Glencoe Science

Chapter Resources

Climate

Includes:

Reproducible Student Pages

ASSESSMENT

- ✔ Chapter Tests
- ✔ Chapter Review

HANDS-ON ACTIVITIES

- ✔ Activity Worksheets for each Student Edition Activity
- ✔ Laboratory Activities
- ✔ Foldables–Reading and Study Skills activity sheet

MEETING INDIVIDUAL NEEDS

- ✔ Directed Reading for Content Mastery
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- ✔ Reinforcement
- ✔ Enrichment
- ✔ Note-taking Worksheets

TRANSPARENCY ACTIVITY MASTERS

- ✔ Section Focus Activity
- ✔ Teaching Transparency Activity
- ✔ Assessment Transparency Activity

Teacher Support and Planning

- ✔ Content Outline for Teaching
- ✔ Spanish Resources
- ✔ Teacher Guide and Answers

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Glencoe Science

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Teacher Wraparound Edition
Interactive Teacher Edition CD-ROM
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Content Outline for Teaching
Directed Reading for Content Mastery
Foldables: Reading and Study Skills
Assessment
- *Chapter Review*
- *Chapter Tests*
- *ExamView Pro Test Bank Software*
- *Assessment Transparencies*
- *Performance Assessment in the Science Classroom*
- *The Princeton Review Standardized Test Practice Booklet*

Directed Reading for Content Mastery in Spanish
Spanish Resources
Guided Reading Audio Program
Reinforcement
Enrichment
Activity Worksheets
Section Focus Transparencies
Teaching Transparencies
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Additional Assessment Resources available with Glencoe Science:

- ExamView Pro Test Bank Software
- Assessment Transparencies
- Performance Assessment in the Science Classroom
- The Princeton Review Standardized Test Practice Booklet
- MindJogger Videoquizzes
- Vocabulary Puzzlemaker Software
- Interactive Explorations and Quizzes CD-ROM with Presentation Builder
- The Glencoe Science Web site at: **science.glencoe.com**
- An interactive version of this textbook along with assessment resources are available online at: **mhln.com**

To the Teacher

This chapter-based booklet contains all of the resource materials to help you teach this chapter more effectively. Within you will find:

Reproducible pages for

- Student Assessment
- Hands-on Activities
- Meeting Individual Needs (Extension and Intervention)
- Transparency Activity Masters

A teacher support and planning section including

- Content Outline of the chapter
- Spanish Resources
- Answers and teacher notes for the worksheets

Hands-On Activities

MiniLAB and Activity Worksheets: Each of these worksheets is an expanded version of each activity and MiniLAB found in the Student Edition. The materials lists, procedures, and questions are repeated so that students do not need their texts open during the lab. Write-on rules are included for any questions. Tables/charts/graphs are often included for students to record their observations. Additional lab preparation information is provided in the *Teacher Guide and Answers* section.

Laboratory Activities: These activities do not require elaborate supplies or extensive pre-lab preparations. These student-oriented labs are designed to explore science through a stimulating yet simple and relaxed approach to each topic. Helpful comments, suggestions, and answers to all questions are provided in the *Teacher Guide and Answers* section.

Foldables: At the beginning of each chapter there is a *Foldables: Reading & Study Skills* activity written by renowned educator, Dinah Zike, that provides students with a tool that they can make themselves to organize some of the information in the chapter. Students may make an organizational study fold, a cause and effect study fold, or a compare and contrast study fold, to name a few. The accompanying *Foldables* worksheet found in this resource booklet provides an additional resource to help students demonstrate their grasp of the concepts. The worksheet may contain titles, subtitles, text, or graphics students need to complete the study fold.

Meeting Individual Needs (Extension and Intervention)

Directed Reading for Content Mastery: These worksheets are designed to provide students with learning difficulties with an aid to learning and understanding the vocabulary and major concepts of each chapter. The *Content Mastery* worksheets contain a variety of formats to engage students as they master the basics of the chapter. Answers are provided in the *Teacher Guide and Answers* section.

Directed Reading for Content Mastery (in Spanish): A Spanish version of the *Directed Reading for Content Mastery* is provided for those Spanish-speaking students who are learning English.

Reinforcement: These worksheets provide an additional resource for reviewing the concepts of the chapter. There is one worksheet for each section, or lesson, of the chapter. The *Reinforcement* worksheets are designed to focus primarily on science content and less on vocabulary, although knowledge of the section vocabulary supports understanding of the content. The worksheets are designed for the full range of students; however, they will be more challenging for your lower-ability students. Answers are provided in the *Teacher Guide and Answers* section.

Enrichment: These worksheets are directed toward above-average students and allow them to explore further the information and concepts introduced in the section. A variety of formats are used for these worksheets: readings to analyze; problems to solve; diagrams to examine and analyze; or a simple activity or lab which students can complete in the classroom or at home. Answers are provided in the *Teacher Guide and Answers* section.

Note-taking Worksheet: The *Note-taking Worksheet* mirrors the content contained in the teacher version—*Content Outline for Teaching*. They can be used to allow students to take notes during class, as an additional review of the material in the chapter, or as study notes for students who have been absent.

Assessment

Chapter Review: These worksheets prepare students for the chapter test. The *Chapter Review* worksheets cover all major vocabulary, concepts, and objectives of the chapter. The first part is a vocabulary review and the second part is a concept review. Answers and objective correlations are provided in the *Teacher Guide and Answers* section.

Chapter Test: The *Chapter Test* requires students to use process skills and understand content. Although all questions involve memory to some degree, you will find that your students will need to discover relationships among facts and concepts in some questions, and to use higher levels of critical thinking to apply concepts in other questions. Each chapter test normally consists of four parts: Testing Concepts measures recall and recognition of vocabulary and facts in the chapter; Understanding Concepts requires interpreting information and more comprehension than recognition and recall—students will interpret basic information and demonstrate their ability to determine relationships among facts, generalizations, definitions, and skills; Applying Concepts calls for the highest level of comprehension and inference; Writing Skills requires students to define or describe concepts in multiple sentence answers. Answers and objective correlations are provided in the *Teacher Guide and Answers* section.

Transparency Activity Masters

Section Focus Transparencies: These transparencies are designed to generate interest and focus students' attention on the topics presented in the sections and/or to assess prior knowledge. There is a transparency for each section, or lesson, in the Student Edition. The reproducible student masters are located in the *Transparency Activities* section. The teacher material, located in the *Teacher Guide and Answers* section, includes Transparency Teaching Tips, a Content Background section, and Answers for each transparency.

Teaching Transparencies: These transparencies relate to major concepts that will benefit from an extra visual learning aid. Most of these transparencies contain diagrams/photos from the Student Edition. There is one *Teaching Transparency* for each chapter. The *Teaching Transparency Activity* includes a black-and-white reproducible master of the transparency accompanied by a student worksheet that reviews the concept shown in the transparency. These masters are found in the *Transparency Activities* section. The teacher material includes Transparency Teaching Tips, a Reteaching Suggestion, Extensions, and Answers to Student Worksheet. This teacher material is located in the *Teacher Guide and Answers* section.

