel is located on its ventral surface. The back surface of a human is the dorsal surface. *More about bilateral symmetry can be found on pages 781–782 of this chapter. National Science Education Standards C.5*

9 A

Animals that can sense prey coming from all directions, like hydra, have radial symmetry. Bilaterally symmetrical animals often have sensory organs only at their anterior ends. *More about symmetry can be found on pages 680–682 of this chapter. National Science Education Standards UCP.5, C.5*

10 C

Vertebrates are bilaterally symmetrical animals that have endoskeletons. Therefore, an organism with an exoskeleton cannot be classified as a vertebrate. *More about vertebrate and invertebrate characteristics can be found on pages 684–685 of this chapter. National Science Education Standards UCP.1, A.2, C.5*

- 1** Though sponges appear to be in the plant kingdom, which of the following provides evidence that they are not plants?
- A They are multicellular.
 - B They develop mesoderm.
 - C They are sessile.
 - D They have no cell walls.
- 2** Sponges can reproduce asexually and sexually. What advantage does sexual reproduction provide for sponges?
- A Sexual reproduction increases diversity among sponge populations, while asexual reproduction does not.
 - B Sexual reproduction is faster than asexual reproduction.
 - C Sexual reproduction is more efficient in water than asexual reproduction.
 - D Sexual reproduction does not require fertilization, while asexual reproduction does.
- 3** What advantage does a jellyfish's body symmetry provide?
- A Its radial symmetry allows it to find food with anterior sensory organs.
 - B Its radial symmetry allows it to detect prey coming from all directions.
 - C Its bilateral symmetry allows it to find food with anterior sensory organs.
 - D Its bilateral symmetry allows it to detect prey coming from all directions.
- 4** In examining the internal organs of a human, you detect the presence of a parasite. Upon closer examination of the parasite, you notice that it has bilateral symmetry and a pseudocoelom. Which of the following could it be?
- A Cnidarian
 - B Planarian
 - C Tapeworm
 - D Pinworm
- 5** Which of the following is NOT a roundworm?
- A *Trichinella*
 - B Nematode
 - C Blood fluke
 - D Hookworm
- 6** Cnidarians have a nervous system composed of a nerve net. When a cnidarian is touched, its musclelike cells contract in response. Is this process regulated by the cnidarian's brain?
- A Yes, all nerve impulses are transmitted through the brain.
 - B Yes, the brain exerts control over the nerve net.
 - C No, the cnidarian's brain is not involved in reflexive actions.
 - D No, cnidarians do not have a brain.
- 7** Which of the following adaptations allows some sponge populations to survive being exposed to colder, harsher temperatures?
- A Gemmule production
 - B Hermaphroditism
 - C Regeneration
 - D Spicule formation
- 8** Flame cells help to remove excess water from a planarian's body. What mechanism is involved in their function?
- A They generate heat in order to facilitate evaporation.
 - B Flagella are used to pull water into the body.
 - C Cilia are used to move water out of the body.
 - D None of the above
- 9** Which of the following adaptations is used by sponges to defend against predators?
- A Toxin production
 - B Spicule formation
 - C Both A and B
 - D Neither A nor B
- 10** Cnidarians are able to reproduce both sexually and asexually. Which of the following stages predominates in the life cycle of a jellyfish?
- A Sexual medusa stage
 - B Asexual medusa stage
 - C Sexual polyp stage
 - D Asexual polyp stage

1 D

All plants have cell walls surrounding the plasma membrane. Since sponges do not, they cannot be classified in the plant kingdom. Instead, they are animals. *More about sponges can be found on pages 693–695 of this chapter. National Science Education Standards UCP.1, C.1, C.5*

2 A

Sexual reproduction allows for traits to be passed to offspring from two parents. Asexual reproduction only results in clones of the parent sponge. *More about sponge reproduction can be found on page 696 of this chapter. National Science Education Standards UCP.3, C.3, C.6*

3 B

A jellyfish is a cnidarian. All cnidarians exhibit radial symmetry, which allows for detection of prey from all directions. *More about cnidarian body symmetry can be found on pages 698–699 of this chapter. See Chapter 25 for more about symmetry. National Science Education Standards UCP.5, C.5*

4 D

Its bilateral symmetry and pseudocoelom indicate that the parasite is a roundworm, and the pinworm is a roundworm. *More about roundworms can be found on pages 711–713 of this chapter. National Science Education Standards UCP.5, A.1, C.5*

5 C

Trichinella, hookworms, and nematodes are all parasitic roundworms. Blood flukes are also parasitic, but they are flatworms. While roundworms have a pseudocoelom, blood flukes are acoelomates. *More about roundworms can be found on pages 711–713 of this chapter. National Science Education Standards UCP.1, C.5*

6 D

The cnidarian's nerve net is a very simple nervous system without a brain. It is composed of a network of nerves that respond to external stimuli. Therefore, when a cnidarian is touched, the nerve impulse is only transmitted through these nerves. *More about cnidarian nervous regulation can be found on page 702 of this chapter. National Science Education Standards C.5, C.6*

7 A

Sponges that live in temperate regions die in the winter months. But, in the fall, these sponges produce seed-like gemmules that survive the winter and grow into adult sponges in the spring. *More about sponge reproduction can be found on page 696 of this chapter. National Science Education Standards C.6*

8 C

Water from flame cells collects in tubules and is moved out of the body of the planarian by the constant motion of cilia. Excess water leaves through pores on the body surface. *More about planarians can be found on pages 707–709 of this chapter. National Science Education Standards C.1, C.5*

9 C

Some species have many sharp spicules that deter predators from eating them. Others, including some tropical sponges, produce chemical toxins that prevent predation. Both methods are effective defense mechanisms. *More about sponge defenses can be found on page 697 of this chapter. National Science Education Standards UCP.5, C.6, G.2*

10 A

Jellyfish utilize a reproductive strategy in which the sexual medusa stage and asexual polyp stage alternate. The dominant stage is the sexual medusa stage. *More about cnidarian reproduction can be found on pages 699–701 of this chapter. National Science Education Standards C.6*

- 1 You discover an organism on the beach. Upon closer examination, you find that the organism has a pseudocoelom, with bilateral symmetry and a hard shell. Would you classify this organism as a mollusk?
- A Yes, all mollusks have these characteristics
 - B No, mollusks are radially symmetrical.
 - C No, mollusks do not have hard shells.
 - D No, mollusks have a true coelom.
- 2 Which of the following structures is a membrane that secretes the shell of some mollusks?
- A Radula
 - B Mantle
 - C Muscular foot
 - D Skin
- 3 You find an empty mollusk shell lying on the beach. Along its edge, there is a series of small holes, which you believe were made by the predator that ate the mollusk. Which of the following structures probably made the holes?
- A Radula
 - B Foot
 - C Nephridia
 - D Siphon
- 4 In order for some mollusks to move through the water, they propel water into and out of their bodies. What do they use to do this?
- A Nephridia
 - B Siphons
 - C Gills
 - D Heart
- 5 Into how many chambers is a mollusk's heart divided?
- A One
 - B Two
 - C Three
 - D Four
- 6 In most mollusks, what is the site of gas exchange with the external environment called?
- A Mouth
 - B Nephridia
 - C Siphon
 - D Gill
- 7 To what class of mollusks do squids belong?
- A Gastropoda
 - B Bivalvia
 - C Cephalopoda
 - D None of the above
- 8 You discover an organism that displays bilateral symmetry, has a coelom, and has two body openings. Would you classify the organism as a segmented worm?
- A Yes, all segmented worms have these characteristics.
 - B No, segmented worms are radially symmetrical.
 - C No, segmented worms are acoelomates.
 - D No, segmented worms have only one body opening.
- 9 What do segmented worms use to anchor their bodies to the soil to facilitate locomotion?
- A Gizzards
 - B Setae
 - C Radula
 - D Nephridia
- 10 Earthworms are often used by farmers to enhance their crops. In addition to aerating the soil, earthworms fertilize the soil with —
- A castings.
 - B setae.
 - C parapodia.
 - D organs.

