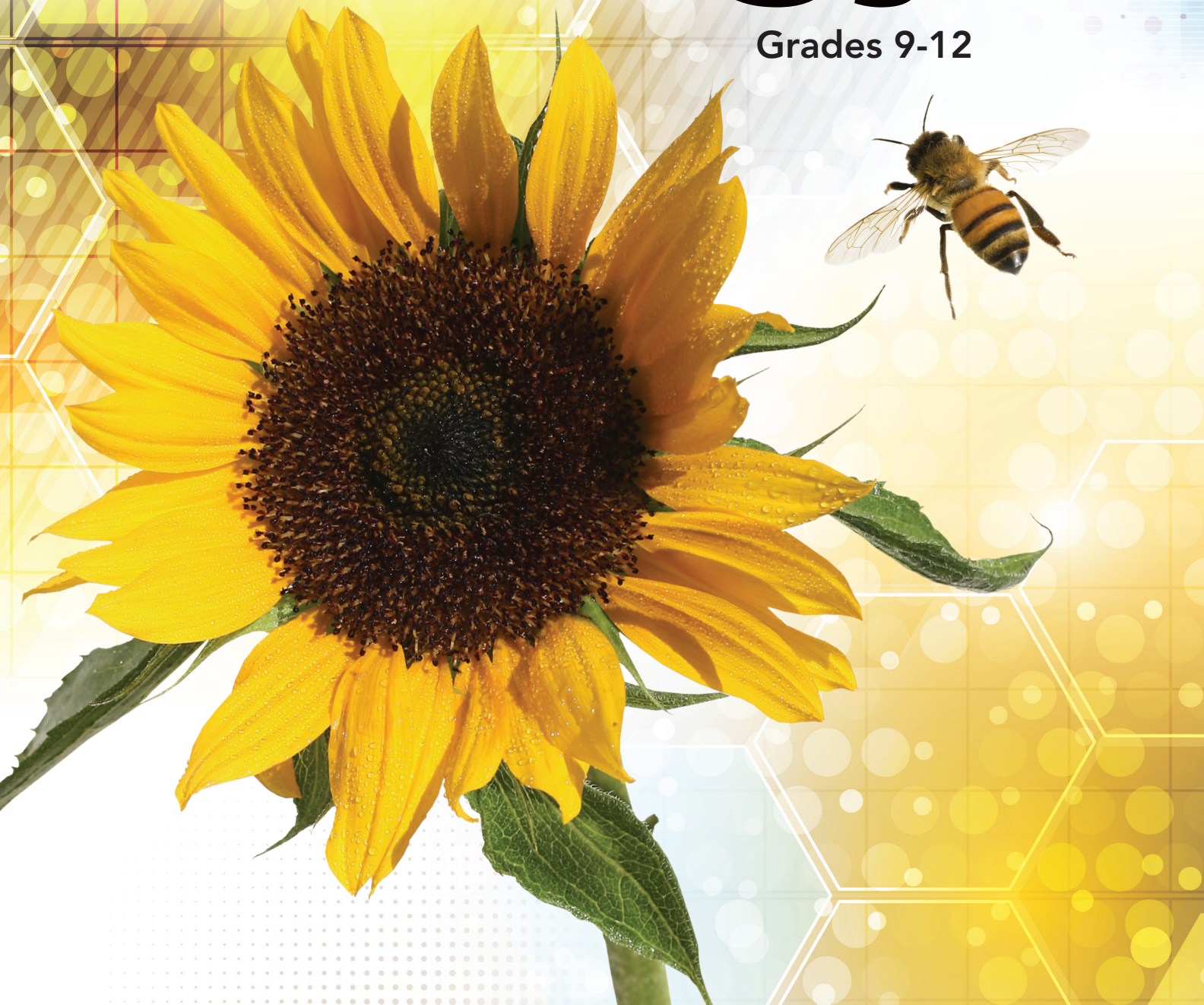
SAVVAS

Sample Assessments
CHAPTER 3
FOR REVIEW PURPOSES ONLY

Miller & Levine

Biology

Grades 9-12



Miller & Levine Biology

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About Assessments

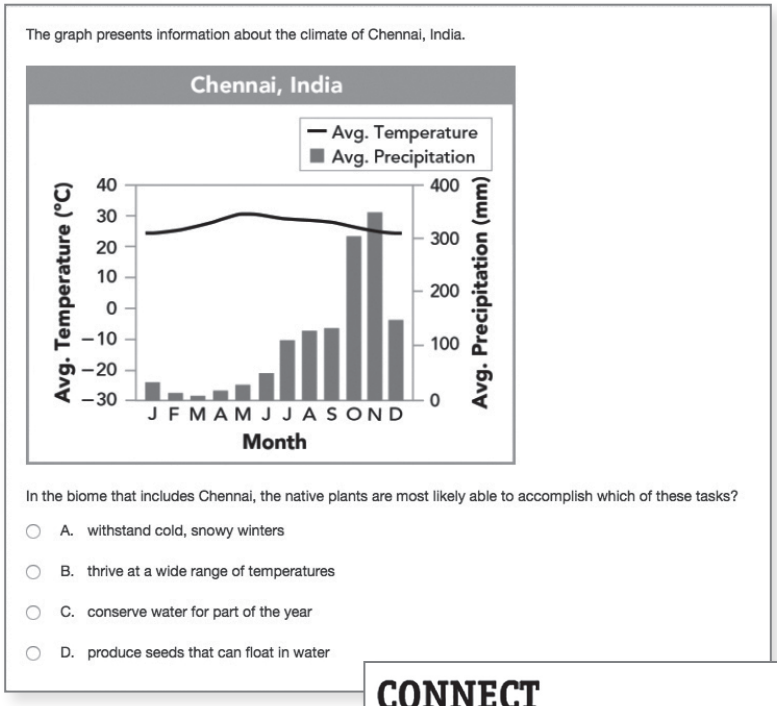
Miller & Levine Biology is rich with assessment types that work in combination to assess three-dimensional learning. Item types include performance-based tasks, research projects, inquiry investigations, labs, open-ended response questions, multiple choice questions and drag-and-drop questions.

When students take the assessments online in Savvas Realize™, the teacher receives instant feedback on performance, informing instruction based on results.

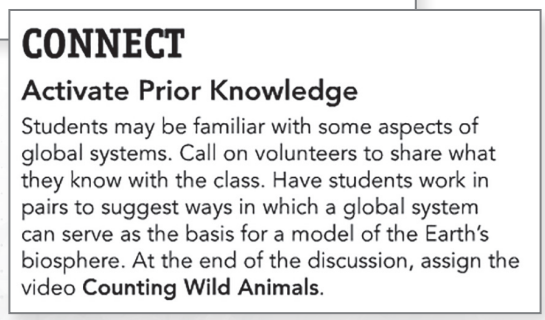
Pre-Testing

Students come to the classroom with a range of pre-existing knowledge and academic backgrounds. Use these methods to measure what students know and inform instruction.

The Diagnostic Pre-Test in Savvas Realize™ allows instructors to assess student knowledge prior to starting the course.

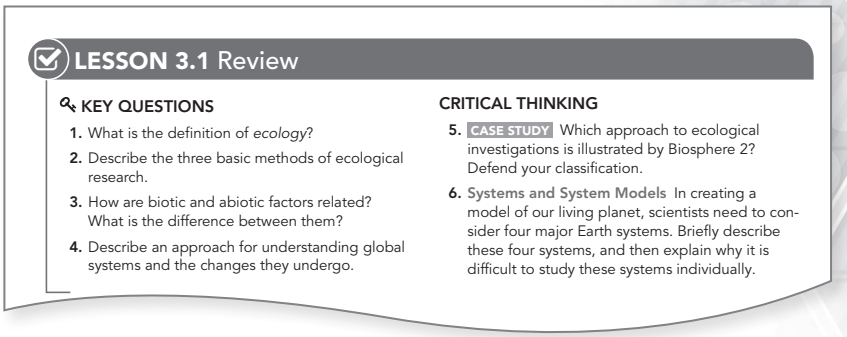


Activate Prior Knowledge – This feature in the Teacher Edition provides a quick reference to help students connect their prior experiences to chapter concepts.



Formative Assessments for Learning

Find a wide variety of in-process evaluations of student comprehension, learning needs, and academic progress within the program. These tools help instructors adjust instruction to meet the needs of a diverse classroom.



LESSON 3.1 Review

KEY QUESTIONS

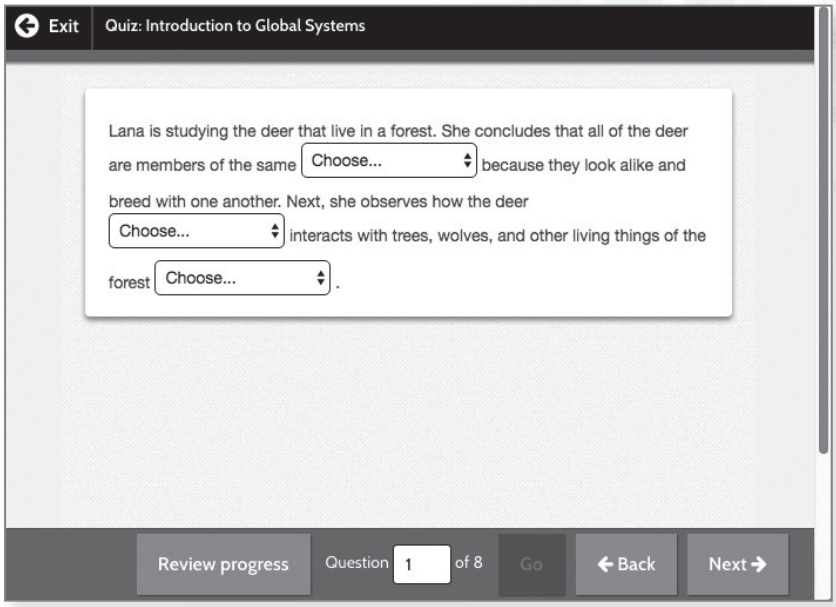
1. What is the definition of *ecology*?
2. Describe the three basic methods of ecological research.
3. How are biotic and abiotic factors related? What is the difference between them?
4. Describe an approach for understanding global systems and the changes they undergo.

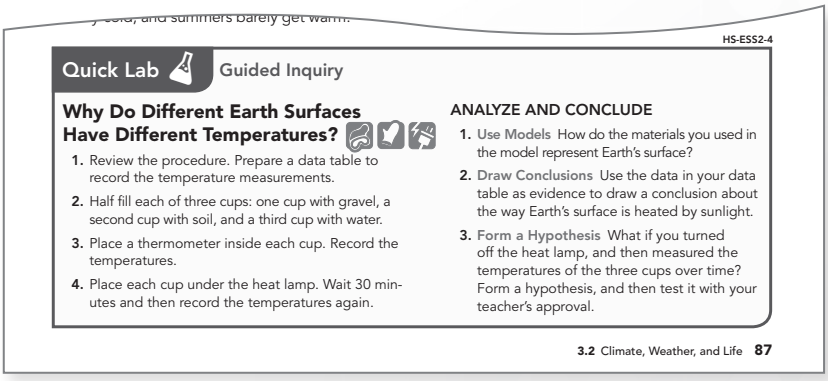
CRITICAL THINKING

5. CASE STUDY Which approach to ecological investigations is illustrated by Biosphere 2? Defend your classification.
6. Systems and System Models In creating a model of our living planet, scientists need to consider four major Earth systems. Briefly describe these four systems, and then explain why it is difficult to study these systems individually.

Lesson Reviews revisit key questions and let students demonstrate science and engineering practices, cross-cutting concepts and critical thinking skills.

Customizable **Lesson Quizzes** available in print or as digital auto-graded assessments on Savvas Realize™ provide a quick assessment opportunity with automatic remediation options.





HS-ESS2-4

Quick Lab Guided Inquiry

Why Do Different Earth Surfaces Have Different Temperatures?