Assessment Transparencies: An *Assessment Transparency* extends the chapter content and gives students the opportunity to practice interpreting and analyzing data presented in charts, graphs, and tables. Test-taking tips that help prepare students for success on standardized tests and answers to questions on the transparencies are provided in the *Teacher Guide and Answers* section.

Teacher Support and Planning

Content Outline for Teaching: These pages provide a synopsis of the chapter by section, including suggested discussion questions. Also included are the terms that fill in the blanks in the students' *Note-taking Worksheets.*

Spanish Resources: A Spanish version of the following chapter features are included in this section: objectives, vocabulary words and definitions, a chapter purpose, the chapter Activities, and content overviews for each section of the chapter.

Reproducible Student Pages

Reproducible Student Pages

Hands-On Activities

Mini LAB

Observing Solar Radiation

Procedure

1. Darken the room.
2. Hold a **flashlight** about 30 cm from a **globe**. Shine the light directly on the equator. With your finger, trace around the light.
3. Now, tilt the flashlight to shine on 30°N latitude. The size of the lighted area should increase. Repeat at 60°N latitude.

Data and Observations

Table 1

Location where beam is directed	Description of size of lighted area
1. Equator	
2. 30°N latitude	
3. 60°N latitude	

Analysis

1. How did the size and shape of the light beam change as you directed the light toward higher latitudes?

2. How does Earth's tilt affect the solar radiation received by different latitudes?

TRY AT HOME Mini LAB

Modeling El Niño

Procedure

1. During El Niño, trade winds blowing across the Pacific Ocean from east to west slacken or even reverse. Surface waters move back toward the coast of Peru.
2. Add **warm water** to a **9 in by 13 in baking pan** until it is two-thirds full. Place the pan on a smooth countertop.
3. Blow as hard as you can across the surface of the water along the length of the pan. Next, blow with less force. Then, blow in the opposite direction.

Data and Observations

Table 1

Effects of Wind on Water Surfaces

Wind force or direction	Observations
1. Greater force	
2. Lesser force	
3. Change of direction	

Analysis

1. What happened to the water as you blew across its surface? What was different when you blew with less force and when you blew from the opposite direction?

2. Explain how this is similar to what happens during an El Niño event.

Activity The Greenhouse Effect

Lab Preview

Directions: *Answer the following questions before you begin the Activity.*

1. What objects in this lab would be hazardous if broken?

2. You have just brought water to a boil in an uncovered pot and turned off the flame under the pot. Without turning the flame back on, how can you keep the water hot?

Do you remember climbing into the car on a warm, sunny day? Why was it so hot inside the car when it wasn't that hot outside? It was hotter in the car because the car functioned like a greenhouse. You experienced the greenhouse effect.

What You'll Investigate

How can you demonstrate the greenhouse effect?

Materials

identical large, empty glass jars (2)
lid for one jar
nonmercury thermometers (3)

Goals

- **Model** the greenhouse effect.
- **Measure and graph** temperature changes.

Safety Precautions

Be careful when you handle glass thermometers. If a thermometer breaks, do not touch it. Have your teacher dispose of the glass safely.

Procedure

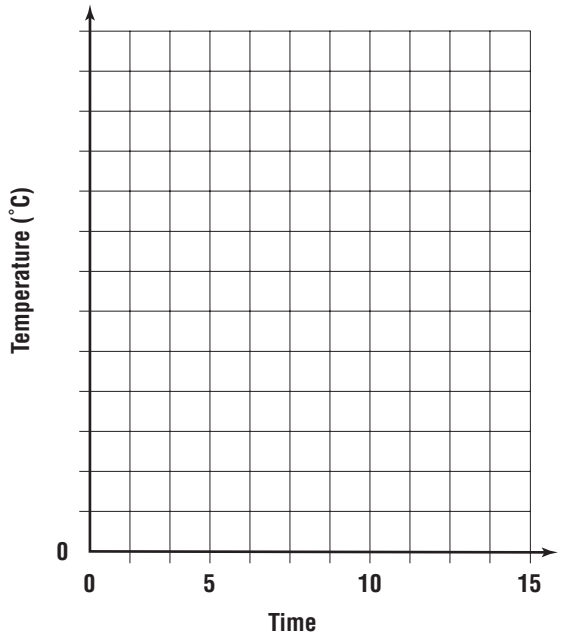
1. Lay a thermometer inside each jar.
2. Place the jars next to each other by a sunny window. Lay the third thermometer between the jars.
3. **Record** the temperatures of the three thermometers. They should be the same.
4. Place the lid on one jar.
5. **Record** the temperatures of all three thermometers at the end of 5, 10, and 15 min.
6. Make a line graph in the space in the Data and Observations section that shows the temperatures of the three thermometers for the 15 min of the experiment.

Data and Observations

Table 1

Jar Temperature			
Time	**Thermometer 1**	**Thermometer 2**	**Thermometer 3**
5 min			
10 min			
15 min			

Activity (continued)



Conclude and Apply

1. **Explain** why you placed a thermometer between the two jars.

2. What were the constants in this experiment? What was the variable?

3. Which thermometer experienced the greatest temperature change during your experiment?

4. **Analyze** what occurred in this experiment. How was the lid in this experiment like the greenhouse gases in the atmosphere?

5. **Infer** from this experiment why you should never leave a pet inside a closed car in warm weather.

Communicating Your Data

Give a brief speech describing your conclusions to your class. **For more help, refer to the Science Skill Handbook.**

Activity Microclimates

Lab Preview

Directions: *Answer the following questions before you begin the Activity.*

1. What should you do if a thermometer breaks?

2. How do large cities affect local climates?

A microclimate is a localized climate that differs from the main climate of a region. Buildings in a city, for instance, can affect the climate of the surrounding area. Large buildings can create microclimates by blocking the sun or changing wind patterns.

What You'll Investigate

Does your school create microclimates?

Materials

thermometers
psychrometer
paper strip or wind sock
large cans (4 or 5)
**beakers or rain gauges (4 or 5)*
unlined paper
**Alternate materials*

Goals

- **Observe** temperature, wind speed, relative humidity, and precipitation in areas outside your school.
- **Identify** local microclimates.

Safety Precautions

CAUTION: *If a thermometer breaks, do not touch it. Have your teacher dispose of the glass safely.*

Procedure

1. Select four or five sites around your school building. Also, select a control site well away from the school.

2. Attach a thermometer to an object near each of the locations you selected. Set up a rain gauge, beaker, or can to collect precipitation.

3. Visit each site at two predetermined times, one in the morning and one in the afternoon, each day for a week. Record the temperature and measure any precipitation that might have fallen. Use a wind sock or paper strip to determine wind direction.

4. To find relative humidity, you'll need to use a psychrometer. A psychrometer is an instrument with two thermometers—one wet and one dry. As moisture from the wet thermometer evaporates, it takes heat energy from its environment, and the environment immediately around the wet thermometer cools. The thermometer records a lower temperature. Relative humidity can be found by finding the difference between the wet thermometer and the dry thermometer and by using the chart on the following page. Record all of your weather data.

5. **Analyze** your data to find patterns. Make separate line graphs for temperature, relative humidity, and precipitation for your morning and afternoon data. Make a table showing wind direction data.