1 D

Mollusks are characterized by bilateral symmetry, a coelom, a digestive tract with two openings, a muscular foot, and a mantle. In addition, some have shells. *More about the structure of mollusks can be found on pages 721–722 of this chapter. National Science Education Standards UCP.1, A.2, C.5*

2 B

A mantle is a membrane that secretes the shells of certain mollusks. It surrounds the mollusk's internal organs. *More about mantles can be found on page 722 of this chapter. National Science Education Standards UCP.5, G.2*

3 A

A radula is a tonguelike organ with rows of teeth. These teeth probably made the holes in the mollusk shell. *More about the way in which mollusks obtain food can be found on page 722 of this chapter. National Science Education Standards UCP.5, A.2, C.6*

4 B

Siphons are funnels that can draw water into and expel water out of the body of a mollusk. This movement of water is used for locomotion. *More about siphons can be found on page 727 of this chapter. National Science Education Standards UCP.5, C.6, G.2*

5 C

Mollusks have closed or open circulatory systems, powered by a three-chambered heart. *More about circulation in mollusks can be found on page 724 of this chapter. National Science Education Standards UCP.5, C.5, G.2*

6 D

Gills consist of filamentous projections, which maximize the surface area available for gas exchange. They are found in most mollusks, not including terrestrial snails. *More about respiration in mollusks can be found on page 725 of this chapter. National Science Education Standards UCP.5, C.5, G.2*

7 C

Cephalopods, also called head-footed mollusks, have tentacles that are used to move and capture food. This class includes the squid, octopus, cuttlefish, and chambered nautilus. *More about the classes of mollusks can be found on pages 725–727 of this chapter. National Science Education Standards UCP.1, C.5, G.2*

8 A

Segmented worms are characterized by bilateral symmetry, a coelom, and two body openings. *More about the structure of segmented worms can be found on pages 728–730 of this chapter. National Science Education Standards UCP.1, A.2, C.5*

9 B

Setae are tiny bristles located on each segment of a segmented worm. They are used to anchor the body into the ground and allow the movement of these worms. *More about the locomotion of segmented worms can be found on page 728 of this chapter. National Science Education Standards UCP.5, C.6, G.2*

10 A

The wastes of an earthworm are called castings. When they are passed out of an earthworm and into the soil, these wastes function as fertilizer. *More about earthworms can be found on pages 728–732 of this chapter. National Science Education Standards C.4, C.6, F.3*

- 1 Which of the following features is a characteristic of arthropods?
- A Coelom
 - B Endoskeleton
 - C Radial symmetry
 - D Vertebrate
- 2 What is the skeleton of an arthropod composed of?
- A Cellulose
 - B Bone
 - C Chitin
 - D Muscle
- 3 Arthropods become more vulnerable to predation after losing their exoskeleton. What is this process called?
- A Parthenogenesis
 - B Molting
 - C Segmentation
 - D Shedding
- 4 Which of the following arthropod segments is located most posterior?
- A Head
 - B Thorax
 - C Cephalothorax
 - D Abdomen
- 5 Spiders have air-filled chambers containing leaflike plates for gas exchange. What are these plates called?
- A Gills
 - B Tracheal tubes
 - C Book lungs
 - D Stoma
- 6 Small openings on the thorax and abdomen of some insects allow air to enter and leave the tracheal tubes. What are these small openings called?
- A Spiracles
 - B Malpighian tubules
 - C Pedipalps
 - D Spinnerets
- 7 Which of the following structures are used to detect the presence and identity of pheromones?
- A Mandibles
 - B Malpighian tubules
 - C Antennae
 - D Eyes
- 8 What is asexual reproduction, in which a new individual develops from an unfertilized egg, called?
- A Metamorphosis
 - B Parthenogenesis
 - C Internal fertilization
 - D None of the above
- 9 Which of the following pairs of arachnid appendages is located most anterior?
- A Legs
 - B Pedipalps
 - C Chelicerae
 - D Spinnerets
- 10 Which of the following stages is seen in insects that undergo incomplete metamorphosis?
- A Larva
 - B Nymph
 - C Pupa
 - D All of the above

- 1 A**
Arthropods are segmented coelomates, with bilateral symmetry and a hard exoskeleton. *More about arthropods can be found on pages 741–746 of this chapter. National Science Education Standards UCP.5, C.5, G.2*
- 2 C**
The arthropod exoskeleton is composed of protein and chitin. *More about exoskeletons can be found on page 742 of this chapter. National Science Education Standards C.5, G.2*
- 3 B**
Because exoskeletons cannot grow, arthropods must shed their exoskeletons periodically, in a process called molting. *More about molting can be found on page 742 of this chapter. National Science Education Standards C.6*
- 4 D**
Most arthropods have three segments: the head, thorax, and abdomen. The abdomen is located at the posterior end of the organism. *More about segmentation in arthropods can be found on page 743 of this chapter. National Science Education Standards UCP.1, C.5*
- 5 C**
Spiders and some other arthropods have book lungs. These air-filled chambers are the sites of gas exchange. *More about gas exchange in arthropods can be found on page 744 of this chapter. National Science Education Standards UCP.5, C.5*
- 6 A**
In arthropods that have tracheal tubes, spiracles allow air to enter and leave the body. *More about tracheal tubes can be found on page 744 of this chapter. National Science Education Standards UCP.5, C.5, G.2*
- 7 C**
Pheromones are chemical signals given off by animals. They are detected by an arthropod's antennae. *More about the senses of arthropods can be found on pages 744–745 of this chapter. National Science Education Standards UCP.5, C.6*
- 8 B**
Some arthropods reproduce asexually, in a process called parthenogenesis. This process involves the development of a new organism from an unfertilized ovum. *More about reproduction in arthropods can be found on page 746 of this chapter. National Science Education Standards C.6, G.2*
- 9 C**
Arachnids have six pairs of appendages. Chelicerae are located most anterior, near the mouth. They are used to hold food or inject poison. *More about arachnid appendages can be found on page 748 of this chapter. National Science Education Standards UCP.1, UCP.5, C.5*
- 10 B**
Incomplete metamorphosis involves three stages: egg, nymph, and adult. *More about metamorphosis can be found on pages 753–754 of this chapter. National Science Education Standards UCP.3, C.6*

- 1 What are the long, tapering arms of echinoderms called?
 - A Pedicellariae
 - B Tube feet
 - C Ampullas
 - D Rays

- 2 What is the endoskeleton of echinoderms composed of?
 - A Chitin
 - B Calcium carbonate
 - C Cellulose
 - D Echinoderms do not have endoskeletons.