1. Review the procedure. Prepare a data table to record the temperature measurements.
2. Half fill each of three cups: one cup with gravel, a second cup with soil, and a third cup with water.
3. Place a thermometer inside each cup. Record the temperatures.
4. Place each cup under the heat lamp. Wait 30 minutes and then record the temperatures again.

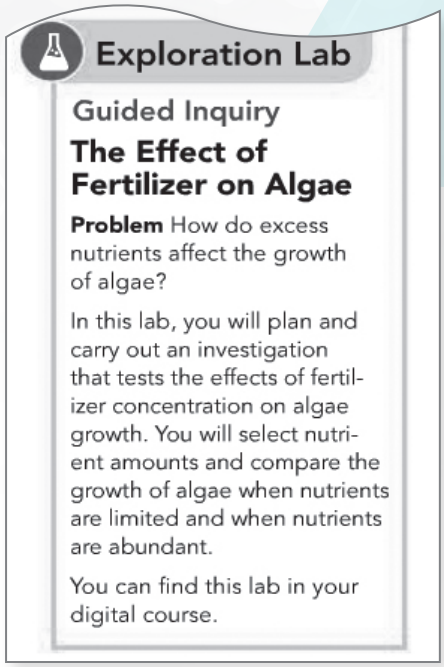
ANALYZE AND CONCLUDE

1. Use Models How do the materials you used in the model represent Earth's surface?
2. Draw Conclusions Use the data in your data table as evidence to draw a conclusion about the way Earth's surface is heated by sunlight.
3. Form a Hypothesis What if you turned off the heat lamp, and then measured the temperatures of the three cups over time? Form a hypothesis, and then test it with your teacher's approval.

3.2 Climate, Weather, and Life 87

Quick Labs include analytical questions where students compare and contrast, use models, engage in argument, communicate information and design experiments.

Chapter Labs are in-depth investigations that allow instructors to monitor student understanding of the science and engineering practices in action. Within labs, students make sense of science phenomena and discover solutions. These labs are editable on Savvas Realize to fit every classroom.



Exploration Lab

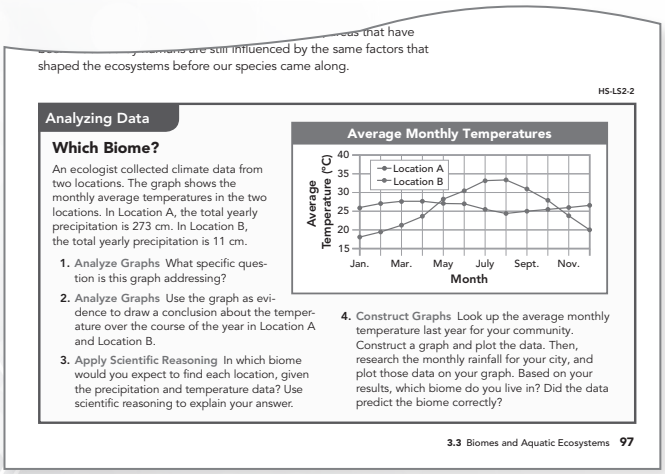
Guided Inquiry

The Effect of Fertilizer on Algae

Problem How do excess nutrients affect the growth of algae?

In this lab, you will plan and carry out an investigation that tests the effects of fertilizer concentration on algae growth. You will select nutrient amounts and compare the growth of algae when nutrients are limited and when nutrients are abundant.

You can find this lab in your digital course.



shaped the ecosystems before our species came along.

HS-LS2-2

Analyzing Data

Which Biome?

An ecologist collected climate data from two locations. The graph shows the monthly average temperatures in the two locations. In Location A, the total yearly precipitation is 273 cm. In Location B, the total yearly precipitation is 11 cm.

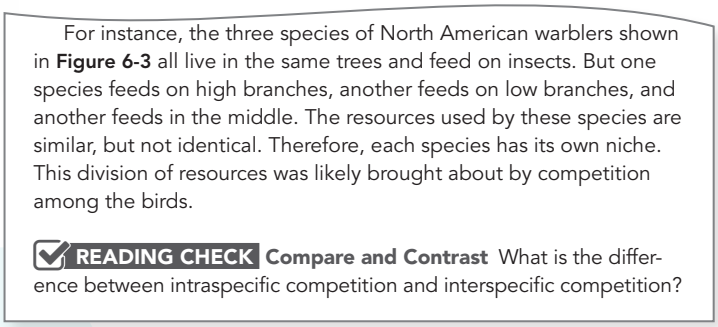
1. **Analyze Graphs** What specific question is this graph addressing?
2. **Analyze Graphs** Use the graph as evidence to draw a conclusion about the temperature over the course of the year in Location A and Location B.
3. **Apply Scientific Reasoning** In which biome would you expect to find each location, given the precipitation and temperature data? Use scientific reasoning to explain your answer.
4. **Construct Graphs** Look up the average monthly temperature last year for your community. Construct a graph and plot the data. Then, research the monthly rainfall for your city, and plot those data on your graph. Based on your results, which biome do you live in? Did the data predict the biome correctly?

Average Monthly Temperatures

3.3 Biomes and Aquatic Ecosystems 97

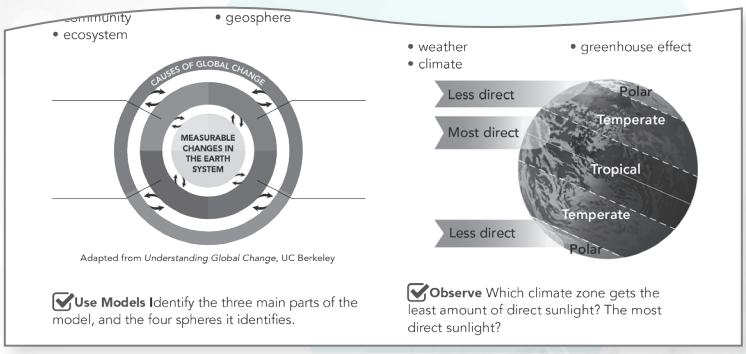
Analyzing Data Labs provide students with opportunities to practice and hone science and engineering skills as they make math connections. With Analyzing Data activities, students use graphs and tables featuring real data.

Reading Checks provide a self-assessment pause point in the narrative. If students can answer these questions, they can feel confident to move on.



For instance, the three species of North American warblers shown in **Figure 6-3** all live in the same trees and feed on insects. But one species feeds on high branches, another feeds on low branches, and another feeds in the middle. The resources used by these species are similar, but not identical. Therefore, each species has its own niche. This division of resources was likely brought about by competition among the birds.

READING CHECK **Compare and Contrast** What is the difference between intraspecific competition and interspecific competition?



• ecosystem • geosphere

Adapted from *Understanding Global Change*, UC Berkeley

Use Models Identify the three main parts of the model, and the four spheres it identifies.

• weather • greenhouse effect
• climate

Observe Which climate zone gets the least amount of direct sunlight? The most direct sunlight?

The **Study Guide** includes summaries, graphic organizers, concept maps, and evidence-based questions to create a reliable system of support and provide another opportunity for student self-assessment.

Summative Assessments of Learning

Evaluate student understanding at the end of every instructional segment. A variety of measures provide multiple data points to assess student progress.

Chapter Assessments ▶
let students review key questions and terms, demonstrate science and engineering practices, cross-cutting concepts and critical thinking skills, and include cross-disciplinary connections for Math and ELA.

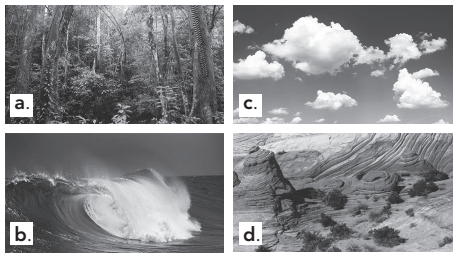
End-of-Course Test Prep
prepares students for high stakes exams. Students interact with a phenomena to demonstrate their progress on all three dimensions.
▼

CHAPTER 3
ASSESSMENT

KEY QUESTIONS AND TERMS

3.1 Introduction to Global Systems

1. The study of the complex system of interactions that sustain life on the planet is
   a. zoology. **c**. chemistry.
   b. ecology. **d**. economics.
2. Which photo represents the geosphere?



3. Nonliving factors of an environment are
   a. biotic. **c**. abiotic.
   b. bacteria. **d**. plankt

11. The concentrations
    that trap heat produ
    a. radiation.
    b. solar energy.
    c. the greenhouse e
    d. the hydrosphere.
12. How is climate diffe
13. What accounts for t
    between the equato
14. What causes wind?
15. What factors affect t
16. How do mountain ra
17. What are some of th
    climate change?

3.3 Biomes and

HS-LS2-2

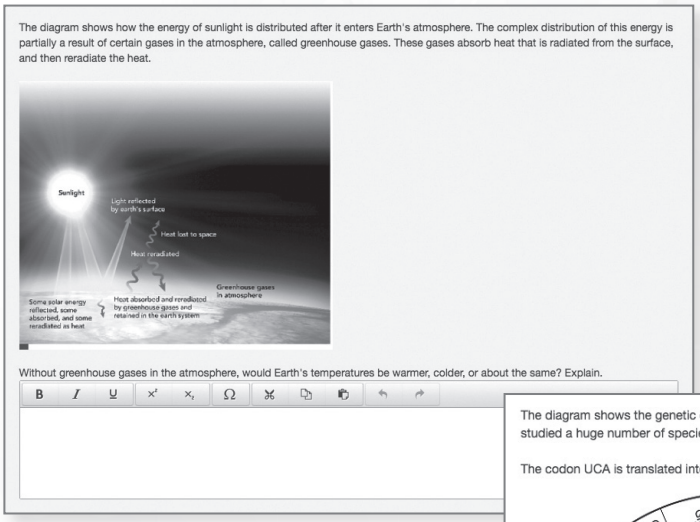
18. The biome that supp
    is the

CHAPTER 6
END-OF-COURSE TEST PRACTICE

1. From 1970 to 2016, scientists were regularly observing the Joshua County Nature Reserve. Their data show that a community of grasses and other small plants was gradually replaced by a pine forest. Which claim or set of claims about the history of the nature reserve could be supported by the data and logical reasoning?
   I. Several years before 1970, a forest fire burned down a pine forest.
   II. For several years until 1970, a pine forest was gradually replaced by grasses and other small plants.
   III. The land was used for farming or ranching before 1970, but was then abandoned.
   A. I only **B**. II only **C**. III only
   D. I and III only **E**. I, II, and II.
2. Modern farming practices often act to reduce biodiversity, such as when genetically-identical
   are raised in large fields. W

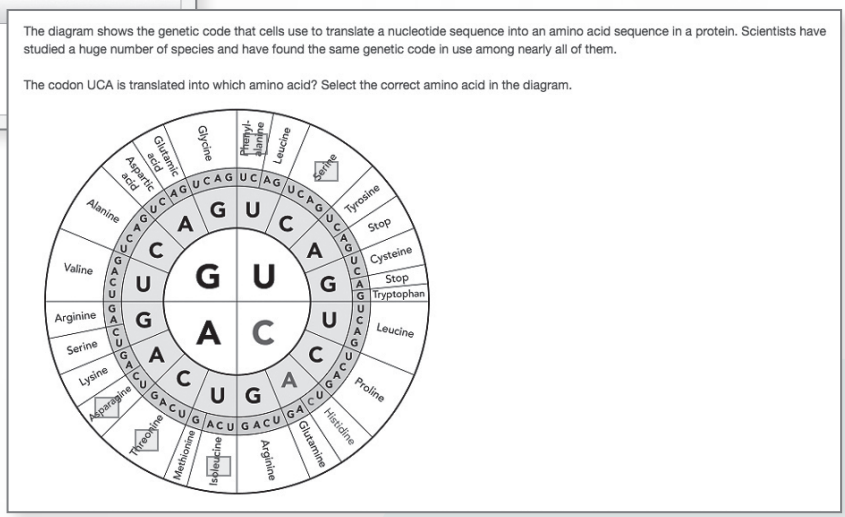
4. A community is concerned about the effect of a proposed housing development on the biodiversity of a local pond. To mitigate the effect of the houses, the community is considering a ban on lawn fertilizer. A computer simulation was used to predict the outcome of the ban. The results are shown in the table.