Activity (continued)

Data and Observations

Table 1

Relative Humidity

Dry bulb temperature (°C)	Dry bulb temperature minus wet-bulb temperature (°C)									
	1	2	3	4	5	6	7	8	9	10
14	90	79	70	60	51	42	34	26	18	10
15	90	80	71	61	53	44	36	27	20	13
16	90	81	71	63	54	46	38	30	23	15
17	90	81	72	64	55	47	40	32	25	18
18	91	82	73	65	57	49	41	34	27	20
19	91	82	74	65	58	50	43	36	29	22
20	91	83	74	66	59	51	44	37	31	24
21	91	83	75	67	60	53	46	39	32	26
22	92	83	76	68	61	54	47	40	34	28
23	92	84	76	69	62	55	48	42	36	30
24	92	84	77	69	62	56	49	43	37	31
25	92	84	77	70	63	57	50	44	39	33

Conclude and Apply

1. Why did you take weather data at a control site away from the school building? How did the control help you analyze and interpret your data?

2. **Compare and contrast** weather data for each of your sites. What microclimates did you identify around your school building? How did these climates differ from the control site? How did they differ from each other?

3. **Infer** what conditions could have caused the microclimates that you identified. Are your microclimates similar to those that might exist in a large city? Explain.

Communicating Your Data

Use your graphs to make a large poster explaining your conclusions. Display your posters in the school building. **For more help, refer to the Science Skill Handbook.**

LAB 1 Laboratory Activity

How do the oceans affect climate?

Meteorologists, people who study weather and climate, are always looking at what happens in the oceans. Most of the climate we experience on land is a result of winds and evaporated water at sea. One of the effects of the oceans is to keep the climate near their shores fairly constant. This happens because the water maintains a relatively even temperature. As a result of the weak attractions that form between the hydrogen atoms of one molecule of water and the oxygen atoms of nearby water molecules, a large amount of heat energy can be absorbed by water before its temperature rises. Air molecules do not have this type of attraction between them; therefore the temperature rises more quickly with heat input from the Sun. Volume is also an important consideration in looking at the effects of the Sun's energy on water molecules. It is much easier for the Sun to heat or cool a small pond than it is for the Sun to heat or cool the ocean. In this laboratory exercise, you will compare the effect of the Sun's energy on water with its effect on the atmosphere. From your data, you will make conclusions about climate in different regions.

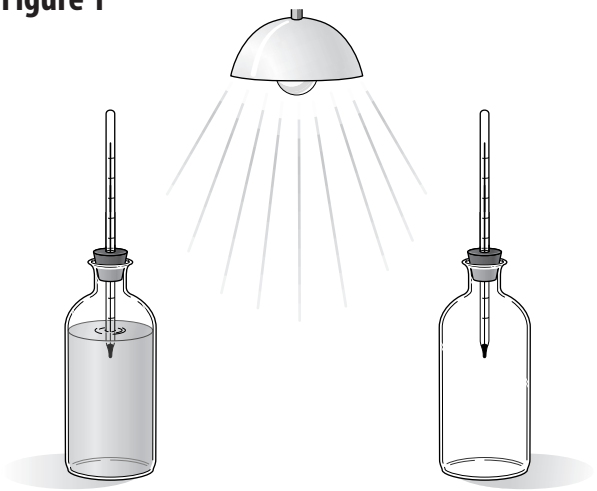
Strategy

You will model and observe the effect of energy from the Sun on water and on air.
You will infer how oceans and energy from the Sun affect climate.

Materials

2 plastic soda bottles (labels removed)
2 cork or rubber stoppers with center holes
2 long, chemistry-type thermometers
water
paper towels
**100-watt light source (if no sunlight is available)*
**apparatus for holding light source stationary*
**Alternate materials*

Figure 1



Procedure

1. Work with a partner. Obtain two bottles, stoppers, and thermometers from your instructor. (The thermometers might be fitted into the stopper holes already.)
2. Place the thermometer GENTLY through the stopper hole. The fit should be snug so the stopper will hold the thermometer, but not so tight that it breaks. If your thermometer breaks, DO NOT pick up the pieces of glass yourself. Tell your instructor what happened. If you are uncomfortable doing this step, ask for help from your instructor.
3. Pour water that has reached room temperature into one of your bottles. You do not need to fill the bottle all the way to the top. You need just enough water to insert the thermometer about 8–10 cm into the water. Use paper towels to wipe up any water spills.
4. Check the temperatures on your thermometers and record them on the table provided . They should both be about the same since they are room temperature.
5. If you have a sunny window in your classroom, place your bottles side by side in the window. If possible, it is even better to place your bottles outside in the Sun. If no sunshine is available, place your bottles under a light bulb, as shown in Figure 1.

Laboratory Activity 1 (continued)

6. After 10 min, observe and record the temperatures inside your bottles. If you need to remove the stoppers and thermometers to read the temperature, replace the stoppers quickly or you will lose heat from the bottles.

7. Repeat step 6 two times, so you have a total of four temperature readings for each bottle.

Data and Observations

Table 1

Time of observation in minutes	Temperature of air bottle (°C)	Temperature of water bottle (°C)
Initial time 0		
10		
20		
30		

Questions and Conclusions

1. Which bottle had the greatest amount of temperature change?

2. How do you explain this based on the idea that weak attractions exist between water molecules?

3. How would you relate this temperature change to warm, coastal climates? To flat, inland landscapes, like deserts?

Laboratory Activity 1 (continued)

4. The climate at the North and South Poles is never warm even though they are surrounded by oceans. How do you explain this? [Hint: Think about the angles of the sun's rays.]

Strategy Check

_____ Can you explain how water and air are affected differently by the Sun's energy?

_____ Can you explain how oceans influence climate?

LAB 2 Laboratory Activity

Solar Energy Storage

Solar energy is not always available when we need it, such as on cloudy days and at night. Storing the solar energy is one of the problems that must be solved before solar energy can be used on a large scale to produce electricity for homes, factories, or businesses. One method of storage involves solids such as rocks. Another method involves the use of water or air.

Strategy

You will construct storage tanks for heat energy.
You will compare the ability of water and gravel to absorb and release heat energy.
You will explain how these storage methods can be used to heat a home.

Materials

2 small coffee cans with lids
water
hot plate
2 nonmercury thermometers
watch with second hand
beaker tongs or pliers
gravel
graph paper
pencils (colored)

Procedure

1. Pour water into one coffee can until it is half full, and set it on the hot plate. **CAUTION:** *Use proper protection when handling a hot plate.* Measure the water's temperature near the bottom of the can and near the top. Record the temperatures in Table 1.
2. Turn the hot plate to high and allow it to heat for 2 min. Turn the hot plate off. Measure the temperature of the water near the bottom of the can with one thermometer and close to the top with the other thermometer every minute for 15 min. Record the temperatures in Table 1. **CAUTION:** *Do not leave thermometer in can during heating.*
3. Using beaker tongs or pliers, remove the can of water from the hot plate. **CAUTION:** *Hot water can cause serious burns.*
4. Allow the hot plate to cool.
5. Pour gravel into the second coffee can until it is half-full, and place it on the hot plate. Measure the temperature near the bottom with one thermometer and near the top of the can with the other thermometer. **CAUTION:** *Follow your teacher's instructions on inserting your thermometer into the gravel. Hot gravel can cause serious burns.* Record the temperatures in Table 1.
6. Repeat step 2. This time with gravel instead of water. Allow the can with the gravel to remain on the hot plate until it is completely cool.