- 3 What are the structures used by echinoderms to pry open the shells of bivalves called?
 - A Ampullas
 - B Tube feet
 - C Pedicellariae
 - D Rays

- 4 Which of the following structures allows water into and out of the water vascular system?
 - A Pedicellariae
 - B Ampulla
 - C Madreporite
 - D Anus

- 5 Which of the following nutritional lifestyles are found in populations of echinoderms?
 - A Herbivorous
 - B Carnivorous
 - C Decomposers
 - D All of the above

- 6 Which of the following echinoderms has a sessile lifestyle?
 - A Sea lily
 - B Sea cucumber
 - C Brittle star
 - D Sea urchin

- 7 Which of the following characteristics can be found in the development of invertebrate chordates?
 - A Gill slits
 - B Notochord
 - C Postanal tail
 - D All of the above

- 8 Which of the following structures is the progenitor of the central nervous system in chordates?
 - A Notochord
 - B Dorsal hollow nerve cord
 - C Muscle blocks
 - D None of the above

- 9 What is the tunic produced by adult sea squirts made of?
 - A Chitin
 - B Calcium carbonate
 - C Cellulose
 - D None of the above

- 10 Tunicates and lancelets are filter feeders. In order to trap food, they secrete mucus from the —
 - A pharynx.
 - B ciliated groove.
 - C gill slits.
 - D None of the above

1 D

The long, tapering arms of echinoderms are called rays. They are covered with spines in many echinoderms. *More about the structure of echinoderms can be found on pages 763–766 of this chapter. National Science Education Standards UCP.5, G.2*

2 B

The endoskeleton of echinoderms is composed of calcium carbonate. *More about the structure of echinoderms can be found on pages 763–766 of this chapter. National Science Education Standards C.5, G.2*

3 B

Tube feet can attach to the shell of a bivalve using their suction-like tips. They can be used to pull the shell apart and gain access to its prey. *More about tube feet can be found on page 765 of this chapter. National Science Education Standards UCP.5, C.6, G.2*

4 C

The madreporite is a sievelike, disk-shaped opening on the dorsal side of an echinoderm's body. It allows water into and out of the water vascular system. *More about the water vascular system can be found on pages 764–765 of this chapter. National Science Education Standards UCP.5, C.5*

5 D

Echinoderms have many different nutritional lifestyles. Some are herbivorous, while others can be carnivorous. Some feed on dead and decaying matter on the ocean floor. *More about nutrition in echinoderms can be found on page 765 of this chapter. National Science Education Standards C.4, C.6*

6 A

Sea lilies are the only sessile echinoderms. All others have mechanisms for locomotion. *More about sea lilies can be found on page 768 of this chapter. National Science Education Standards C.6*

7 D

All chordates have a notochord, a dorsal hollow nerve cord, gill slits, and a postanal tail during development. *More about invertebrate chordates can be found on pages 770–775 of this chapter. National Science Education Standards UCP.5, C.5, G.2*

8 B

The cells in the dorsal hollow nerve cord form the brain and spinal cord. *More about the dorsal hollow nerve cord can be found on page 771 of this chapter. National Science Education Standards UCP.5, C.5, G.2*

9 C

Tunicates secrete a tough sac made of cellulose, called a tunic. *More about tunicates can be found on pages 772–773 of this chapter. National Science Education Standards C.5, C.6, G.2*

10 B

The ciliated groove captures food during filter feeding. Mucus is secreted in order to trap food. *More about tunicates and lancelets can be found on pages 772–775 of this chapter. National Science Education Standards UCP.5, C.6*

- 1 The backbone of a bony fish is comprised of several separate vertebrae. Suppose a mutant fish was born with these vertebrae fused together. How might this mutation affect the fish?
- A It would be a more effective predator because it would be able to swim faster.
 - B It would be a more effective predator because its backbone would be stronger.
 - C It would be a less effective predator because its backbone would be weaker.
 - D It would be a less effective predator because it would swim more slowly.
- 2 Which of the following is NOT a cartilaginous fish?
- A Eel
 - B Shark
 - C Ray
 - D Skate
- 3 Early amphibians made the transition from swimming in water to walking on land. Why might walking have required significantly more energy than swimming?
- A There is less oxygen available in air than there is in water.
 - B The muscles are required to support the entire weight of the organism on land.
 - C Wind resistance created more friction than water.
 - D None of the above
- 4 Lungs were an important adaptation for life on land. Why couldn't amphibians use gills to breathe once they began walking on land?
- A There is not enough oxygen in the air.
 - B The temperature of the air fluctuated greatly.
 - C The gills could not have been kept moist enough for gas exchange.
 - D All of the above.
- 5 Fins are fan-shaped membranes that attach to the endoskeleton of most fishes. Which of the following is NOT a function of fins?
- A Swimming
 - B Digestion
 - C Balance
 - D Steering
- 6 Cartilaginous fishes possess a series of fluid-filled canals running along the sides of their bodies. These are used for detecting movement and vibrations in the surrounding water. This adaptation is called the —
- A canal perception system.
 - B swim bladder.
 - C fluid motion sensor.
 - D lateral line system.
- 7 In studying the fossil evidence of an unknown fish species, you recognize a pattern of cone-shaped scales. Which of the following might be the unknown fish?
- A Salmon
 - B Shark
 - C Gar
 - D None of the above
- 8 Which of the following is NOT in a subclass of bony fishes?
- A Hagfish
 - B Lungfish
 - C Coelacanth
 - D Catfish
- 9 What feature of amphibians prevents them from inhabiting areas with colder climates?
- A Amphibians are endothermic.
 - B Amphibians breathe using lungs.
 - C Amphibians are ectothermic.
 - D All of the above.
- 10 As a frog embryo develops, it passes through an aquatic stage, called a tadpole. Tadpoles are physiologically different from the adult frog that will eventually develop. These physiological changes take place in a process called —
- A fertilization.
 - B metamorphosis.
 - C molting.
 - D None of the above

1 D

Separate vertebrae enable a great deal of flexibility among bony fishes. Since these fishes swim by continuously flexing their backbones, fused vertebrae would significantly decrease their rate of locomotion. This would affect the fish's ability to capture prey. *More about bony fishes can be found on pages 798–801 of this chapter. National Science Education Standards UCP.5, A.1, C.6*

2 A

Some classes of fishes have skeletons made of cartilage while others have skeletons made of bone. Sharks, skates, and rays are all cartilaginous fishes. Eels, on the other hand, are bony fishes that maintain great flexibility through the presence of separate vertebrae. *More about cartilaginous fishes can be found on pages 799–800 of this chapter. National Science Education Standards UCP.1, C.5*

3 B

In the water, an animal's weight is supported by the buoyancy of the water. However, once on land, an animal must support its own weight. Therefore, walking on land is more strenuous and requires more energy. *More about the amphibians' transition to life on land can be found on pages 806 and 808–809 of this chapter. National Science Education Standards UCP.4, C.5, C.6*