Year	Number of Species		
	No development	Development unregulated	Development, with a fertilizer ban
0	100	100	100
5	95	90	90
10	102	77	83
15	98		
20			

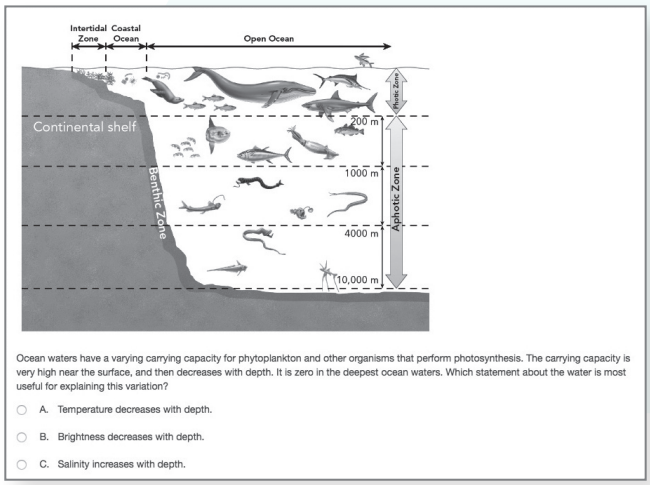


Customizable Chapter Tests available in print and as digital auto-graded assessments on Savvas Realize™ provide an easy assessment opportunity with automatic remediation options.

End-of-Course Assessment at the end of the program prepares students for the content and format of the high-stakes exams.



Unit Benchmark Tests at the end of each unit test ongoing mastery tied to course benchmarks. Available as a digital auto-graded test on Savvas Realize™ or as a downloadable and editable document.

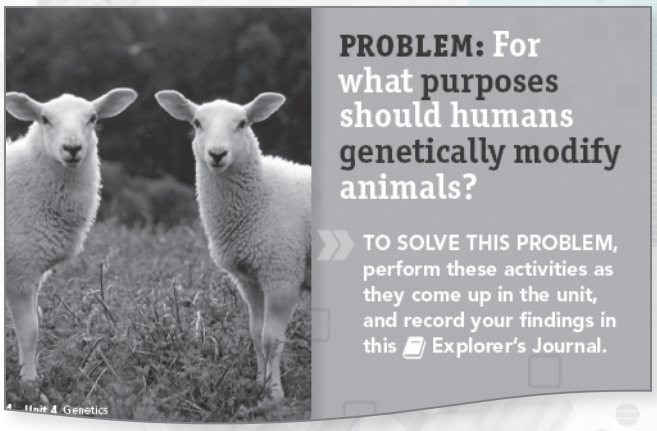


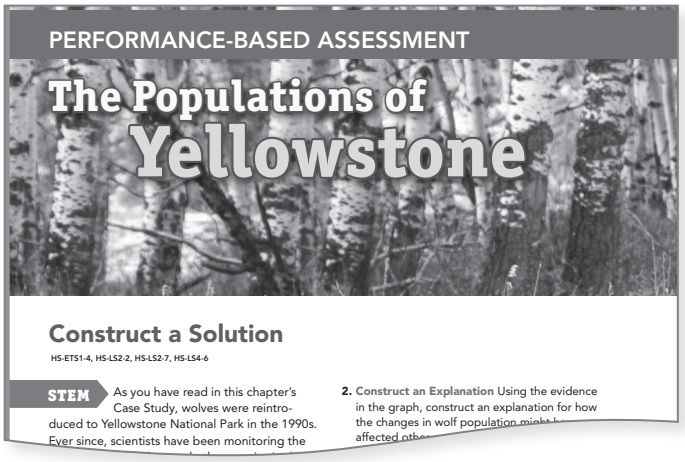
Exam*View*® Assessment Suite – ***Miller & Levine Biology*** is complimented by an Exam*View*® assessment suite, which is available for download through Savvas Realize™. This computerized test bank is fully customizable and editable.

Performance-Based Tasks

Find evidence of new student learning with performance-based tasks. With these assignments, students demonstrate their mastery of performance expectations by applying their understanding to new problems.

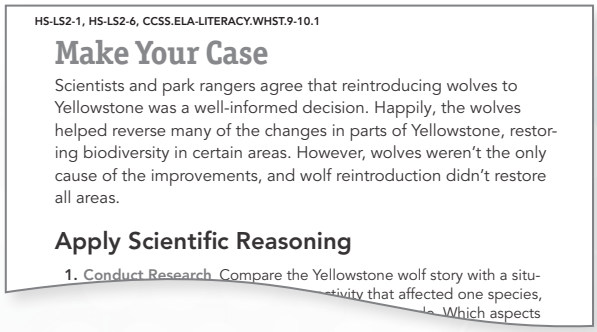
The **Problem-Based Learning** path is a true example of three-dimensional learning. Once the unit is introduced, students will design their own project and participate in active learning by completing a path of activities including labs, STEM projects, authentic readings, interactivities, and scientific research to discover a solution to their chosen problem. They record and analyze their findings in the Explorer's Journal.





Performance-Based Assessment promotes active learning by involving students in evaluating solutions, constructing arguments and analyzing data. These include projects focused on scientific inquiry or engineering design. Through the PBAs, students will again get an opportunity to demonstrate mastery of the performance expectations as well as practice the science and engineering practices. Evaluation rubrics are available in the Teacher Edition.

In the **Make Your Case** feature at the end of every chapter, students present solutions to the chapter case study by constructing arguments, evaluating and working with their peers.



STEM Projects located in the Explorer's Journal feature science and engineering practices while allowing students to engage in active learning. These activities mimic real life scientists and allow students to practice science as they discover solutions.

Partial sample, full test available on Savvas Realize™

Pre-Post Test

1. Kim works as a dog trainer. She wants to apply the methods of science inquiry to improve her business and professional skills. Which of the following tasks can she achieve **most** successfully by applying science inquiry?

Ⓐ developing criteria to rank dogs from best trained to worst trained

Ⓑ explaining the behavior of dogs and testing any explanation with observations or an experiment

Ⓒ constructing an argument to convince pet owners that dog training is worth the investment of time and money

Ⓓ deciding whether to expand her business by hiring an assistant dog trainer

2. Nathan is comparing the cells from a species of amoeba with a species of bacteria. Both species are unicellular, meaning individuals exist as a single cell.

Which characteristic of the cells should Nathan expect to be the same in both species?

Ⓐ the size and shape of the cell

Ⓑ the method of reproduction, or making more cells of the species

Ⓒ the organization of DNA into structures such as chromosomes and the cell nucleus

Ⓓ the genetic code that is used by DNA and RNA to direct protein synthesis

9. A population of seals lives along the rocky shores of the northern coast of California. The seals hunt and eat fish that they catch in the water. As the population increases in size, which of the events listed below becomes more likely to occur?

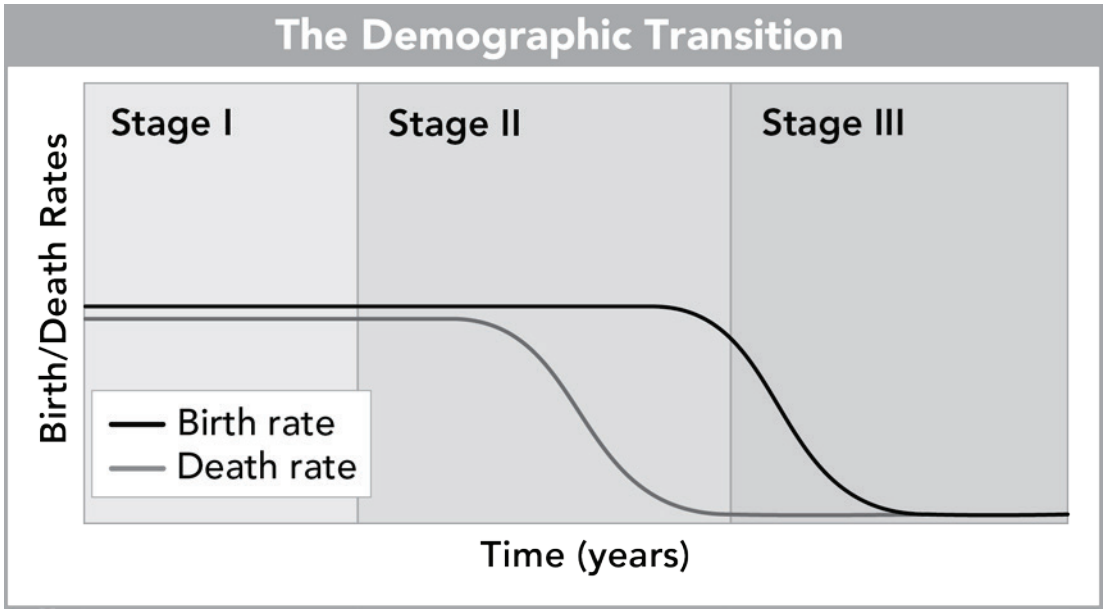
Ⓐ The seal population expands onto land, and the growth rate continues to increase.

Ⓑ A severe storm or a tidal wave acts to reduce the seal population by 25 percent.

Ⓒ Competition for food acts to slow the growth rate of the population.

Ⓓ Infectious diseases stop spreading through the population as the seals develop resistance to them.

10. The graph describes the changes that occur when a country undergoes the demographic transition, which involve changes to birth rate and death rate.



As explained by the graph, when does the population of the country increase most rapidly? Assume that both immigration and emigration are insignificant to the population size.

Ⓐ During Stage I, when both birth rate and death rate are high

Ⓑ During Stage II, when birth rate is much higher than death rate

Ⓒ During Stage III, when birth rate and death rate are low

Ⓓ During Stages I and III, when birth rate and death rate are equal

17. A common chemical reaction in cells occurs when a phosphate group is added to adenosine diphosphate (ADP) to form adenosine triphosphate (ATP). What purpose does this reaction serve?

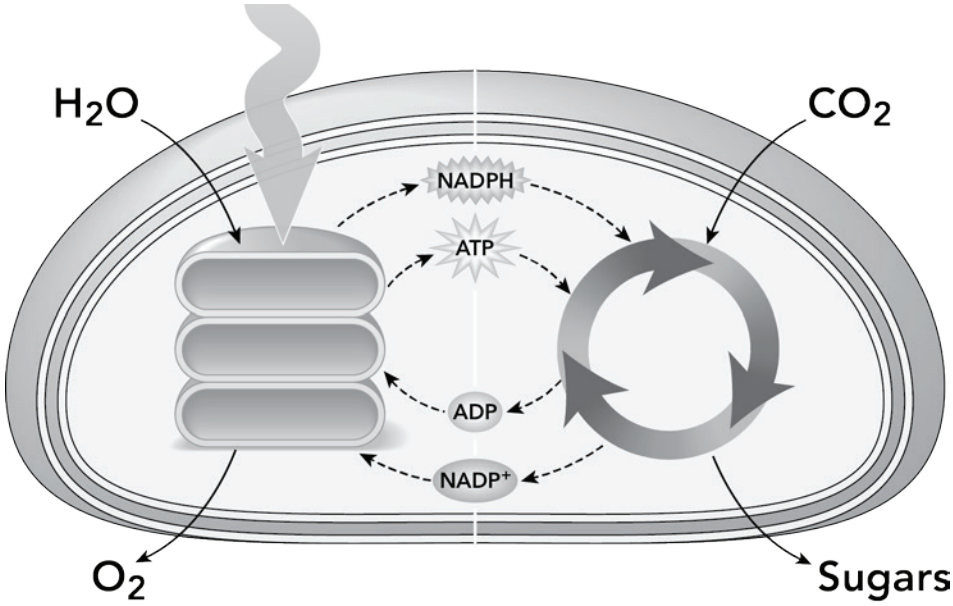
Ⓐ releasing energy for use by the cell

Ⓑ storing energy for later use by the cell

Ⓒ transferring phosphate groups for assembly into proteins

Ⓓ transferring phosphate groups for assembly into glucose

18. The diagram is a model of the process of photosynthesis.



The left half and right half of the diagram model which stages of photosynthesis?