Laboratory Activity 2 (continued)

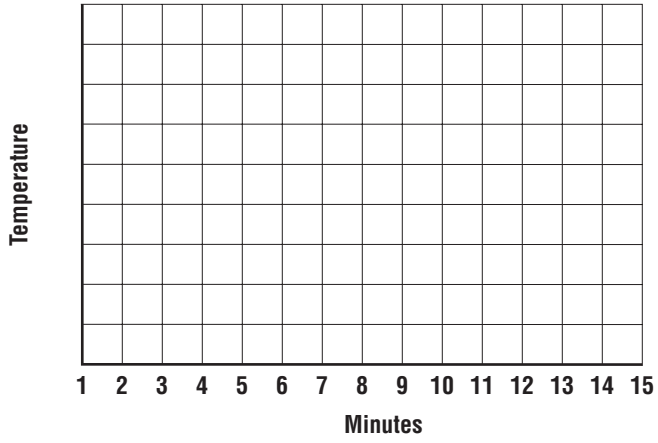
Data and Observations

Table 1

Time (min)	Temperature (°C)			
	Water		Gravel	
	Top	Bottom	Top	Bottom
Prior to heating				

Laboratory Activity 2 (continued)

Directions: *Graph temperature and time for each material. Use a different-colored pencil for each material.*



Questions and Conclusions

1. Which material heated more rapidly? How do you know?

2. Which material cooled more rapidly? How do you know?

3. Which material would you choose to store heat energy from a solar collector? Explain.

4. If you use a solar collector that circulates water, you need a large tank of water to store the heat, generally 2.7 L per square meter. How much water would you need to store to heat a house with an area of 1380 m^2?

5. How would you store the rocks necessary for a solid solar storage system?

Laboratory Activity 2 (continued)

6. How can you change the storage system to make it more efficient than it is in this activity?

_____

_____

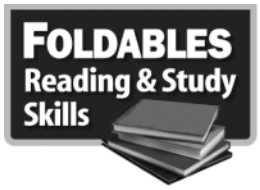
_____

Strategy Check

_____ Can you construct tanks for heat energy?

_____ Can you compare the ability of water and gravel to absorb and release heat energy?

_____ Can you explain how these storage methods can be used to heat a home?



Climate

Directions: *Use this page to label your Foldable in the* ***Before You Read*** *at the beginning of the chapter.*

Climate Classification

Tropical

Mild

Dry

Continental

Polar

High Elevation

It is always hot here, except at high elevations.

It is colder here because the air is thinner.

This climate can have warm or cool summers.

This climate is found around the Mediterranean Sea.

This climate is never warm.

This type can be arid or semiarid.

Meeting Individual Needs

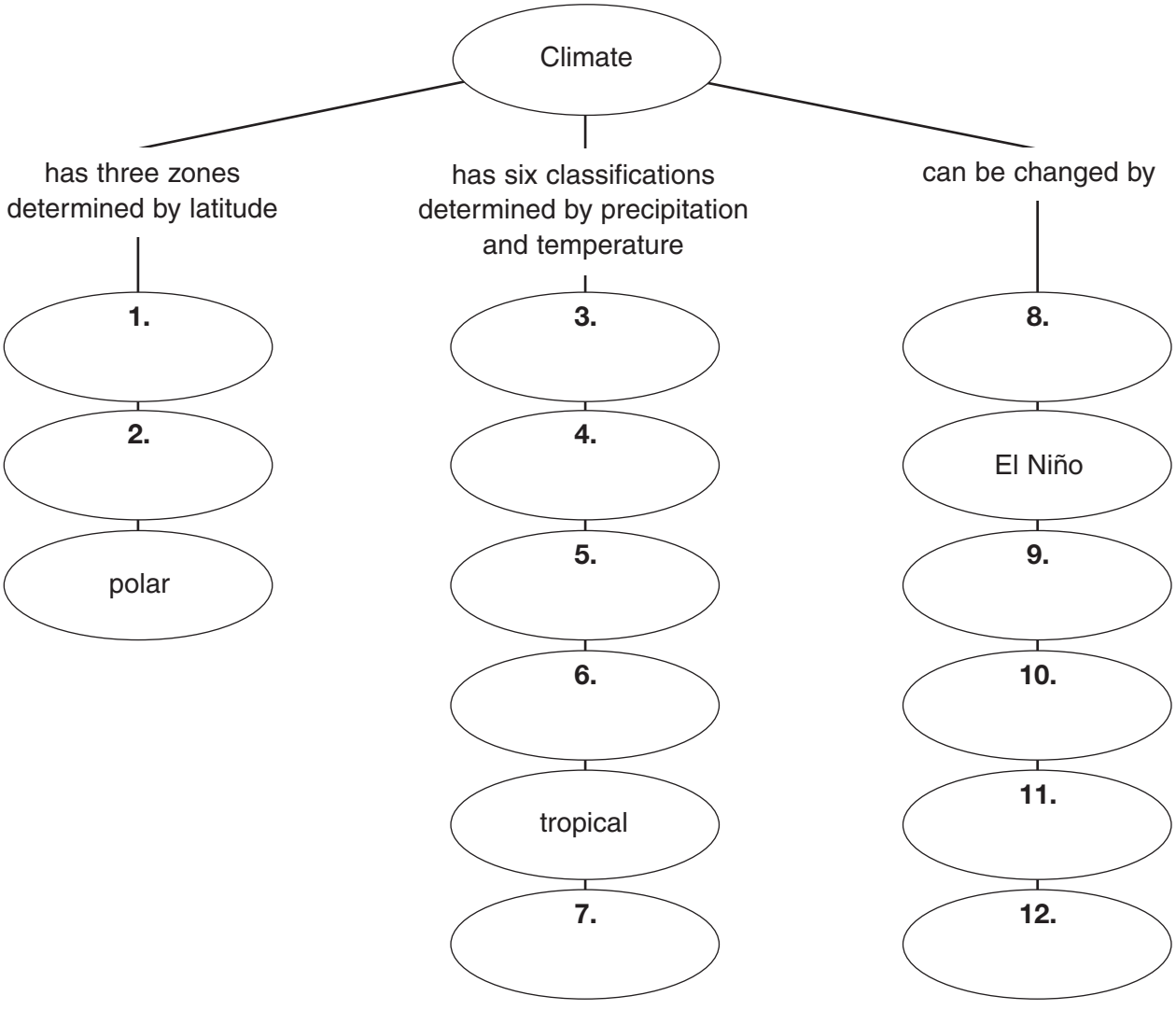
Name Date Class

Directed Reading for Content Mastery

Overview Climate

Directions: *Use the following terms to complete the concept map below.*

mild **solar output** **large cities** **tropical**
volcanic eruptions **temperate** **continental**
seasons **polar** **dry**
meteorite collisions **high elevation**