4 C

The site of gas exchange must be kept moist in order to transport soluble gases across cell membranes. Once on land, it would be impossible to keep the exposed surfaces of gills moist. Therefore, an internalized respiratory system was required for breathing on land. *More about the challenges of life on land can be found on pages 808–809 of this chapter. National Science Education Standards UCP.5, C.5*

5 B

The paired fins of fishes are important structural adaptations that are used in locomotion. They function for balance, swimming, and steering and, in some fishes, are used for protection. *More about fins can be found on page 798 of this chapter. National Science Education Standards UCP.5, C.6*

6 D

Cartilaginous and bony fishes developed a sensory system called the lateral line system. It is a line of fluid-filled canals running along the sides of a fish, which are used to detect movement in their environments. *More about the sensory systems of fishes can be found on page 798 of this chapter. National Science Education Standards UCP.1, UCP.5, C.3*

7 A

Different groups of fishes have different types of scales. While primitive bony fish have diamond-shaped scales and sharks have tooth-shaped scales, later bony fish have round or cone-shaped scales. Salmon is one of these modern bony fishes. *More about fish scales can be found on page 797 of this chapter. National Science Education Standards UCP.1, UCP.2, A.1, C.5*

8 A

There are two subclasses of bony fishes: lobefinned fishes, and ray-finned fishes. Hagfishes belong to the class Agnatha, which have cartilaginous skeletons. *More about the diversity of fishes can be found on pages 799–800 of this chapter. National Science Education Standards UCP.1, C.5*

9 C

Amphibians are ectothermic animals. Their body temperature fluctuates along with external temperatures. Therefore, amphibians tend to inhabit warmer regions. *More about amphibians can be found on pages 803–809 of this chapter. National Science Education Standards UCP.3, C.5, C.6*

10 B

Amphibians undergo the process of metamorphosis, in which they pass through distinct stages of development toward adulthood. The tadpole is the intermediate aquatic stage in the development of frogs. *More about metamorphosis can be found on page 805 of this chapter. National Science Education Standards UCP.3, C.5*

- 1 Which of the following adaptations is characteristic of crocodiles?
- A Scaly skin
 - B Ectothermic
 - C Four-chambered heart
 - D All of the above
- 2 To allow for terrestrial reproduction, reptiles have evolved an egg containing a —
- A yolk.
 - B chorion.
 - C amnion.
 - D All of the above
- 3 What is the membranous sac into which an embryo's wastes are excreted called?
- A Chorion
 - B Allantois
 - C Jacobson's organ
 - D Placenta
- 4 What is the dorsal part of a turtle's shell called?
- A Carapace
 - B Amnion
 - C Plastron
 - D Dome
- 5 From what did birds most likely evolve?
- A Scaly reptiles
 - B Tuatara
 - C Theropods
 - D None of the above
- 6 What do birds have that distinguishes them from other organisms?
- A Four-chambered hearts
 - B Wings
 - C Amniotic eggs
 - D Feathers
- 7 Muscles used for flight are attached to which of the following structures?
- A Posterior air sac
 - B Sternum
 - C Trachea
 - D None of the above
- 8 Which of the following behaviors allows a bird to maintain a constant body temperature in extremely hot weather?
- A Spreading wings
 - B Panting
 - C Flattening feathers
 - D All of the above
- 9 For bird embryos, which of the following structures is the site of gas exchange?
- A Allantois
 - B Shell
 - C Chorion
 - D Posterior air sacs
- 10 Which of the following birds has webbed feet for swimming?
- A Ptarmigan
 - B Owl
 - C Penguin
 - D Hummingbird

1 D

Crocodylians have four-chambered hearts, scaly skin, and are ectothermic. *More about reptilian features can be found on pages 817–821 of this chapter. National Science Education Standards UCP.5, C.5, G.2*

2 D

Reptiles produce amniotic eggs, containing a yolk, chorion, and amnion. *More about amniotic eggs can be found on pages 818–819 of this chapter. National Science Education Standards C.5*

3 B

The allantois is a membranous sac into which an embryo's wastes are secreted. *More about the allantois can be found on page 819 of this chapter. National Science Education Standards UCP.5, C.5, G.2*

4 A

Turtles, unlike other reptiles, have a shell, composed of a carapace and plastron. The dorsal part of the shell is called a carapace. *More about turtles can be found on page 822 of this chapter. National Science Education Standards UCP.5, G.2*

5 C

Evidence from fossils supports the assertion that birds evolved from theropods, small, two-legged dinosaurs. *More about the origin of birds can be found on page 826 of this chapter. National Science Education Standards UCP.2, UCP.4, C.3, G.3*

6 D

Birds are the only organisms with feathers. *More about feathers can be found on pages 826–827 of this chapter. National Science Education Standards UCP.5*

7 B

Muscles used for flight are connected to the upper bone of a bird's wings and to the sternum, a large breastbone. *More about the flight of birds can be found on pages 827–828 of this chapter. National Science Education Standards UCP.5, C.6*

8 D

Birds are endotherms, and thus are able to regulate their internal temperature. In order to release heat, birds spread their wings, pant, and flatten their feathers. *More about temperature regulation in birds can be found on page 828 of this chapter. National Science Education Standards UCP.4, C.5, C.6*

9 C

The chorion is the membrane that forms around the other components of an amniotic egg. It is the site of gas exchange during respiration. *More about an amniotic egg can be found on page 819 of this chapter. National Science Education Standards UCP.5, C.5, G.2*

10 C

Penguins are flightless birds that have webbed feet to facilitate swimming. *More about the diversity of birds can be found on pages 830–831 of this chapter. National Science Education Standards UCP.5, C.6*

- 1 What is the hair of a mammal made of?
 - A Cellulose
 - B Keratin
 - C Chitin
 - D Chlorophyll
- 2 What is a group of cells that secretes fluid called?
 - A Diaphragm
 - B Placenta
 - C Gland
 - D Organ
- 3 Which of the following is characteristic of mammals?
 - A Mammary glands
 - B Four-chambered heart
 - C Diaphragm
 - D All of the above
- 4 What are teeth used primarily for crushing and grinding food called?
 - A Molars
 - B Canines
 - C Incisors
 - D Chisel
- 5 You discover the remains of what appears to be a mammal. Upon examining the teeth of the animal, you find that there are predominantly premolars and molars. What type of lifestyle did this animal probably live?
 - A Herbivorous
 - B Carnivorous
 - C Omnivorous
 - D It cannot be determined.
- 6 What is the name of the hollow, muscular organ in which mammal offspring develop?
 - A Placenta
 - B Diaphragm
 - C Uterus
 - D Pouch
- 7 Which of the following types of mammals develop for a short period within the mother, followed by another period outside the mother in a pouch?
 - A Placental
 - B Monotreme
 - C Marsupial
 - D Primate
- 8 In which of the following areas would you find monotremes?
 - A Australia
 - B New Guinea
 - C Tasmania
 - D All of the above
- 9 During which era did mammals experience a dramatic increase in their populations?
 - A Precambrian
 - B Cenozoic
 - C Mesozoic
 - D None of the above
- 10 What do mammals contract to inhale?
 - A Lungs
 - B Mammary gland
 - C Diaphragm
 - D Heart