Ⓐ the light-sensitive reactions and the cellular respiration reactions

Ⓑ the gas-dependent reactions and the liquid-dependent reactions

Ⓒ the thylakoid reactions and the stroma reactions

Ⓓ the light-dependent reactions and the light-independent reactions

Chapter Test Answer Key

Pre-Post Test

1. B
2. D
3. D
4. C
5. A
6. A
7. D
8. A
9. C
10. B
11. C
12. B
13. B
14. D
15. C
16. B
17. B
18. D
19. C
20. B
21. B
22. D
23. A
24. D

Formative Assessment Samples

FORMATIVE

Introduction to Global Systems Lesson 3.1 Review

LESSON 3.1 Review

KEY QUESTIONS

1. What is the definition of *ecology*?
2. Describe the three basic methods of ecological research.
3. How are biotic and abiotic factors related? What is the difference between them?
4. Describe an approach for understanding global systems and the changes they undergo.

CRITICAL THINKING

5. CASE STUDY Which approach to ecological investigations is illustrated by Biosphere 2? Defend your classification.
6. **Systems and System Models** In creating a model of our living planet, scientists need to consider four major Earth systems. Briefly describe these four systems, and then explain why it is difficult to study these systems individually.

Guided Inquiry Quick Lab

bitterly cold, and summers barely get warm.

HS-ESS2-4

Quick Lab Guided Inquiry

Why Do Different Earth Surfaces Have Different Temperatures?

1. Review the procedure. Prepare a data table to record the temperature measurements.
2. Half fill each of three cups: one cup with gravel, a second cup with soil, and a third cup with water.
3. Place a thermometer inside each cup. Record the temperatures.
4. Place each cup under the heat lamp. Wait 30 minutes and then record the temperatures again.

ANALYZE AND CONCLUDE

1. **Use Models** How do the materials you used in the model represent Earth's surface?
2. **Draw Conclusions** Use the data in your data table as evidence to draw a conclusion about the way Earth's surface is heated by sunlight.
3. **Form a Hypothesis** What if you turned off the heat lamp, and then measured the temperatures of the three cups over time? Form a hypothesis, and then test it with your teacher's approval.

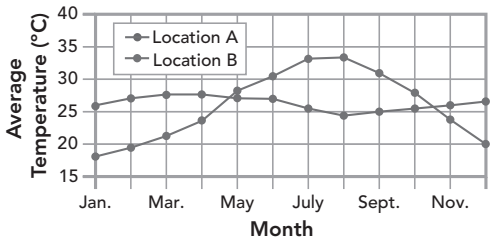
Analyzing Data Lab

Analyzing Data

Which Biome?

An ecologist collected climate data from two locations. The graph shows the monthly average temperatures in the two locations. In Location A, the total yearly precipitation is 273 cm. In Location B, the total yearly precipitation is 11 cm.

Average Monthly Temperatures



1. **Analyze Graphs** What specific question is this graph addressing?
2. **Analyze Graphs** Use the graph as evidence to draw a conclusion about the temperature over the course of the year in Location A and Location B.
3. **Apply Scientific Reasoning** In which biome would you expect to find each location, given the precipitation and temperature data? Use scientific reasoning to explain your answer.
4. **Construct Graphs** Look up the average monthly temperature last year for your community. Construct a graph and plot the data. Then, research the monthly rainfall for your city, and plot those data on your graph. Based on your results, which biome do you live in? Did the data predict the biome correctly?

Guided Inquiry Chapter Lab

Full customizable Lab available on Savvas Realize™

In Your Neighborhood Lab — Open-Ended Inquiry

Abiotic Factors and Plant Selection

Problem What plants will grow well in a garden near you?

For plants to grow, they need the right combination of biotic and abiotic factors. In this lab, you will collect data about abiotic factors in your region. Then, you will plan a garden by selecting the plants that can grow successfully in your area.

You can find this lab online in your digital course.

Lesson Quiz

3.1 Introduction to Global Systems

Directions

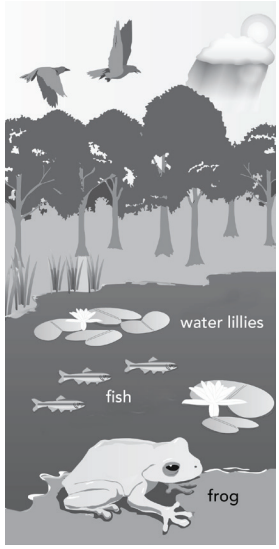
For multiple choice questions, write the letter that best answers the question or completes the statement on the line provided. For other question types, follow the directions provided.

FORMATIVE

1. For each missing word, circle the choice that correctly completes the sentence.

Lana concludes that all of the deer in a forest are members of the same **(geosphere / ecosystem / species / hydrosphere)** because they look alike and breed with one another. She observes how the deer **(population / community / ecosystem / biosphere)** interacts with trees, wolves, and other living things of the forest **(population / community / species / geosphere)**.

_____ **2.** The illustration shows biotic and abiotic factors in a pond ecosystem.



Which are biotic factors of the pond ecosystem?

a. fish, water lilies, and frogs
b. pond water and rain that falls on the pond
c. air above the pond, and the pond water
d. the sunlight that shines on the pond

_____ **3.** Scientists generally use three approaches to study ecology. Which is an example of experimentation?

a. counting the number of migrating geese that visit a pond

b. using a computer program to predict the growth of a forest

c. raising ants in terrariums, each identical except for the clay content of the soil

d. observing frogs as they swim across a pond

_____ **4.** Most organisms in the biosphere exchange the gases oxygen and carbon dioxide with the atmosphere. Which of the following describes an exchange of matter between the atmosphere and the geosphere?

a. a volcanic eruption releasing carbon dioxide into the atmosphere

b. carbon dioxide dissolving from the atmosphere into ocean water

c. the remains of living things settling on the floor of the ocean, and then becoming rock

d. water vapor condensing in the air to form clouds

_____ **5.** Which of the following BEST describes the hydrosphere?

a. bodies of water on the surface of Earth, but not the water in the atmosphere or underground

b. salt water in the oceans, but not fresh water

c. water that is underground or mixed into the geosphere

d. water in any location on Earth, including the atmosphere, surface, and underground.

_____ **6.** Harvey is studying the turtles that live in a pond. His knowledge of ecology will be MOST USEFUL for explaining which of these observations of the turtles?

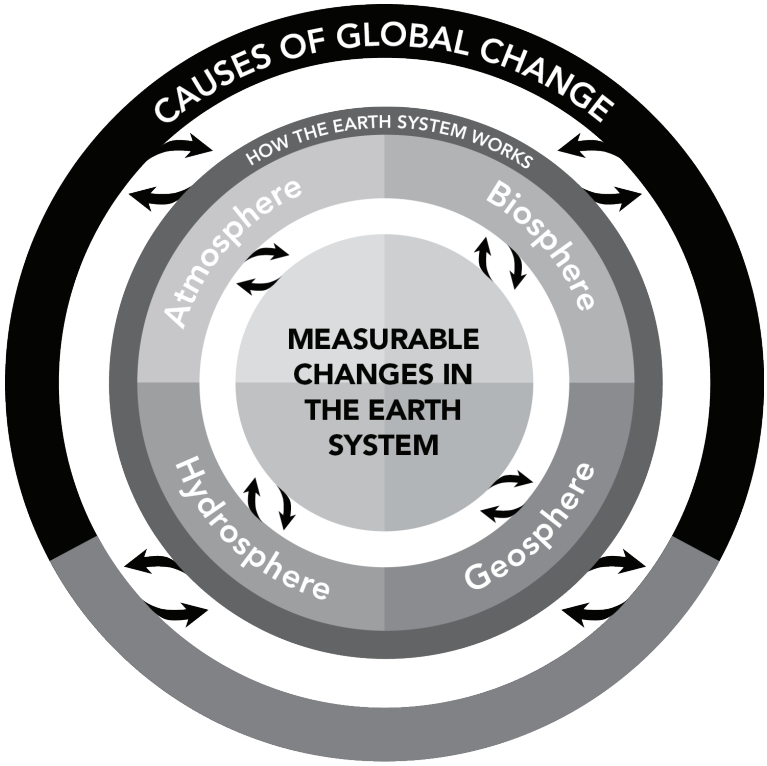
a. The carapace (shell) of the turtle appears to be an extension of its spine.

b. A female turtle lays a clutch of eggs along the shore of the lake, and not in the water.

c. One summer, the size of the turtle population suddenly increases, but then gradually decreases.

d. A turtle may remain underwater for several minutes, but then surfaces for at least a brief moment.

_____ **7.** The diagram is a simplified model of Earth systems and their interactions. The model is used to analyze the causes and effects of global changes to Earth systems, such as changes to Earth's climate.



Adapted from *Understanding Global Change*, UC Berkeley

Which statement BEST explains why the model is useful for analyzing global changes to Earth systems?

a. The causes and effects of global changes involve one Earth system only.
b. The causes of global changes involve two Earth systems, and the effects involve the remaining two Earth systems.
c. Earth systems interact with one another, and the causes and effects of global changes involve all of the systems.
d. The causes and effects of global changes act separately on each Earth system, and the systems do not interact with one another.

_____ **8.** Ecology includes studying ecosystems at different levels. Which is the largest or broadest level?

a. biome
b. biosphere
c. community
d. ecosystem

Lesson Quiz Answer Key

3.1 Introduction to Global Systems

1. species, population, community
2. a
3. c
4. a
5. d
6. c
7. c
8. b

FORMATIVE

Lesson Quiz Review

3.1 Introduction to Global Systems

Use the information below to review the correct answers on the Lesson Quiz.

1. A species is a group of similar organisms that are able to breed with one another to produce more species members. All the members of the same species in an area, such as the deer in a forest, form a population. All of the populations in an area, such as a forest or a lake, form a community.
2. The biotic factors of an ecosystem are the living factors, such as the plants and animals that live in the ecosystem or that visit it. The abiotic factors are the nonliving factors, including temperature, water quality, soil type, and amount of sunlight.
3. Observation may also include measurements, such as counting the geese that visit a pond. An experiment involves observations and measurements in environments that the scientist controls or regulates, such as beakers in a laboratory, or terrariums in a classroom. A computer model acts as an artificial representation of nature or natural events. The model is based on mathematical equations or logic that the scientist thinks represents a natural system.
4. Volcanoes form from the geosphere, which is the solid, rocky part of Earth. When volcanoes erupt, carbon dioxide and other gases that were trapped beneath the surface are released into the atmosphere. Note that the example of the remains of living things becoming rock involves interactions among the biosphere, hydrosphere, and geosphere, but not the atmosphere directly.
5. The hydrosphere includes water in all locations on Earth, including within the atmosphere, on Earth's surface, and deep underground. In part for this reason, the hydrosphere interacts directly with all other Earth systems.
6. Ecology is the study of the interactions among organisms and their environment, including the nonliving parts (such as the water of a lake) and the living parts (such as the plants, animals, and microorganisms that live in the lake). Ecology can help explain changes in population sizes over time, as well as why some organisms thrive in a lake or other environment, while other organisms live poorly there. Note that other branches of biology are more useful for explaining the interior of an animal's body, its behavior, or its growth and development.
7. As the model shows, all four Earth systems interact with one another. For this reason, a change in one system can lead to changes in any or all of the other systems. For example, the causes and effects of global climate change are not confined to the atmosphere, but involve the hydrosphere, biosphere, and geosphere as well.