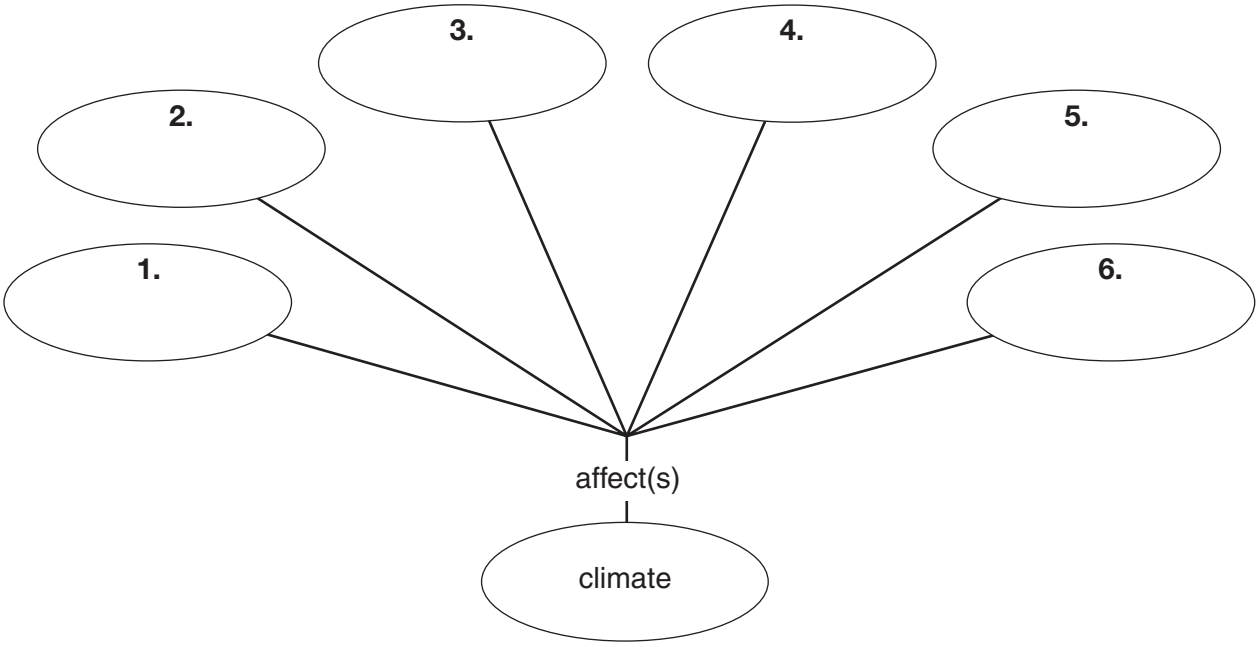


Directed Reading for Content Mastery

Section 1 ▪ What is climate?
Section 2 ▪ Climate Types

Directions: *Unscramble the following terms to complete the concept map below.*

tudealti **gelar estici** **dnalmsfor**
isodbe fo tarew **oecan rrucenst** **isanotumn**



Directions: *Choose the phrase on the right that correctly completes each sentence. Write the letter of the phrase in the space provided.*

_____ **7.** The fur of mammals is an example of a _____.

_____ **8.** Water heats up and cools down _____.

_____ **9.** As air rises, _____.

_____ **10.** Climates can be classified based on _____.

_____ **11.** Hibernation and estivation are two kinds of _____.

_____ **12.** Deserts are common on the _____.

a. temperature, moisture, and amount of sunlight.

b. it cools.

c. structural adaptation.

d. leeward side of mountains, away from the wind.

e. more slowly than land.

f. behavioral adaptations.

Directed Reading for Content Mastery

Section 3 ▪ Climatic Changes

Directions: *Circle the term that correctly completes each sentence.*

1. (Earth's rotation/Earth's tilt) causes seasons.

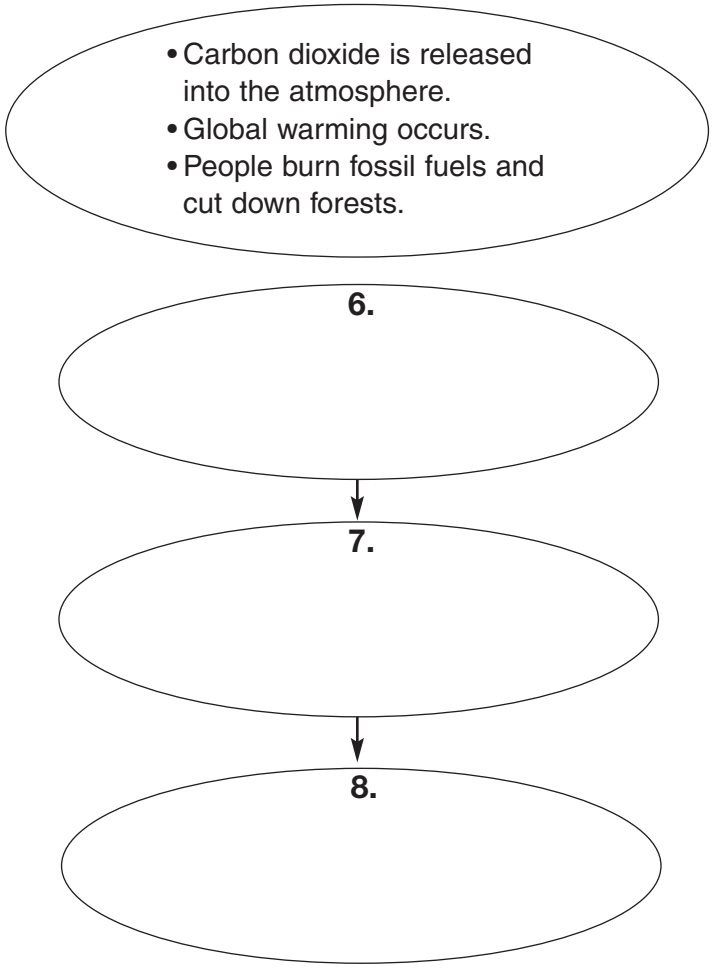
2. El Niño occurs when (rain/wind) patterns change over the Pacific Ocean.

3. The amount of (carbon dioxide/volcanic ash) in the atmosphere helps create the greenhouse effect.

4. Great events such as meteorite collisions and (volcanic eruptions/glaciation) can affect the amount of sunlight reaching Earth.

5. Because of fairly (low/constant) solar radiation near the equator, the tropics do not have great seasonal temperature changes.