1 B

Mammalian hair is made of keratin. Mammals are the only organisms with hair. *More about hair can be found on pages 841–842 of this chapter. National Science Education Standards C.5*

2 C

A gland is a group of cells that secretes fluids. Mammals have glands that secrete saliva, sweat, hormones, and other fluids. *More about glands can be found on page 842 of this chapter. National Science Education Standards UCP.5, G.2*

3 D

Mammals have mammary glands for nursing, a four-chambered heart, and a diaphragm for respiration. *More about mammals can be found on pages 840–851 of this chapter. National Science Education Standards UCP.5, C.5, G.2*

4 A

Molars are teeth used for grinding and crushing food. *More about mammalian teeth can be found on pages 843–844 of this chapter. National Science Education Standards UCP.5, G.2*

5 A

Herbivores generally have only molars and premolars, used to grind the cellulose found in plants. *More about mammalian teeth can be found on pages 843–844 of this chapter. National Science Education Standards UCP.5, A.1, C.6*

6 C

The offspring of some mammals develop in the uterus, a hollow, muscular organ. *More about mammalian development can be found on pages 848–850 of this chapter. National Science Education Standards UCP.5, G.2*

7 C

Marsupials develop for a short time inside the mother, followed by an extended period in a pouch located on the outside of the mother's body. *More about mammalian development can be found on pages 848–850 of this chapter. National Science Education Standards C.6*

8 D

Monotremes are found only in Australia, Tasmania, and New Guinea. *More about monotremes can be found on pages 850–851 of this chapter. National Science Education Standards C.6*

9 B

The population of mammals exploded during the Cenozoic Era, sometimes called the golden age of mammals. *More about the origin of mammals can be found on pages 850–851 of this chapter. National Science Education Standards UCP.3, UCP.4, C.3, G.3*

10 C

Contraction of the diaphragm causes the chest cavity to expand and take in large amounts of air. *More about respiration in mammals can be found on page 843 of this chapter. National Science Education Standards UCP.5, C.5*

- 1 What are changes in temperature, duration of daylight, and the presence of a predator all examples of?
A Behavior
B Reflex
C Stimuli
D Instinct
- 2 Which of the following behaviors is inherited?
A Egg retrieval
B Courtship
C Reflex
D All of the above
- 3 What is a simple, automatic response involving no conscious control called?
A Reflex
B Instinct
C Learned behavior
D Adaptation
- 4 What behavior do many animals exhibit in order to reduce competition?
A Courtship
B Fight-or-flight responses
C Territoriality
D Reflex
- 5 What are chemicals used to mark territorial boundaries called?
A Mammary glands
B Pheromones
C Marking oils
D Nuptial gifts
- 6 Aggressive behavior in animals often leads to social ranking. What do social rankings form?
A Circadian rhythm
B Territory
C Dominance hierarchy
D Courtship
- 7 How long is the circadian rhythm for migratory birds?
A One year
B 24 hours
C Three months
D Five years
- 8 Animals living in hot environments may attempt to conserve energy by —
A estivation.
B migration.
C hibernation.
D nesting.
- 9 An animal that forms a social attachment to its mother shortly after birth demonstrates which learned behavior?
A Insight
B Habituation
C Imprinting
D Trial-and-error
- 10 What is an internal need that causes an animal to act called?
A Habituation
B Motivation
C Stimulus
D None of the above

- 1 C**
External cues, such as the presence of a predator or a change in temperature, are called stimuli. *More about stimuli can be found on page 859 of this chapter. National Science Education Standards UCP.3, C.6*
- 2 D**
Inherited, or innate, behaviors include automatic responses to stimuli and instinctive behaviors. *More about inherited, automatic, and instinctive behaviors can be found on pages 860–867 of this chapter. National Science Education Standards C.6*
- 3 A**
A reflex is a simple, automatic response that involves no conscious control. *More about reflexes can be found on page 861 of this chapter. National Science Education Standards C.6, G.2*
- 4 C**
Territorial behaviors reduce competition by allowing for the efficient use of resources. *More about territoriality can be found on page 863 of this chapter. National Science Education Standards UCP.1, C.5, C.6*
- 5 B**
Pheromones are chemicals used to communicate with other individuals. *More about the use of pheromones in territoriality can be found on page 863 of this chapter. National Science Education Standards C.5, C.6, G.2*
- 6 C**
A social ranking within a group is called a dominance hierarchy. This is formed by aggressive and submissive behaviors. *More about dominance hierarchies can be found on pages 864–865 of this chapter. National Science Education Standards UCP.1, C.5, C.6*
- 7 B**
A circadian rhythm is a behavioral cycle of 24 hours, or one day. *More about circadian rhythms can be found on page 865 of this chapter. National Science Education Standards C.6*
- 8 A**
Estivation is a state of reduced metabolism experienced by animals living in extremely hot environments. *More about estivation can be found on pages 866–867 of this chapter. National Science Education Standards UCP.3, C.5, C.6*
- 9 C**
Imprinting is a form of learning in which a social attachment is formed during a specific time in one's life. *More about imprinting can be found on page 869 of this chapter. National Science Education Standards C.6, G.2*
- 10 B**
An internal need that causes an animal to act is called a motivation. *More about motivation can be found on page 870 of this chapter. National Science Education Standards C.6, G.2*

- 1 Which of the following types of tissue interacts with hairs on the skin to respond to cold and fright?
- A Epithelial
 - B Connective
 - C Muscle
 - D Nervous
- 2 Psoriasis is the uncontrolled division of skin cells. Under normal conditions, these cells divide only enough to replace the dead cells that are shed. These dividing cells are found in which layer of the skin?
- A Exterior epidermis
 - B Interior epidermis
 - C Dermis
 - D Pores
- 3 What is the pigment that protects underlying cells from ultraviolet light called?
- A Melatonin
 - B Ascorbic acid
 - C Melanin
 - D Lactic acid
- 4 Which of the following vitamins is produced by skin cells in response to sunlight?
- A Vitamin A
 - B Vitamin B
 - C Vitamin C
 - D Vitamin D
- 5 Which of the following types of burns is characterized by the death of only epidermal cells, redness, and mild pain?
- A First degree
 - B Second degree
 - C Third degree
 - D None of the above
- 6 Which of the following bones is associated with the axial skeleton?
- A Vertebrae
 - B Shoulder bone
 - C Hip bone
 - D Arm bone
- 7 What is the connective tissue that connects muscle to bone called?
- A Bursa
 - B Ligament
 - C Tendon
 - D Bone spurs
- 8 Newly formed bone cells are called —
- A osteoblasts.
 - B cartilage.
 - C osteocytes.
 - D spongy bone.
- 9 Which of the following is produced in red marrow?
- A White blood cells
 - B Red blood cells
 - C Clotting fragments
 - D All of the above
- 10 Which of the following types of muscle is under conscious control?
- A Smooth muscle
 - B Skeletal muscle
 - C Cardiac muscle
 - D All of the above

1 C

Muscle tissues interact with the hairs on the skin to respond to stimuli, such as cold and fright. *More about the different types of body tissues in skin can be found on page 893 of this chapter. National Science Education Standards C.6, F.1*