8. The biosphere is one of the four major global systems. The other three systems are the atmosphere, geosphere, and hydrosphere. A biome is a large community of plants and animals that occupies a region of Earth. Examples of biomes are the tropical rain forest, the tundra, and grasslands. An ecosystem is smaller than a biome, while a community is the set of all populations in an ecosystem.

FORMATIVE

Lesson Review

Go to your Biology Foundations Workbook for longer versions of these lesson summaries.

3.1 Introduction to Global Systems

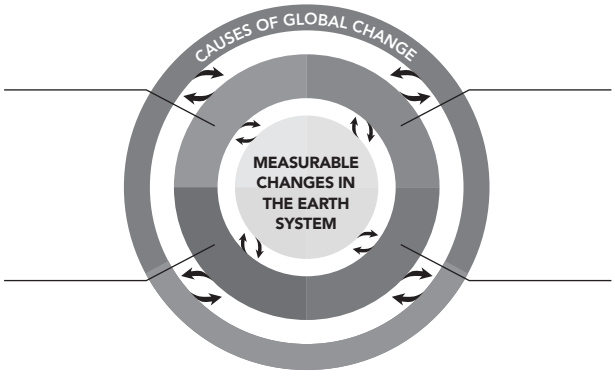
Ecology is the scientific study of interactions among organisms, populations, and communities and their interactions with their environment.

Ecologists generally rely on three main approaches, all of which are part of scientific methodology: observation, experimentation, and modeling. Ecologists may use tools ranging from DNA analysis to data gathered from satellites.

A biotic factor is any living part of the environment with which an organism might interact, including animals, plants, mushrooms, and bacteria. An abiotic factor is any nonliving part of the environment, such as sunlight, heat, precipitation, humidity, wind or water currents, and soil type.

One way to understand global systems is to develop a model that shows those systems, the processes that operate within in each system, and ways those systems and processes interact.

- biosphere
- ecology
- species
- population
- community
- ecosystem
- biotic factor
- abiotic factor
- atmosphere
- hydrosphere
- geosphere



Adapted from *Understanding Global Change*, UC Berkeley

Use Models Label the four spheres in the model.

3.2 Climate, Weather, and Life

Climate is defined by patterns and averages of temperature, precipitation, clouds, and wind over many years. Weather consists of short-term changes in temperature, precipitation, clouds, and wind from day to day, or minute to minute.

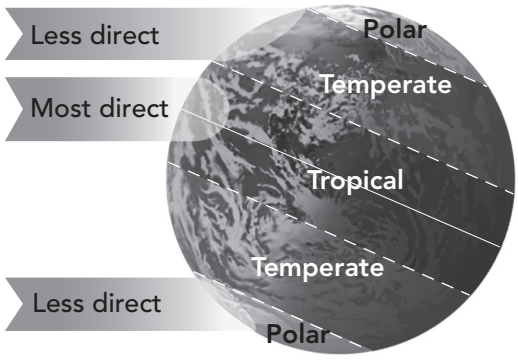
The global climate system is powered and shaped by the total amount of solar energy retained in the biosphere as heat, and by the unequal distribution of that heat between the equator and the poles. Earth's average temperature is determined by the balance between the amount of heat that stays in the atmosphere and the amount of heat that is lost to space.

Ocean currents are driven and shaped by patterns of warming and cooling, by winds, and by the locations of continents.

Regional climates are shaped by latitude, the transport of heat and moisture by winds and ocean currents, and by geographic features such as mountain ranges, large bodies of water, and ocean currents.

Climate change involves changes in temperature, clouds, winds, patterns and amounts of precipitation, and the frequency and severity of extreme weather events.

- climate
- weather
- greenhouse effect



Observe Which climate zone gets the least amount of direct sunlight? The most direct sunlight?

3.3 Biomes and Aquatic Ecosystems

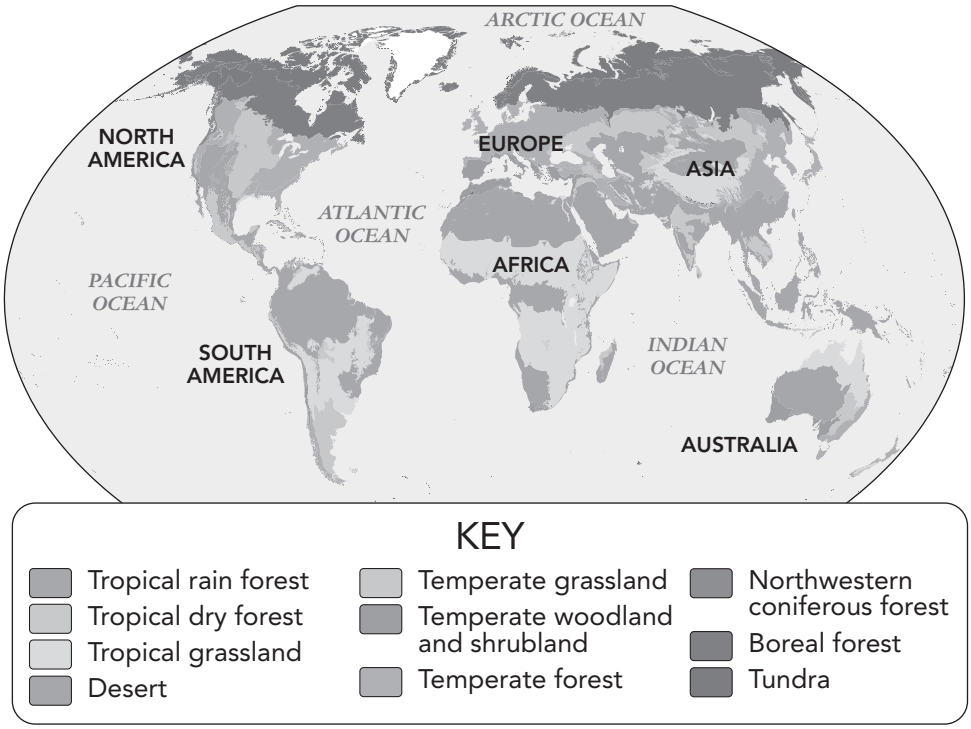
Biomes are described in terms of abiotic factors such as climate and soil type, and biotic factors such as plant and animal life.

Aquatic ecosystems are described primarily by salinity, depth, temperature, flow rate, and concentrations of dissolved nutrients.

Freshwater ecosystems can be divided into three main categories: rivers and streams, lakes and ponds, and freshwater wetlands.

Estuaries serve as spawning and nursery grounds for many ecologically and commercially important fish and shellfish.

- biome
- canopy
- understory
- humus
- taiga
- permafrost
- photic zone
- aphotic zone
- plankton
- wetland
- estuary



Compare Find the locations of boreal forests, temperate forests, and tropical rain forests. How do the locations compare?

Organize Information

Complete the table. For each cause, identify an effect and describe an example.

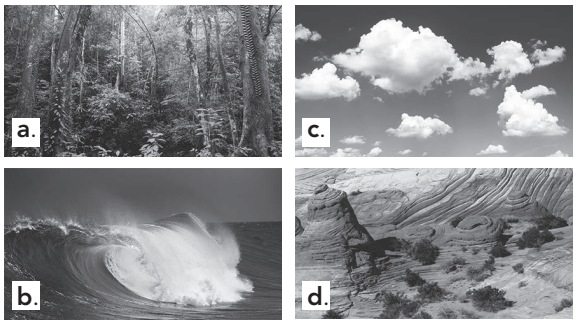
Cause	→	Effect	Example
Greenhouse gases	→	warms the atmosphere.	1.
Wind currents	→	2.	3.
Ocean currents	→	4.	El Niño

Summative Assessment Samples

KEY QUESTIONS AND TERMS

3.1 Introduction to Global Systems

1. The study of the complex system of interactions that sustain life on the planet is
   a. zoology. **c**. chemistry.
   b. ecology. **d**. economics.
2. Which photo represents the geosphere?



3. Nonliving factors of an environment are
   a. biotic. **c**. abiotic.
   b. bacteria. **d**. plankton.
4. The global system that contains most of the life on Earth is the
   a. atmosphere. **c**. hydrosphere.
   b. geosphere. **d**. biosphere.
5. Compare the terms *population*, *community*, and *ecosystem*.
6. What are the three general approaches that are used to study ecology?
7. What are the properties of a useful model of global systems?
8. Describe one of the interactions between the four major Earth systems.

3.2 Climate, Weather, and Life

HS-LS2-2, HS-ESS2-4

9. The climate zone closest to the equator is
   a. polar. **c**. tropical.
   b. temperate. **d**. torrid.
10. Average temperatures, precipitation, and wind patterns in an area define its
    a. geosphere. **c**. weather.
    b. climate. **d**. atmosphere.
11. The concentrations of gases in the atmosphere that trap heat produce
    a. radiation.
    b. solar energy.
    c. the greenhouse effect.
    d. the hydrosphere.
12. How is climate different from weather?
13. What accounts for the unequal distribution of heat between the equator and the poles?
14. What causes wind?
15. What factors affect the path of an ocean current?
16. How do mountain ranges affect climate?
17. What are some of the long-term, natural causes of climate change?

3.3 Biomes and Aquatic Ecosystems

HS-LS2-2

18. The biome that supports more species than all other biomes is the
    a. savannah.
    b. temperate grassland.
    c. boreal forest.
    d. tropical rain forest.
19. Taiga is a synonym for the
    a. boreal forest.
    b. temperate woodland.
    c. tropical dry forest.
    d. desert.
20. Which variable do scientists use to divide the open ocean into two zones?
    a. salinity
    b. latitude
    c. depth
    d. oxygen
21. Which biome is characterized by permafrost?
22. What factors describe aquatic ecosystems?
23. What is the ocean zone in which photosynthesis cannot occur?
24. Describe the difference between a wetland and an estuary.
25. Where does the most photosynthesis on Earth occur?

CRITICAL THINKING

HS-LS2-2, HS-ESS2-4

26. **Compare and Contrast** How are aquatic ecosystems similar to ecosystems on land? How are they different?

27. **Plan Your Investigation** Ecologists have discovered that the seeds of many plants that grow in forests cannot germinate unless they have been exposed to fire. Design an experiment to test whether a particular plant has seeds with this requirement. Include your hypothesis statement, a description of both the control and experimental groups, and an outline of your procedure.

28. **Use Models** Give an example of a model biologists use to better understand ecological phenomena. How does the model help?

29. **Construct an Argument** One friend says biotic factors are more important than abiotic factors to ecology. Another friend says abiotic factors are more important than biotic factors. What do you think? Defend your position using examples from a specific biome of your choice.

30. **Construct an Explanation** A plant grower has a greenhouse where she grows plants in the winter. The greenhouse is exposed to direct sunlight and often gets too hot for the plants. She paints the inside of the glass with a chalky white paint, and the temperature drops to comfortable levels. Explain why this solution works.

31. **Integrate Information** Although the amount of precipitation is low, most parts of the tundra are very wet during the summer. How would you explain this apparent contradiction?

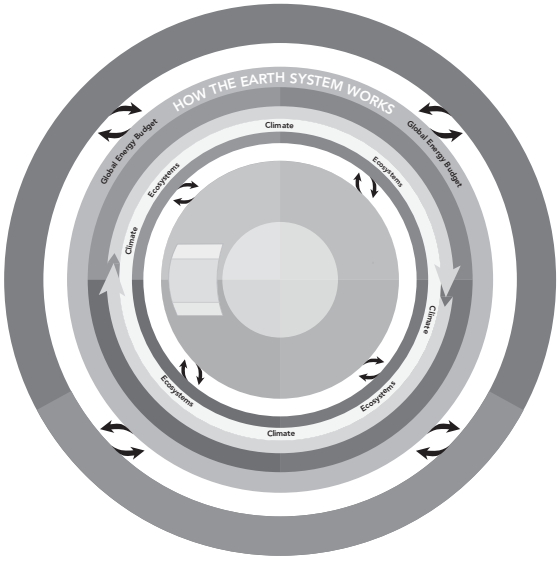
32. **Identify Patterns** Consider these two biomes: (1) the temperate grassland and (2) the temperate woodland and shrubland. Coyotes live in both biomes. Describe two adaptations that might enable coyotes to tolerate conditions in both biomes.