Directions: *Place the sentences in the top oval in correct order in the flow chart that follows.*

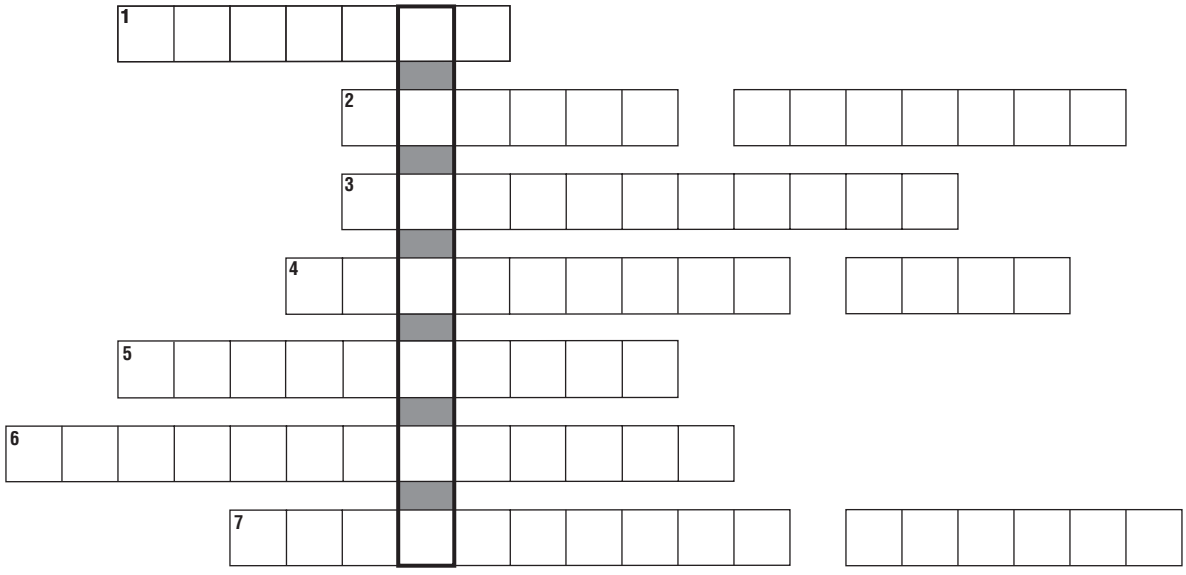


Directed Reading for Content Mastery

Key Terms
Climate

Directions: *Use the following terms to complete the puzzle below. The letters in the dark vertical box will spell a familiar word.*

adaptation **global warming** **hibernation**
temperate zone **deforestation** **tropics** **greenhouse effect**



1. Regions of Earth that receive the most solar radiation

2. Increase in global temperatures

3. An animal's long period of inactivity during winter

4. Moderate temperature zone between the polar zone and the tropics

5. Any structure or behavior that helps an organism survive in its environment

6. Destroying and cutting down trees

7. Natural heating caused when gases in the atmosphere trap heat

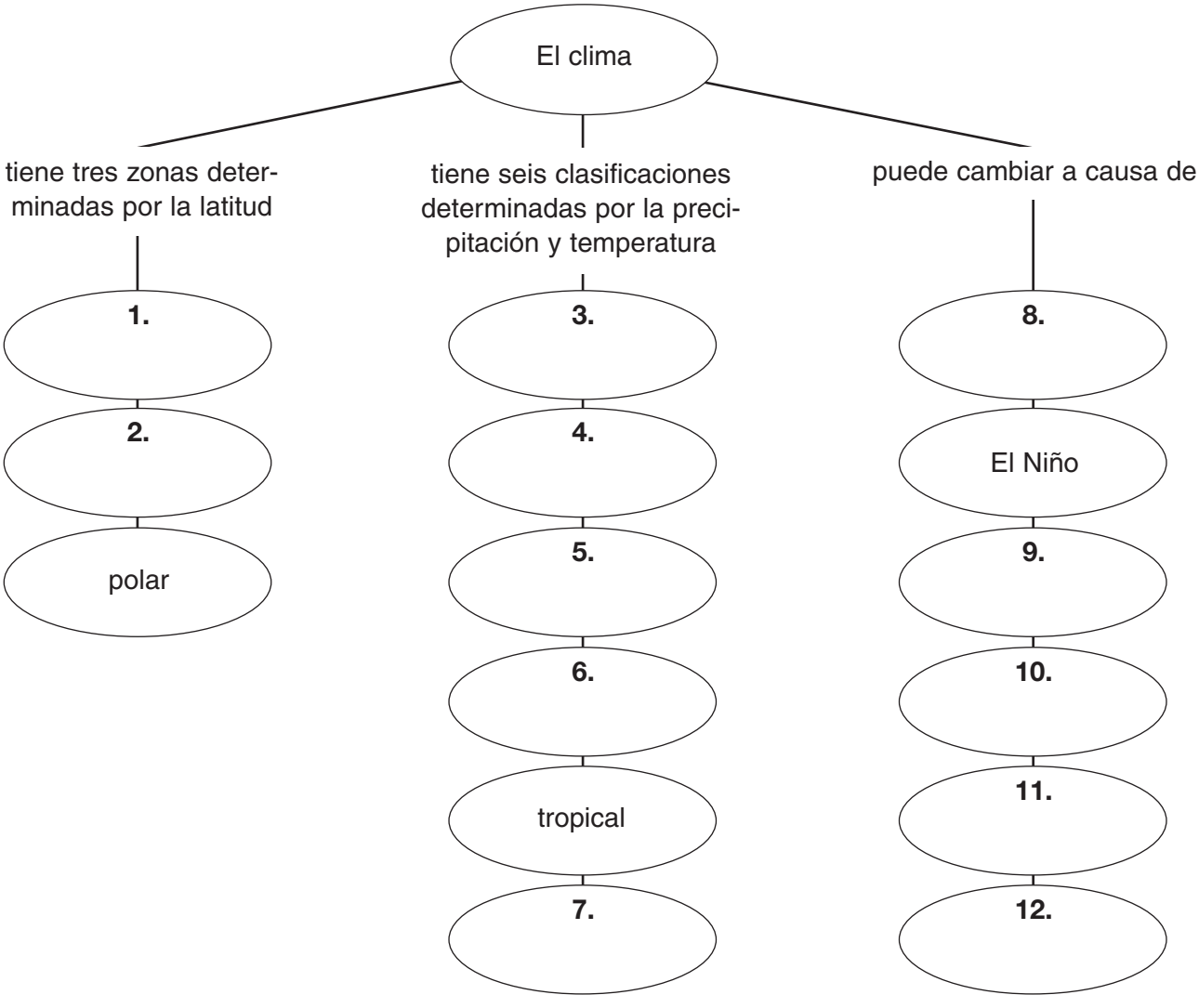
8. The familiar word in the dark vertical box is _____.