2 B

The interior epidermis contains living cells that divide and replace dead skin cells shed from the exterior epidermis. *More about the layers of skin can be found on pages 893–896 of this chapter. National Science Education Standards C.1, C.5, F.1*

3 C

Melanin is a pigment produced in skin cells that absorbs ultraviolet light. Exposure to sunlight increases melanin production. *More about melanin can be found on page 894 of this chapter. National Science Education Standards C.5, F.1*

4 D

Vitamin D is produced by skin cells that are exposed to ultraviolet radiation. Vitamin D facilitates the absorption of calcium into the bloodstream. *More about the functions of skin can be found on pages 896–897 of this chapter. National Science Education Standards C.5, F.1*

5 A

First degree burns, like sunburn, are characterized by the death of epidermal cells along with redness and mild pain. *More about skin injuries can be found on pages 897–898 of this chapter. National Science Education Standards C.1, F.1*

6 A

The axial skeleton includes the skull and the bones that support it, such as vertebrae, ribs, and the sternum. *More about skeletal structure can be found on pages 899–900 of this chapter. National Science Education Standards UCP.5, G.2*

7 C

Tendons are thick bands of connective tissue that attach muscle to bone. *More about joints can be found on pages 899–901 of this chapter. National Science Education Standards UCP.5, G.2*

8 C

Newly formed bone cells are called osteocytes. They are formed by potential bone cells, called osteoblasts. *More about bone formation can be found on pages 902–903 of this chapter. National Science Education Standards C.1, G.2*

9 D

Red bone marrow produces red blood cells, white blood cells, and cell fragments involved in clotting. *More about bone marrow can be found on pages 903–904 of this chapter. National Science Education Standards C.1, G.2*

10 B

Humans can control the contraction of skeletal muscle because it is voluntary muscle. Smooth and cardiac muscle are both involuntary. *More about the various types of muscle can be found on pages 905–906 of this chapter. National Science Education Standards UCP.5, G.2*

- 1 Which of the following is involved in mechanical digestion?
 - A Amylase
 - B Teeth
 - C Pepsin
 - D Saliva

- 2 What is amylase used to break down?
 - A Lipids
 - B Starches
 - C Proteins
 - D Vitamins

- 3 What covers the opening of the respiratory tract to prevent food from entering the lungs?
 - A Epiglottis
 - B Tongue
 - C Tonsils
 - D Mucus

- 4 Where does food move right after passing through the stomach?
 - A Esophagus
 - B Pancreas
 - C Large intestine
 - D Small intestine

- 5 Where is bile stored?
 - A Liver
 - B Pancreas
 - C Gallbladder
 - D Stomach

- 6 What are organic substances needed in small quantities to maintain growth and metabolism called?
 - A Proteins
 - B Vitamins
 - C Minerals
 - D Fats

- 7 Which of the following controls the pituitary gland?
 - A Hypothalamus
 - B Thyroid gland
 - C Adrenal gland
 - D Hippocampus

- 8 What kind of hormones bind to receptors in the cytoplasm of cells?
 - A Amino acid hormones
 - B Steroid hormones
 - C Both A and B
 - D Neither A nor B

- 9 Which of the following hormones does the adrenal gland produce?
 - A Aldosterone
 - B Adrenaline
 - C Glucocorticoids
 - D All of the above

- 10 The hormone that stimulates the release of calcium from bone tissue is called —
 - A thyroid hormone.
 - B calcitonin.
 - C parathyroid hormone.
 - D human growth hormone.

1 B

The process of mechanical digestion includes chewing. Teeth break apart food to expose more surface area to the actions of chemical digestion. *More about mechanical digestion can be found on pages 917–919 of this chapter. National Science Education Standards UCP.5, F.1*

2 B

Amylase is secreted in your mouth to break down polysaccharides, or starches. *More about chemical digestion can be found on pages 918–923 of this chapter. National Science Education Standards B.3, C.5, F.1*

3 A

The epiglottis is a flap of cartilage that covers the opening of the respiratory tract while you swallow. *More about swallowing can be found on pages 918–920 of this chapter. National Science Education Standards UCP.5, F.1*

4 D

After moving through the stomach, food enters the small intestine where digestion continues. *More about the small intestine can be found on pages 921–922 of this chapter. National Science Education Standards C.5, F.1*

5 C

Bile, used in fat digestion, is produced in the liver and stored in the gallbladder. *More about bile can be found on pages 921–922 of this chapter. National Science Education Standards C.5, F.1*

6 B

Vitamins are organic nutrients that are required to maintain growth and metabolism. Vitamins can be found naturally in foods, or can be taken as supplements. *More about vitamins can be found on page 926 of this chapter. National Science Education Standards C.5, F.1*

7 A

The pituitary gland is under nervous control. The hypothalamus sends messages to the pituitary gland, causing it to secrete hormones. *More about the pituitary gland can be found on pages 929–930 of this chapter. National Science Education Standards UCP.1, C.5, F.1*

8 B

Steroid hormones are made from lipids, which allow them to pass through the plasma membrane and enter the cell. They bind to receptors in the cytoplasm and then enter the nucleus. *More about steroid hormones can be found on pages 932–933 of this chapter. National Science Education Standards C.1, F.1*

9 D

The adrenal gland produces glucocorticoids, aldosterone, adrenaline, and norepinephrine. *More about the adrenal gland can be found on pages 933–934 of this chapter. National Science Education Standards C.5, F.1*

10 C

Parathyroid hormone (PTH) stimulates the release of calcium from bone tissue and the absorption of calcium by the intestines. *More about thyroid and parathyroid hormones can be found on pages 934–935 of this chapter. National Science Education Standards C.5, F.1*

- 1 Which of the following carries impulses from the skin to the central nervous system?
- A Sensory neurons
 - B Motor neurons
 - C Interneurons
 - D Synapses
- 2 The presence of a stimulus causes which of the following actions in a neuron?
- A Sodium passes out of the cell
 - B Potassium passes into the cell
 - C Sodium passes into the cell
 - D Repolarization
- 3 In which of the following do impulses move fastest?
- A Unmyelinated white matter
 - B Myelinated white matter
 - C Unmyelinated gray matter
 - D Myelinated gray matter
- 4 Which of the following structures is found in the brain stem?
- A Pons
 - B Medulla oblongata
 - C Midbrain
 - D All of the above
- 5 Stimulation by which of the following causes an increase in heart rate?
- A Somatic nervous system
 - B Parasympathetic nervous system
 - C Sympathetic nervous system
 - D Hypothalamus
- 6 Fluid found in a structure of the inner ear stimulates hair cells in response to sound waves. In which structure is this fluid stored?
- A Malleus
 - B Stapes
 - C Cochlea
 - D Incus
- 7 Neurotransmitters are used to transmit signals across a(n) —
- A axon.
 - B cell body.
 - C dendrite.
 - D synaptic space.
- 8 Morphine is an opiate used in controlling pain. What does it act on?
- A Central nervous system
 - B Peripheral nervous system
 - C Receptors at the site of pain
 - D Both A and B
- 9 Which of the following drugs is a stimulant?
- A Alcohol
 - B Nicotine
 - C Heroin
 - D Barbiturates
- 10 Which of the following drugs appears to impede the movement of sodium and calcium ions, thus disrupting the transmission of nerve impulses?
- A Cocaine
 - B Amphetamines
 - C Alcohol
 - D Caffeine