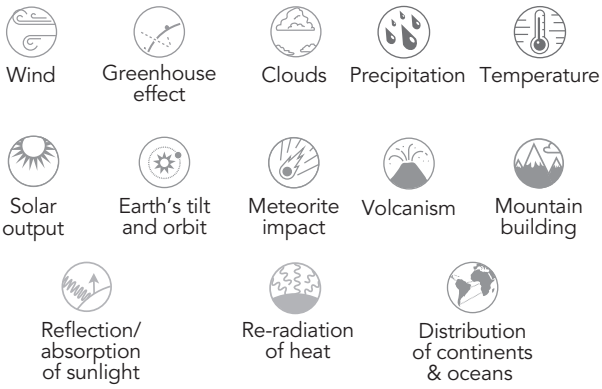
33. **Construct an Explanation** How does the greenhouse effect help to explain Earth's climate?

34. **Form a Hypothesis** The deep ocean lies within the aphotic zone and is very cold. Suggest some of the unique characteristics that enable animals to live in the deep ocean.

35. **Communicate Information** A developer has proposed filling in a salt marsh to create a coastal resort. What positive and negative effects do you think this proposal would have on wildlife and local residents? Would you support the proposal?

Use the following information and the image shown to answer questions 36 and 37. In this chapter, you have been introduced to the Understanding Global Change model. The icons for those items covered so far are listed.





36. **Use Models** Determine where in the global change model each item should be located, and explain why it is located there.

37. **Evaluate Models** Looking at the model as we have assembled it so far, choose one icon. How many connections with other parts of the model does this icon have? Which process does this icon influence?

CROSSCUTTING CONCEPTS

38. **Structure and Function** Deciduous trees in tropical dry forests lose water through their leaves every day. During summers with adequate rain, the leaves remain on the trees. During the cold dry season, the trees drop their leaves. In an especially dry summer, how might the adaptation of dropping leaves enable a tree to tolerate the drought?

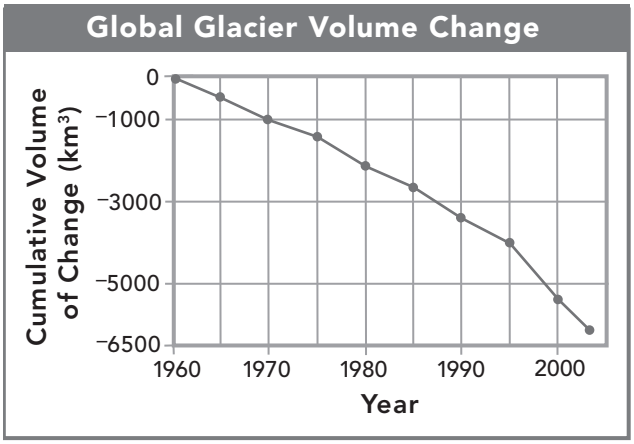
39. **Systems and System Models** Think about how you could model the levels of organization shown in **Figure 3-1** using only circles to represent the levels. Sketch your model, including labels on each circle. Then, compare it to the model in **Figure 3-4**, which also uses circles. How are the two models different?

MATH CONNECTIONS

Analyze and Interpret Data

CCSS.MATH.CONTENT.HSN.Q.A.2,
CCSS.MATH.CONTENT.HSS.IC.B.6

The graph below summarizes the changes in the total volume of ice in all the world's glaciers since 1960. (Volume is calculated from measurements of glacier surface area and depth.) Note that the volume changes on the *y*-axis are negative, meaning an overall loss of volume. Use the graph to answer questions 40–42.



40. **Analyze Graphs** In which ten-year span was the greatest volume of glacial ice lost? What was the total loss of volume over that timespan?

41. **Calculate** Suppose a particular glacier covers 100 km^2, and it loses 30 cm of depth in a decade. Approximately what volume (km^3) is lost? Show your work.

42. **Conduct Research** Investigate the most reasonable explanation for the loss of global glacier mass since 1960. Summarize your findings in a short paragraph.

LANGUAGE ARTS CONNECTIONS

Write About Science

CCSS.ELA-LITERACY.WHST.9-10.2

43. **Write Explanatory Texts** Choose one of the major biomes, and write an overview of its characteristics. Explain how abiotic factors and common plants and wildlife are interrelated. Support your explanation with specific examples.

Read About Science

CCSS.ELA-LITERACY.RST.9-10.2

44. **Central Ideas** Review Lesson 3.2 to summarize generally how heat (or lack of heat) affects the vertical movements of large masses of air and large volumes of water. Then summarize the effects of other factors that influence wind and ocean currents and regional climate patterns.

SUMMATIVE

END-OF-COURSE TEST PRACTICE

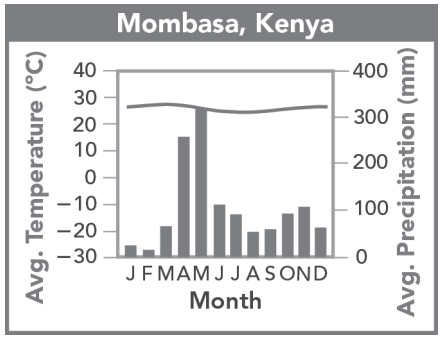
1. Kara uses a model that shows slight changes to Earth's motion through space over many thousands of years. This model helps her explain long-term climate change due to what variable?
   A. volcanic activity
   B. meteor or asteroid strikes
   C. ocean circulation
   D. carbon dioxide levels in the atmosphere
   E. input of solar energy

2. Lionel uses a model that includes the atmosphere and sunlight to predict Earth's temperatures. In this model, why does increasing the levels of carbon dioxide in the atmosphere cause temperatures to increase?
   A. Sunlight passes through carbon dioxide.
   B. Sunlight is absorbed by carbon dioxide.
   C. Heat is trapped by carbon dioxide.
   D. Carbon dioxide generates heat.
   E. Carbon dioxide reacts with water to release heat.

3. Scientists have concluded that human activities are affecting the atmosphere and causing rapid climate change on a global scale. Which statement provides the strongest evidence that these changes to global climate are NOT the result of natural causes, such as variations in Earth's orbit?
   A. Until recently, Earth's climate had remained relatively constant.
   B. Variations in Earth's orbit cannot be measured precisely.
   C. Variations in Earth's orbit would affect climate only minimally.
   D. Earth's climate depends mostly on the output of the sun.
   E. Variations in Earth's orbit occur gradually over 100,000 years.

Questions 4 and 5

This climate diagram shows the average temperature (line graph) and precipitation (bar graph) during each month of the year.



4. Plants that thrive in this type of climate are most likely adapted to which of these conditions?
   A. seasonal variations in temperature
   B. seasonal variations in precipitation
   C. year-long cold temperatures
   D. dense, competitive growth
   E. rich, fertile soil

5. Which plant feature would MOST LIKELY be common in this type of climate?
   A. leaves with waxy coverings
   B. tall, woody trunks
   C. broad, flat leaves
   D. watery fruits
   E. roots that dangle in the air

ASSESSMENT

For additional assessment practice, go online to access your digital course.

If You Have Trouble With...					
Question	1	2	3	4	5
See Lesson	3.2	3.2	3.3	3.3	3.3
Performance Expectation	HS-ESS2-4	HS-ESS2-4	HS-ESS3-6	HS-LS2-2	HS-LS2-2

Partial sample, full test available on Savvas Realize™

Chapter Test

3 The Biosphere

Directions

For multiple choice questions, write the letter that best answers the question or completes the statement on the line provided. For other question types, follow the directions provided.

_____ **1.** Which of these subjects is MOST LIKELY to be studied in ecology?

a. the method of water transport in a tree
b. a comparison of muscle cells among birds and reptiles
c. the circulatory system of earthworms
d. the interaction between populations of wolves and deer

_____ **2.** A heron is affected by many factors in its environment. What distinguishes the biotic factors from the abiotic factors?

a. location in the water or out of the water
b. plant or animal
c. living or nonliving
d. food or not food

_____ **3.** Which data are MOST useful for analyzing the climate of the region?

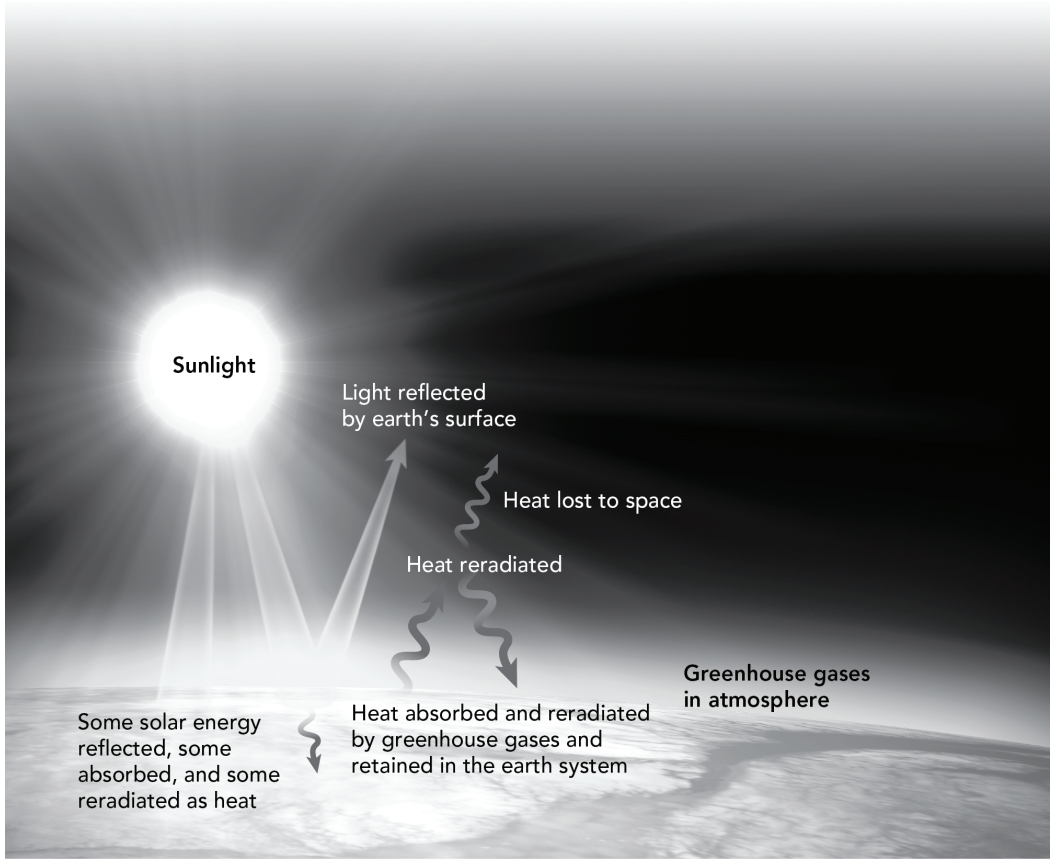
a. average time of sunrise and sunset in July
b. the highest and the lowest daily rainfall in July of this year
c. the daily high temperature for every day in July of this year
d. average temperatures for July, measured over 30 years

_____ **4.** Greenhouse gases include carbon dioxide and methane. How do greenhouse gases act to increase air temperatures near Earth's surface?

a. They transmit visible light that enters the atmosphere.
b. They trap heat that is radiated from the surface.
c. They reflect heat that enters the atmosphere.
d. They emit heat when they undergo chemical reactions.

Refer to the passage and diagram to answer questions 16 to 18.