Lectura dirigida para Dominio del contenidio

Sinopsis Clima

Instrucciones: *Usa los siguientes términos para completar el mapa conceptual.*

moderado **potencia solar** **ciudades grandes** **tropical**
erupciones volcánicas **temperatura** **continental**
estaciones **polar** **seco**
colisiones de meteoritos **alta elevación**



Satisface las necesidades individuales

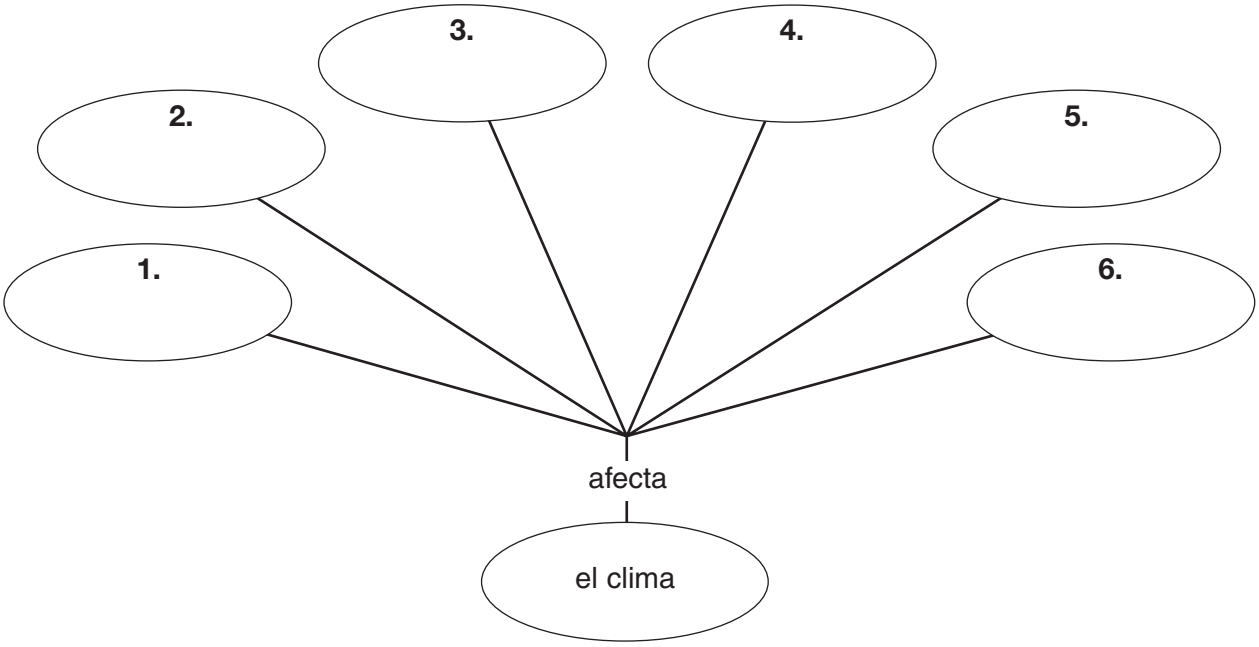
Lectura dirigida para Dominio del contenidio

Sección 1 ▪ ¿Qué es el clima?
Sección 2 ▪ Tipos de clima

Instrucciones: *Descifr los siguientes términos para completar el mapa conceptual.*

tudealti **gelar estici** **dnalmsfor**

isodbe fo tarew **oecan rrucenst** **isanotumn**



Instrucciones: *Escoge la letra de la frase que complete correctamente cada oración. Escribe la letra en el espacio dado.*

_____ **7.** El pelo de los mamíferos es un ejemplo de _____.

_____ **8.** El agua se calienta y se enfría _____.

_____ **9.** A medida que el aire se eleva, _____.

_____ **10.** Los climas pueden clasificarse con base en _____.

_____ **11.** La hibernación y la estivación son dos clases de _____.

_____ **12.** Los desiertos son comunes en _____.

a. temperatura, humedad y cantidad de luz solar.

b. se enfría.

c. adaptación estructural.

d. el lado de sotavento de las montañas, dando la espalda al viento.

e. más lentamente que la tierra.

f. adaptaciones del comportamiento.

Satisface las necesidades individuales

Lectura dirigida para Dominio del contenidio

Sección 3 ▪ Cambios climáticos

Instrucciones: *Haz un círculo alrededor del término que responde correctamente cada oración.*

1. (La rotación/inclinación) de la Tierra causa las estaciones.

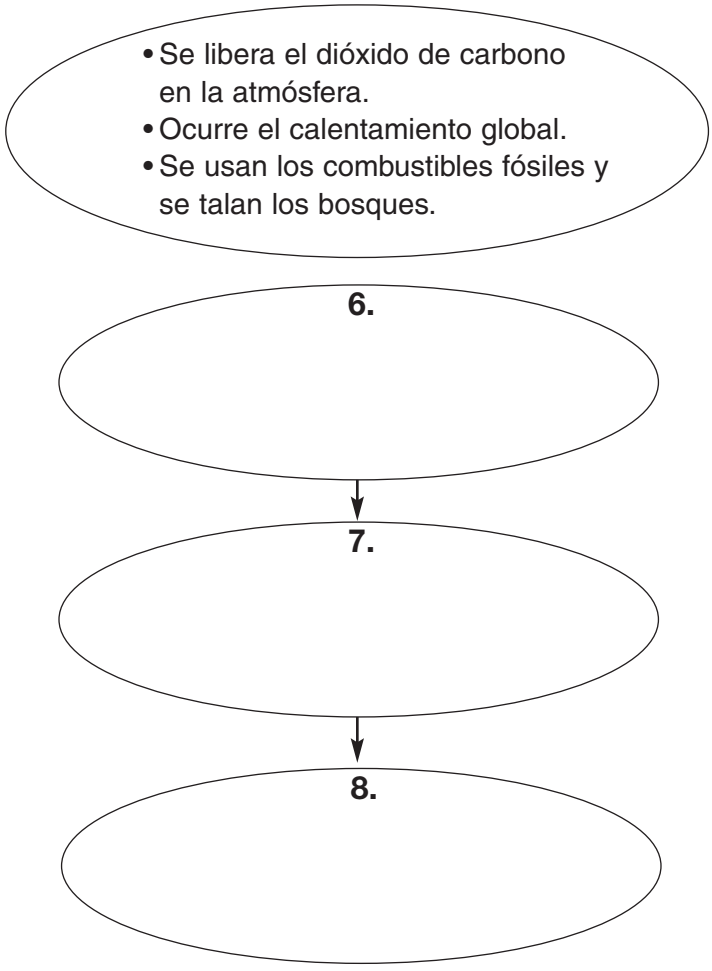
2. El Niño ocurre cuando cambian los patrones de (lluvia/viento) sobre el océano Pacífico.

3. La cantidad de (dióxido de carbono/cenizas volcánicas) en la atmósfera ayuda a crear el efecto de invernadero.

4. Sucesos importantes como las colisiones de meteoritos y (erupciones volcánicas-/glaciaciones) pueden afectar la cantidad de luz solar que llega a la Tierra.

5. Debido a la radiación solar (baja/constante) cerca del ecuador, los trópicos no experimentan grandes cambios de temperatura.