1 A

Sensory neurons carry impulses from the skin, and other parts of the body, to the central nervous system. *More about neurons can be found on pages 943–946 of this chapter. National Science Education Standards C.5, F.1*

2 C

Stimulation of a neuron causes an influx of sodium ions, resulting in depolarization of the neuron. *More about neural transmission can be found on pages 944–946 of this chapter. National Science Education Standards C.1, C.5*

3 B

A myelin sheath increases the speed at which an impulse moves down a neuron. White matter consists of myelinated neurons, while gray matter consists of unmyelinated neurons. *More about white and gray matter can be found on pages 945–946 of this chapter. National Science Education Standards UCP.5*

4 D

The brain stem is composed of the medulla oblongata, pons, and midbrain. It controls involuntary activities in the body. *More about the structure of the brain can be found on page 947 of this chapter. National Science Education Standards UCP.1, C.5, F.1*

5 C

The sympathetic nervous system causes several changes associated with the fight-or-flight response, including an increase in heart rate. *More about the autonomic nervous system can be found on pages 949–950 of this chapter. National Science Education Standards UCP.1, UCP.3, C.5, F.1*

6 C

The cochlea contains fluid that moves in response to sound waves. This movement stimulates hair cells to transmit impulses to the brain, where the sound is decoded. *More about hearing can be found on pages 952–954 of this chapter. National Science Education Standards UCP.5, F.1*

7 D

The area between two neurons is called a synaptic space. An impulse is carried across this space by neurotransmitters. *More about synapses can be found on page 946 of this chapter. National Science Education Standards C.5, F.1*

8 A

Opiates are analgesics that act directly on the central nervous system to relieve severe pain. *More about analgesics can be found on page 957 of this chapter. National Science Education Standards UCP.1, C.5, F.1*

9 B

Nicotine is a stimulant that increases the activity of the sympathetic nervous system. *More about stimulants can be found on pages 960–961 of this chapter. National Science Education Standards C.5, F.5*

10 C

Alcohol, a depressant, appears to block the movement of sodium and calcium ions, which impedes the transmission of nerve impulses. *More about depressants can be found on pages 961–962 of this chapter. National Science Education Standards C.5, F.5*

- 1 Where does air go after passing the epiglottis?
A Larynx
B Pharynx
C Lungs
D Stomach
- 2 Which of the following structures is the site of gas exchange during respiration?
A Trachea
B Bronchi
C Alveoli
D Larynx
- 3 When the diaphragm contracts, the chest cavity becomes —
A smaller, causing increased pressure in the chest.
B smaller, causing decreased pressure in the chest.
C larger, causing increased pressure in the chest.
D larger, causing decreased pressure in the chest.
- 4 What controls the rate of breathing?
A Medulla oblongata
B Hippocampus
C Hypothalamus
D Cerebellum
- 5 Red blood cells carry oxygen attached to —
A the nucleus.
B the plasma membrane.
C hemoglobin.
D iron.
- 6 At the site of a wound, a web forms that eventually facilitates the formation of a scab. What is this web composed of?
A Red blood cells
B Fibrin
C Hemoglobin
D White blood cells
- 7 A person with type AB blood requires a blood transfusion. Which of the following types of blood can be given?
A Type A
B Type B
C Type O
D All of the above
- 8 Vessels that carry blood away from the heart are called —
A arteries.
B veins.
C capillaries.
D cells.
- 9 Oxygen-depleted blood from the body enters which chamber of the heart?
A Right ventricle
B Left ventricle
C Right atrium
D Left atrium
- 10 As a result of osmotic pressure, water, glucose, and waste products are filtered into which part of the nephron?
A Urethra
B Distal tubule
C Bowman's capsule
D Ureter

1 A

After passing the epiglottis, air moves through the larynx on its way to the lungs. *More about the path air takes through the body can be found on pages 971–972 of this chapter. National Science Education Standards C.5, F.1*

2 C

Gas exchange takes place in the alveoli, tiny sacs of the lungs surrounded by a network of blood vessels. *More about gas exchange can be found on page 972 of this chapter. National Science Education Standards UCP.5, C.5, F.1*

3 D

The diaphragm contracts to increase the size of the chest cavity. This increase in volume causes a drop in air pressure inside the chest, resulting in the intake of air. *More about breathing can be found on pages 973–974 of this chapter. National Science Education Standards UCP.5, F.1*

4 A

Breathing rate is under involuntary control by the medulla oblongata, which responds to the level of carbon dioxide in the blood. *More about the control of respiration can be found on page 974 of this chapter. National Science Education Standards UCP.1, C.5, F.1*

5 C

Hemoglobin, an iron-containing protein, is found in red blood cells. It binds to oxygen and transports it through the blood. *More about hemoglobin can be found on page 976 of this chapter. National Science Education Standards C.1, C.5, F.1*

6 B

Protein fibers, called fibrin, are linked together in a network to form a web at the site of a wound. This network traps escaping blood cells, eventually forming a protective scab over the wound. *More about blood clotting can be found on page 977 of this chapter. National Science Education Standards UCP.5, C.5, F.1*

7 D

An individual with type AB blood has no anti-A or anti-B antibodies. Therefore, he or she can receive blood containing any combination of these antigens. *More about blood surface antigens can be found on pages 977–979 of this chapter. National Science Education Standards C.5, F.1*

8 A

Arteries carry blood from the heart to the rest of the body and veins carry blood from the body to the heart. *More about blood vessels can be found on pages 979–980 of this chapter. National Science Education Standards C.5, F.1*

9 C

Oxygen-poor blood from the body enters the right atrium through the venae cavae. *More about the heart can be found on pages 980–984 of this chapter. National Science Education Standards UCP.5, C.5, F.1*

10 C

Particles from the blood are filtered into the Bowman's capsule. *More about the function of the kidney can be found on pages 985–987 of this chapter. National Science Education Standards C.5, F.1*

- 1 In which part of the sperm cell are mitochondria found?
 - A Head
 - B Midpiece
 - C Tail
 - D All of the above

- 2 Through which of the following structures does sperm leave the testes?
 - A Vas deferens
 - B Urethra
 - C Epididymis
 - D Seminal vesicles

- 3 Which pH value is semen most likely to have?
 - A 2
 - B 5
 - C 7
 - D 9

- 4 Which of the following hormones stimulates the production of testosterone?
 - A FSH
 - B Estrogen
 - C LH
 - D None of the above

- 5 The passageway between the uterus and vagina is called the —
 - A cervix.
 - B oviduct.
 - C urethra.
 - D abdomen.