The diagram shows how the energy of sunlight is distributed after it enters Earth's atmosphere. The complex distribution of this energy is partially a result of certain gases in the atmosphere, called greenhouse gases. These gases absorb heat that is radiated from the surface, and then reradiate the heat.



_____ **16.** What is the relationship between the greenhouse effect and sunlight?

a. Greenhouse gases absorb sunlight, and then reradiate it to the surface.

b. Greenhouse gases reflect sunlight into space, preventing it from reaching the surface.

c. Greenhouse gases absorb sunlight, preventing it from reaching the surface.

d. Greenhouse gases absorb heat, and sunlight is the source of energy of the heat.

Chapter Test Answer Key

3 The Biosphere

1. d

2. c

3. d

4. b

5. a

6. c

7. a

8. d

9. c

10. c

11. a

12. c

13. d

14. a

15. b

16. d

17. d

18. The greenhouse effect acts to trap heat in the atmosphere. Without the greenhouse effect, much of the energy that Earth received in sunlight would be radiated into space. Earth's temperatures would be significantly colder than they are now.

Rubric:
1 pt: State that Earth's temperatures would be colder without greenhouse gases.
1 pt: Explain that greenhouse gases act to trap heat within the atmosphere.

19. d

20. c

Chapter Test Review

3 The Biosphere

Use the information below to review the correct answers on the Chapter Test.

1. Ecology is the scientific study of the interactions among organisms. Other branches of biology study processes within organisms, as well as structures such as cells, tissues, organs, and organ systems.

2. Biotic factors are the living things that affect an organism in its environment. A heron is affected by the fish that it eats, as well as by algae that might foul the water where it wades. Abiotic factors are the nonliving factors that affect an organism. These factors include temperature, sunlight, water supply, and air quality.

3. Climate is the pattern of weather that a region experiences. These patterns are determined by observations and measurements taken over many years. Data on average rainfall and temperatures for July, measured over 30 years, would provide useful information about climate data. In contrast, data from an unusually rainy day or hot day in July would show only climate extremes, and not the typical pattern.

4. Earth's atmosphere transmits most of the light that strikes it. The light heats the surface, which then radiates the energy back into the atmosphere. Greenhouse gases absorb much of this energy, and this traps heat in the atmosphere. Note that this process does not involve any chemical reactions among the greenhouse gases.

5. Global winds form because of the uneven heating of Earth's surface by the sun. Hot air rises and cold air sinks. The currents of air in the atmosphere form patterns that include belts of strong winds along the surface, especially over the ocean. The global winds push along the ocean water, which helps form global ocean currents. Note that Earth's rotation affects both global winds and ocean currents.

6. Biomes are defined as regions with similar climates and similar communities of plants and animals. Land in a temperate grasslands biome will be covered in grasses and sometimes a few trees, and will be home to grazing animals that eat the grass. However, the species of plants and animals may differ among different parts of a biome.

7. The graph shows average precipitation in bars, and average temperature as a line. Make sure to read the appropriate scale for each part of the graph. The average precipitation is as high as 300 mm per month from December to April, and then decreases to about 100 mm per month from May to November. Average temperatures are about 30°C throughout the year.

8. The boreal forest, or taiga, is characterized by forests of pine trees and other conifers. The climate includes cool summers followed by long, cold winters. The taiga is bordered on the north by a treeless biome, the tundra.

9. The photic zone is the region of the ocean that is well lit by the sun. This zone extends from the surface to a depth of about 200 meters. Beneath it is the dark, aphotic zone, which sunlight does not reach. Note that the aphotic zone does not exist along ocean coastlines, where the water is relatively shallow.

10. A wetland describes an ecosystem that is covered in water, or where the water level is just beneath the surface. The water level may fluctuate during the year, and some wetlands are dry for much of the year. Note that estuaries are a specific type of wetlands, and they form where rivers meet the sea.

11. Estuaries are fragile ecosystems that are important in many ways. They help absorb excess water from hurricanes and other storms, and they help supply groundwater. They also provide nurseries or spawning grounds for many ocean animals. Note that coral reefs form in shallow ocean waters, and not estuaries. The primary productivity of the ocean ecosystem is due mainly to tiny phytoplankton that live near the surface of the water.

12. Like nearly all other primary producers, phytoplankton harness the energy of sunlight to make their own food. Sunlight is available only in the photic zone of the ocean, which extends to a depth of about 200 meters. Phytoplankton float in the water of the photic zone.

13. Scientists build and use many kinds of models, including drawings and illustrations, physical models, mathematical models that are based on equations, and computer models. In this example, scientists are using their model to predict climate change, but not to gather evidence or to conduct an experiment. Data that is generated by a model is not the same as evidence from observations of the natural world.

14. Each of the four main Earth systems interacts with the other three systems. Matter cycles endlessly among all four systems, and energy is transferred from one system to another. Note that many living things live within the bodies of water of the hydrosphere. Others live at or near the intersection of the atmosphere and the geosphere, which is Earth's surface. Life does not exist throughout the entire atmosphere or geosphere.

15. The geosphere is often described as the "solid stuff" that makes up Earth. Rocks and soil are part of the geosphere. However, other Earth systems mix into the geosphere. The soil contains water from the hydrosphere, and a variety of living things or once-living matter from the biosphere. Air mixes into the soil, too.

16. As shown by the diagram, sunlight passes through Earth's atmosphere and reaches the surface. The surface absorbs much of the energy of sunlight, and then radiates it as heat. Greenhouse gases absorb some of this heat, trapping the heat within the atmosphere.

17. Greenhouse gases act to trap heat within Earth systems. If concentrations of these gases are increasing, then more heat will be trapped within the atmosphere, and less heat will be radiated into space.

Can we make a working model of our living planet?

Biosphere 2, a habitat designed to model a life-sustaining space colony, didn't make the grade. But its "failure" taught us a lot.

HS-LS2-2, HS-ESS2-4, HS-ETS1-2, HS-ETS1-3

Make Your Case

Engineers and ecologists thought they'd designed a system that could sustain eight people sealed off from the outside world. But unexpected things happened. Some problems involved chemical reactions with parts of the project's structure. Others arose when organisms that were stocked in the system—and some that got in on their own—interacted in unexpected ways. Research the detailed history of Biosphere 2, along with more recent efforts to design self-sustaining systems.

Developing and Using Models

1. **Evaluate Models** Biosphere 2 was intended to be a small-scale model of Biosphere 1. From your research, discuss the limitations of this model.
2. **Evaluate and Revise** If you were an engineer designing a new artificial biosphere, what approach would you use? How could your design attempt to avoid the problems faced by Biosphere 2? Can you find any papers published by current projects using this facility to support your explanation with evidence?

Technology on the Case

Eyes Above the Sky

Biospherians could easily measure changes in their habitat's mini-ecosystems using simple tools. They could see which species were doing well, and which were dying. They could easily record population changes in weedy plants and insect pests. But many natural systems are far too large to be studied using standard methods. New technology offers a solution to this problem.

For years, scientists have been using satellites and airplanes to carry devices sensitive to short-wave ultraviolet (UV) and long-wave infrared (IR) light. These tools can distinguish forests, grasslands, and farms. Now, an amazing improvement is being developed at the Carnegie Institute for Science. Spectranomics, as it is called, can identify individual tree species in a forest, and even record their height.

How does it work? New technology precisely measures light reflected by plants across a very broad spectrum. The data make it possible to pinpoint individual trees and shrubs. Meanwhile, researchers on the ground take samples of plant leaves, record which wavelengths those leaves absorb and reflect, and identify the species to which each type of leaf belongs. When data gathered by the airborne instruments are analyzed together with the information that connects plant leaf characteristics with species names, they identify plant species!

Careers on the Case

Work Toward a Solution

Organizing data for useful analysis is the job of a data scientist.

Data Scientist

Data scientists are experts at selecting the most useful way to display complex data. Then they design and construct their displays, often with the aid of computers. Some data scientists work to display data on climate or populations. Others work for engineers, financial institutions, and other businesses.

VIDEO

Watch this video to learn about other careers in biology.

hhmi | BioInteractive

Invasives
IN YOUR NEIGHBORHOOD

It was just a little snake

when you bought it. But, a year later, your Burmese python was as long as you are tall and weighed more than you do. This was not the kind of pet you had in mind. Unfortunately, some Burmese python owners have reached the same conclusion and have abandoned their enormous pets in Florida's Everglades National Park. These pythons have flourished in their new home and are causing large declines in small mammal populations in the Everglades. Burmese pythons are an invasive species . . . and they are not alone. In fact, invasives are all around us.

PROBLEM LAUNCH
Choose an invasive species in your local ecosystem to focus on.

VIDEO

BOUNCE TO ACTIVATE

Watch a video about Australia's battle with the poisonous cane toad.

PERFORMANCE-BASED

PROBLEM: How can you reduce the impact of an invasive species on your local ecosystem?

TO SOLVE THIS PROBLEM, perform these activities as they come up in the unit and record your findings in your Explorer's Journal.

INTERACTIVITY

Investigate how invasive species can disrupt a native food web.

INTERACTIVITY

Conduct a virtual investigation to see the effect of the introduced Burmese pythons on the Everglades ecosystem.

STEM PROJECT

Design a solution to help control the population of the local invasive species you chose.

AUTHENTIC READING

Read about how an invasive species is changing hemlock forests in the Smoky Mountains.

INTERACTIVITY

Virtually test different strategies for controlling an invasive frog in the American southwest.

PROBLEM WRAP-UP

Present your findings, and propose a solution for reducing the impact of a local invasive species.

Unit 2 Problem Rubric

Use this rubric to help you assess your own solution as well as your classmates' presentations.

	EXEMPLARY Score your work 4 if:	ACCOMPLISHED Score your work 3 if:	DEVELOPING Score your work 2 if:	BEGINNING Score your work 1 if:
Define the Problem Student Score _____ Teacher Score _____	Local invasive species is correctly identified and described; impact on the ecosystem is summarized.	Local invasive species is correctly identified and described, but negative impact on ecosystem is not clearly defined.	Invasive species is identified, but it may not be in the local ecosystem or its impact may not be identified.	Species identified is not invasive or is not part of the local ecosystem; no impact is presented.
Do Research Student Score _____ Teacher Score _____	When researching the local invasive species, multiple sources are used and correctly cited; sources are unbiased and reliable; information is appropriately related to the topic	When researching the local invasive species, multiple sources are used, most of which are unbiased and reliable; sources are cited correctly; some sources may not be directly related to the topic.	When researching the local invasive species, several sources are used, but some may be biased or unreliable and some information may not be directly related to topic; sources may not be cited correctly.	When researching the local invasive species, only one or two sources are used or sources selected are unreliable; sources may not be cited or are cited incorrectly.
Develop a Solution Student Score _____ Teacher Score _____	Solution to problem is identified and supported by research or evidence; solution is evaluated and revised as needed.	Solution to problem is identified and is mostly supported by research or evidence; solution is evaluated, but may not have been revised or completed based on evaluation.	Solution suggested is reasonable, but not supported by research or evidence; solution may not have been evaluated appropriately.	Solution is unrealistic or does not address the problem.
Communicate Information Student Score _____ Teacher Score _____	Information is presented in an organized manner; visuals are useful; data is provided.	Information is presented in an organized manner, but some parts may be unclear or missing.	Information is presented in a disorderly manner that is complete, but difficult to follow.	Information is not presented in an organized manner, and presentation is incomplete.