- 6 Prior to puberty, the development of eggs is arrested at which phase of meiosis?
 - A Prophase I
 - B Metaphase I
 - C Anaphase I
 - D Telophase I

- 7 Which of the following increases sharply just prior to ovulation?
 - A FSH
 - B Estrogen
 - C LH
 - D hGH

- 8 What is the ball of cells that implants in the uterine lining called?
 - A Blastocyst
 - B Zygote
 - C Embryo
 - D Egg

- 9 Where do oxygen and nutrients from the mother's blood diffuse into the embryo's blood?
 - A Umbilical cord
 - B Placenta
 - C Both A and B
 - D Neither A nor B

- 10 Which of the following hormones affects growth in humans?
 - A Thyroxin
 - B hGH
 - C Testosterone
 - D All of the above

1 B

The midpiece of the sperm contains many mitochondria, used to power the movement of the flagella. *More about the structure of sperm can be found on page 996 of this chapter. National Science Education Standards UCP.5, C.1, F.1*

2 C

Sperm travels from the testes into the epididymis, a coiled tube within the scrotum. Sperm completes its maturation within the epididymis. *More about the path sperm takes can be found on pages 996–997 of this chapter. National Science Education Standards UCP.5, F.1*

3 D

Semen is alkaline which functions to neutralize the acidity of the vagina. Therefore, it must have a pH greater than 7. *More about semen can be found on page 997 of this chapter. National Science Education Standards C.5, F.1*

4 C

Luteinizing hormone (LH) causes cells in the testes to produce testosterone. *More about hormones and the male reproductive system can be found on page 998 of this chapter. National Science Education Standards C.5, F.1*

5 A

The bottom of the uterus narrows to form the cervix, the bottom of which opens into the vagina. *More about human female anatomy can be found on page 999 of this chapter. National Science Education Standards UCP.5, F.1*

6 A

Prior to birth, a female begins the production of eggs. However, the process is arrested at prophase I until ovulation begins at puberty. *More about the production of ova can be found on page 1000 of this chapter. National Science Education Standards UCP.3, C.1, F.1*

7 C

While estrogen gradually increases, LH levels undergo a sharp increase just prior to ovulation. *More about the menstrual cycle can be found on pages 1002–1004 of this chapter. National Science Education Standards UCP.3, F.1*

8 A

After fertilization, the zygote divides by mitosis to form a blastocyst. This blastocyst attaches to the uterine lining, where it develops into an embryo. *More about fertilization can be found on pages 1005–1006 of this chapter. National Science Education Standards C.1, F.1*

9 B

Blood vessels from the mother and embryo lie closely together in the placenta, allowing for the diffusion of oxygen, nutrients, and waste products across their membranes. *More about exchange in the placenta can be found on page 1007 of this chapter. National Science Education Standards UCP.5, C.5, F.1*

10 D

Human growth is influenced by human growth hormone (hGH), thyroxin, estrogen, and testosterone. *More about human growth can be found on page 1013 of this chapter. National Science Education Standards C.5, F.1*

- 1 Which of the following diseases can be proven to be caused by a pathogen using Koch's postulates?
- A Syphilis
 - B AIDS
 - C Anthrax
 - D Lyme disease
- 2 *Staphylococcus aureus*, a bacterium that infects humans, is present in many hospital rooms. Many health care workers also carry this bacterium. How would you ensure that the bacterium would not infect your patients?
- A Wear a face mask and sterile gloves when treating patients.
 - B Clean the rooms where patients stay with germicides.
 - C Monitor waste disposal.
 - D All of these methods would be effective in preventing infection.
- 3 Substances produced by some bacteria can have severe effects on humans. What are these substances called?
- A Venoms
 - B Toxins
 - C Histamines
 - D Antigens
- 4 What is a disease that is constantly present in a population called?
- A Epidemic
 - B Pandemic
 - C Endemic
 - D Bubonic
- 5 Which of the following symptoms is associated with the release of histamines?
- A Redness
 - B Pain
 - C Swelling
 - D All of the above
- 6 Which of the following types of phagocytes is found in body tissues?
- A Macrophages
 - B Neutrophils
 - C Monocytes
 - D Eosinophils
- 7 A cell infected with a virus produces a chemical that diffuses to surrounding cells, resulting in the production of antiviral proteins. What is this chemical called?
- A Histamine
 - B Pus
 - C Interferon
 - D Basophil
- 8 What is a small mass of tissue that contains lymphocytes and filters pathogens from the lymph called?
- A Lymph vein
 - B Lymph node
 - C Lymph duct
 - D Lymph capillary
- 9 What are antibody-producing cells called?
- A Helper T cells
 - B Plasma cells
 - C Cytotoxic T cells
 - D Invaders
- 10 What did Edward Jenner inject into an individual to induce active immunity in that individual?
- A Antibodies to smallpox virus
 - B Small amounts of smallpox virus
 - C Antibodies to cowpox virus
 - D Small amounts of cowpox virus

1 C

In order to use Koch's postulates, the pathogen must be able to be grown on pure culture. However, many pathogens, such as HIV, cannot be grown in the absence of live tissue. Anthrax was proven to be a pathogen by Koch's postulates. *More about Koch's postulates can be found on pages 1024–1025 of this chapter. National Science Education Standards UCP.2, A.2*

2 D

Infection is spread by several routes—through the air (by coughing or sneezing), by inanimate objects, and by direct touch. All of these methods would be effective in preventing the spread of the staphylococcus bacterium. *More about the spread of infectious diseases can be found on pages 1026–1027 of this chapter. National Science Education Standards C.5, C.6, F.1, F.5, G.1, G.2*

3 B

Toxins are poisonous substances produced by some bacteria. They can have lethal effects on some hosts. *More about toxins can be found on pages 1028–1029 of this chapter. National Science Education Standards C.5, C.6, F.1*

4 C

A disease that is constantly present in a population, such as the common cold, is considered endemic to that population. *More about patterns of diseases can be found on page 1029 of this chapter. National Science Education Standards UCP.3, F.1*

5 D

Inflammation is caused by the release of histamines. It is characterized by redness, pain, swelling, and heat. *More about innate defenses can be found on pages 1031–1035 of this chapter. National Science Education Standards C.5, C.6, F.1*

6 A

Macrophages are found in body tissues. Other phagocytes, such as neutrophils, monocytes, and eosinophils, are found circulating in the bloodstream. *More about phagocytes can be found on pages 1032–1034 of this chapter. National Science Education Standards C.1, F.1*

7 C

Interferons are produced by virally infected cells. They spread to nearby cells to induce antiviral protein production. *More about interferons can be found on pages 1033–1035 of this chapter. National Science Education Standards C.1, C.5, F.1*

8 B

A lymph node is a small mass of tissue that contains lymphocytes and filters pathogens from the lymph fluid. *More about the lymphatic system can be found on pages 1035–1036 of this chapter. National Science Education Standards UCP.5, F.1*

9 B

Antibody immunity is mediated by B cells. In response to activation by a helper T cell, some B cells become plasma cells and produce antibodies. *More about antibody immunity can be found on page 1037 of this chapter. National Science Education Standards C.1, F.1*

10 D

Edward Jenner injected a young boy with cowpox virus taken from a lesion on a milkmaid's hand. This virus induced an immune response in the boy, which later protected him from infection with smallpox virus. *More about active immunity can be found on pages 1038–1040 of this chapter. National Science Education Standards UCP.2, C.6, G.1–G.3*

Chapter _____

Directions: Fill in the bubbles completely for the answer choice you think is best.

1 A B C D2 A B C D3 A B C D4 A B C D5 A B C D6 A B C D7 A B C D8 A B C D9 A B C D10 A B C D