Meet the Anthromes

Construct an Argument

HS-ESS3-6, CCSS.ELA-LITERACY.WHST.9-10.8, CCSS.ELA-LITERACY.WHST.9-10.9

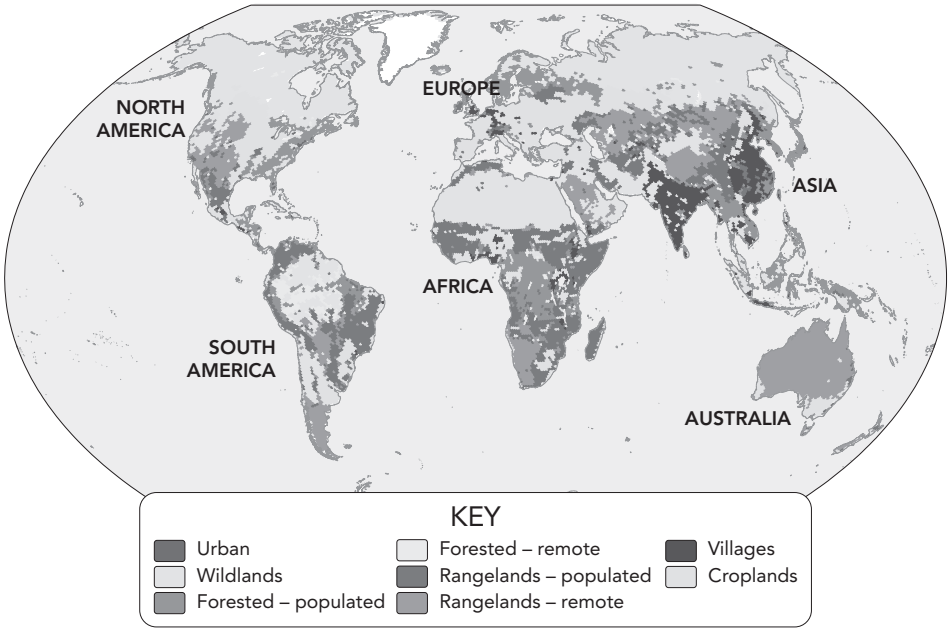
Mosses and lichens grow on the tundra, lions hunt zebras on grasslands, and tall pine trees cover the taiga. However, do these classifications of biomes apply to the place where you live? Probably not. Scientists use the term *anthropogenic biome*, or *anthrome*, to describe biomes that humans have altered. Examples include dense urban areas. Here, buildings and pavement may cover nearly all of the land, with only small areas put aside for parks or stands of trees. Other anthromes consist of land used for farm crops and livestock. In these anthromes, human-selected plants and animals have replaced native species.

The map shows the major anthromes of the world. Compare it to the map of the natural biomes shown in **Figure 3-16**.

1. **Classify** Describe the properties of the place where you live. Then, use the information in the map to classify the anthrome you live in.
2. **Synthesize Information** How does the distribution of anthromes across the world compare to the distribution of biomes?
3. **Use Evidence to Construct an Argument** How do you think the world's natural biomes and anthromes will change in the future? Conduct research to help you construct your argument. Look for data and opinions from different sources, such as these.
   - nonprofit organizations devoted to conservation and wildlife
   - government agencies
   - economists and business groups
4. **Communicate** Write a short essay to present your argument about the future of Earth's natural biomes and anthromes. Support your argument with evidence from this chapter and from your research. Address the following criteria in your essay:
   - Predict which natural biomes or anthromes will expand, which will shrink, and which will stay the same size.
   - Include data, scientific reasoning, or expert opinions to support your predictions.
   - Cite your sources and evaluate their credibility. If you find reliable sources that provide conflicting information or opinions, discuss your evaluation of them.

SCIENCE PROJECT

In suburbs, pavement and houses have replaced the natural biome.



Anthromes
This map shows the locations of major anthropogenic biomes of the world.

Evaluation Rubric

Share the rubric with your students before they begin their assignment so that they know how you will evaluate their performance.

Scoring Rubric	Score 3	Score 2	Score 1
Prediction	Student essay makes predictions about changes in both biomes and anthromes.	Student essay predicts changes in either biomes or anthromes.	Student essay does not predict changes in biomes or anthromes.
Support and Evaluation	Student essay presents data, logical reasoning, and expert opinion for each prediction and evaluates conflicting views.	Student essay lacks data, expert opinion, and logical reasoning for one or more of the predictions. No evaluation of conflicting views.	Student essay lacks data, expert opinion, and logical reasoning for the predictions. No evaluation of conflicting views is given.
Citations	Student essay has full citations for all research results.	Student essay has incomplete citations or lacks some citations for research results.	Student essay lacks citations for research results.

Controlling Local Invasives

Controlling invasives requires both diligence and creativity, but thankfully there are many success stories both in the U.S. and throughout the world. What can you do to make a success story in your ecosystem?

Timing Chapter 5, Lesson 2

DEFINE THE PROBLEM HOW CAN YOU REDUCE THE IMPACT OF AN INVASIVE SPECIES ON YOUR LOCAL ECOSYSTEM.

1. List your chosen invasive species and summarize its effects on your local ecosystem.

Sample answer: Eurasian milfoil spreads widely among lakes and streams in our region. The milfoil changes the ecosystem because of how it grows. For example, it grows in thick mats on a lake's surface that can crowd out other plants.

BRAINSTORM SOLUTIONS

2. With your partners, brainstorm a list of possible methods for controlling the invasive species you chose. Include methods that have been tried elsewhere and possible revisions to these methods.

Sample answers: Introduce insects that eat milfoil.

Harvest milfoil mats regularly, as done in very popular lakes.

Encourage people to clean milfoil from boats (already underway).

Add more native plants to lakes.

Try feeding milfoil to farm animals.

CHOOSE A SOLUTION

3. Decide on one of the methods that you identified. Explain the reasons for your choice and how you think it will address the problem.

Sample answer: We propose to encourage people to clear milfoil from their boats. We could make these encouragements by creating a social media blog. We also propose to coordinate a native plant project to help combat the growth of milfoil.

DESIGN A SOLUTION

4. Plan how you will put your solution into action. What materials do you need?

Sample answer: First we could get the contact information for our state's Department of Natural Resources. We can volunteer to help with the removal of Eurasian milfoil. Next, we could provide a link to the state's website on our social media page. Also, under the supervision of the Department of Natural Resources, we could coordinate a native plant project where we and members of the community could participate in the project.

5. Do you need permission or cooperation from others? What sort?

Sample Answer: We need permission from the local and state government/Department of Natural Resources to participate in any native plant project or link to our social media site.

6. How will you measure the success of the solution?

Sample answer: We can schedule routine observations to see if there is a reduction in the Eurasian milfoil. Also, we can develop charts and maps to record our observations of the milfoil reduction.

7. Use the space below to design your solution. If you are building a solution, draw a detailed, labeled sketch of your design. If not, draw a concept map, flow chart, or other visual representation of the action steps you are planning to take.

Check that drawings accurately represent students' choice of a plan and have detailed action steps and labels.

COMMUNICATE RESULTS

8. Prepare a brief presentation to share your solution with the class. Include any visuals or drawings you think would be helpful. Remember, that your solution is a work-in-progress right now and that you are asking the class for improvement suggestions. Present what you have and listen carefully for feedback. Use the lines below to briefly outline what you will cover in your presentation.

Sample answer:

Beth: Introduction and overview

Jamal: The problems caused by milfoil.

Honoria: Research and brainstorming ideas

Oscar: Testing the plan, and the results

Beth: Conclusions and recommendations

9. Your classmates will also be presenting their solutions. Answer the following questions for each presentation.

- What features of the solution do you think are useful?

  Sample answer: Easy and inexpensive to implement; potential for success, and on-going education for boaters.

- What limitations do you see with the solution?

  Sample answer: We can educate boaters on cleaning milfoil, but boaters must keep cleaning their boats regularly to ensure they don't transfer the milfoil.

- What ideas do you think would improve the solution?

  Sample answer: We might want to set up continuing education or a seasonal event for boaters, instead of just a one-time presentation, to encourage them to clean their boats regularly.

- What questions, if any, do you have that were not addressed in the presentation?

  Sample answer: How will you encourage boaters to attend your presentation? Will you continue to monitor the native plants you plant?

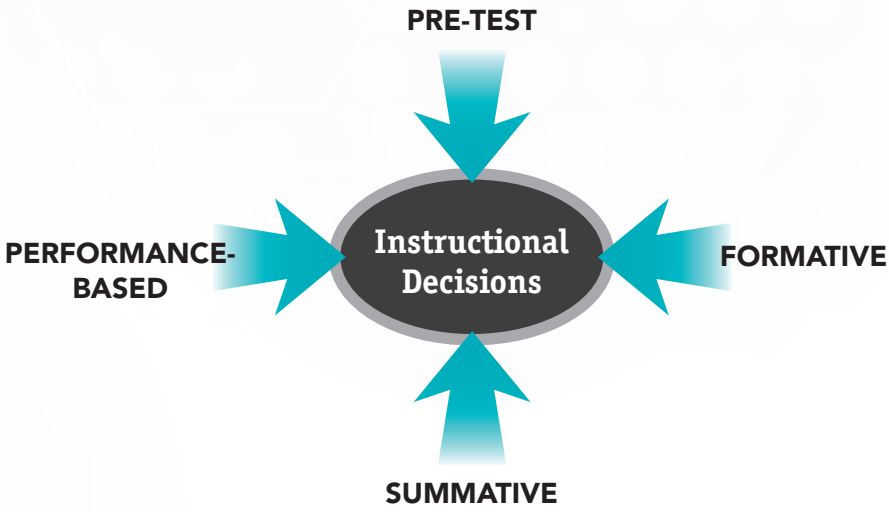
EVALUATE AND REDESIGN

10. Evaluate any suggestions you received from other students. Sketch or describe features of the solution that you think can be improved.

Sample answer: Perhaps with the cooperation of the Department of Natural Resources, we as students and the community can volunteer in manually removing the Eurasian milfoil.

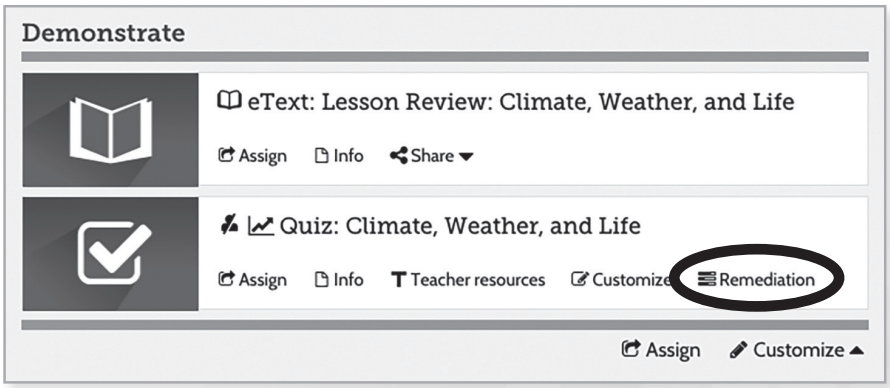
Data to Inform Instruction

Make informed instructional decisions with **multiple data points**. Pre-Testing, Formative, Summative, and Performance-Based assessments provide varied ways to monitor student understanding.



Activities, homework, and assessments are assignable through Savvas Realize™. **Automatic grading capabilities** make it easier for instructors to provide quick and easy delivery of feedback.

Within Savvas Realize™, instructors can instantly access **student and class data** that shows mastery on assessments, online activity, and overall progress. Embedded assessments deliver instant data that allow teachers to easily monitor students' progress and inform instruction.



Remediation: All standard digital assessments have the option for auto-remediation. Depending on the area that needs improvement, reviews and activities will be automatically assigned to the student to help fill in the gaps.

Miller & Levine Biology

Ignite Curiosity

Promote Understanding

Inspire Learning

For Students:

- Student Edition
- Student Edition eText
- Digital Explorer's Journal Problem-Based Learning Workbook
- Biology Foundations: Reading and Study Guide Workbook
- Savvas Realize™

For Teachers:

- Teacher Edition
- Teacher Edition eText
- Digital Explorer's Journal: Problem-Based Learning Workbook Teacher Edition
- Digital Biology Foundations: Reading and Study Guide Workbook Teacher Edition
- Exam*View*® Test Bank
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