Instrucciones: *Ordena las oraciones en el diagrama de flujo.*



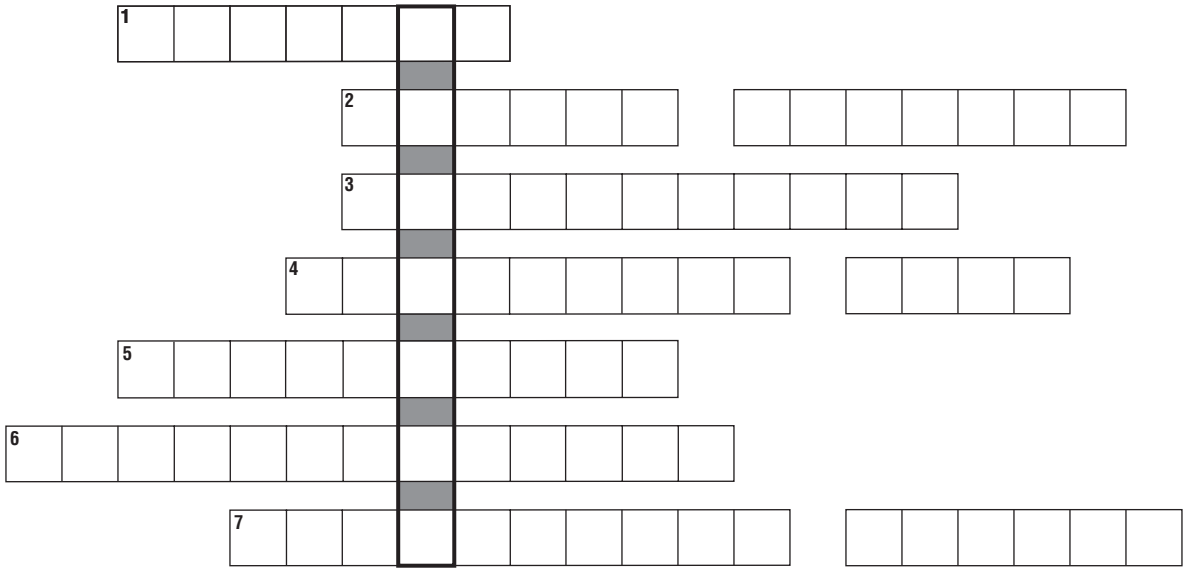
Satisface las necesidades individuales

Lectura dirigida para Dominio del contenidio

Palabras claves Clima

Instrucciones: *Usa los siguientes términos para completar el crucigrama. Las letras en los cuadrados sombreados deletrean una palabra familiar.*

adaptación **calentamiento global** **hibernación**
zona templada **tala** **trópicos** **efecto de invernadero**



1. Regiones de la Tierra que reciben la mayor cantidad de radiación solar.

2. Aumento en las temperaturas globales.

3. Período largo de inactividad de un animal durante el invierno.

4. Zona de temperatura moderada entre la zona polar y los trópicos.

5. Cualquier estructura o comportamiento que le ayuda a un organismo a sobrevivir en su ambiente.

6. Destrucción y tala de árboles.

7. Calentamiento natural que ocurre cuando los gases en la atmósfera atrapan el calor.

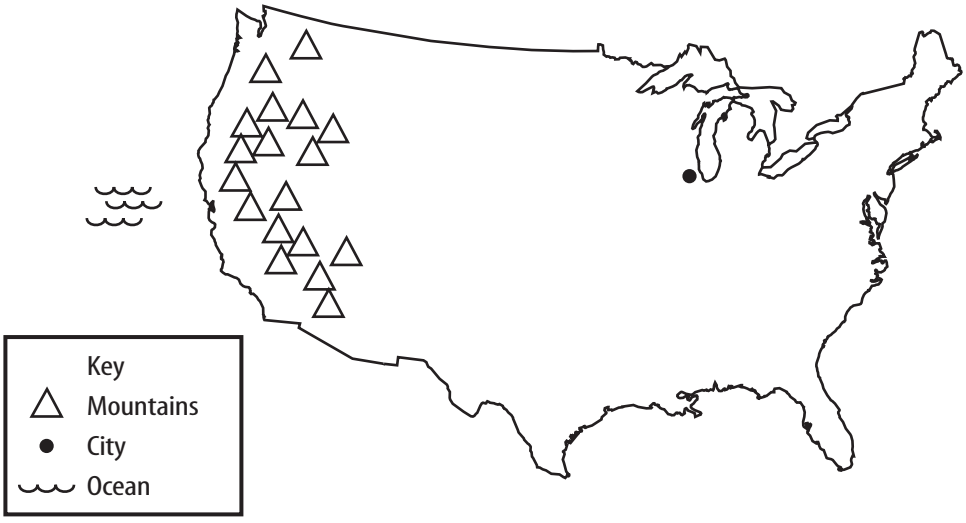
8. La palabra familiar en los cuadrados verticales es _____.

Satisface las necesidades individuales

Name Date Class

SECTION 1 Reinforcement

What is climate?



Directions: *On the map above, note the factors that can affect the climate. Then, in the table below, enter the names of these factors and describe the effects they cause.*

Factors	Effects
1.	
2.	
3.	

Meeting Individual Needs

Name Date Class

SECTION 2 Reinforcement

Climate Types

Directions: *Complete the following sentences using the correct terms.*

1. The type of plants found in a region depends on the region's _____.
2. The fur of mammals _____ them from the cold.
3. A(n) _____ is a characteristic that helps an organism survive.
4. Desert turtles and lizards obtain the moisture they need from their _____.
5. Some mammals survive cold winters in a state of inactivity called _____.
6. Lungfish survive intense heat in an inactive state called _____.
7. A body structure that helps an organism survive in its environment is a(n) _____ adaptation.
8. In the Köppen System, climate groups are classified according to temperature and _____.

Directions: *Answer the following questions on the lines provided.*

9. What is an adaptation?

_____

_____

10. What behavioral adaptations help snakes survive in hot, dry places?

_____

_____

11. What are three body structures that help cactus plants survive in dry climates?

_____

_____

12. How do the body structures you listed above help the cactus plants survive in dry climates?

_____

_____

13. Name the six groups of climates in the Köppen Classification System.

_____

_____

_____

Meeting Individual Needs

Name Date Class

SECTION 3 Reinforcement

Climatic Changes

Directions: *Answer the following questions on the lines provided.*

1. In the illustration, what season is it in the northern hemispheres? In the southern hemisphere?

2. Where on Earth are the seasonal variations of temperature and day length greatest? Least?

3. What are the effects of El Niño?

4. What is global warming?

5. How might global warming affect Earth?

6. What are some possible causes for climatic changes in the past?

7. What is the greenhouse effect?

8. How does the greenhouse effect influence Earth?

9. How do scientists know what Earth's climate was like in earlier geologic eras?

Meeting Individual Needs

SECTION 1 Enrichment

Shadowy Figures

The state of California is especially lucky when it comes to climate. On the western side, the warm Pacific Ocean keeps coastal temperatures generally mild. The eastern side has the beautiful Sierra Nevada Mountain range, where people camp in summer and ski in winter. However, California's neighbor to the east, Nevada, is not so lucky. Nevada's climate is a rain shadow desert.

Rain for Agriculture

The rain shadow forms when warm moist air from the Pacific Ocean blows east and inland. As the moist air moves toward the mountains, the warm air is forced upward where it cools. The cooling condenses the moisture in the air, producing rain for central and northern California. Because of this rain, farmers easily grow fruit, nuts, rice, vegetables, and cotton. Grass also grows well, sustaining large herds of livestock for milk and meat.

The Dry Side

The problem for Nevada is that the Sierra Nevada Mountains are so high that very little moisture gets past them. Nevada receives so little moisture that much of the state is a desert. Agriculture consists primarily of ranching and forage production. Tourism, government-related activities, and the mining of gold, silver, and other minerals are more important than agriculture in Nevada's economy. Most food comes from California and other places.

Food production, however, is one of California's major industries. The food you eat today might have come from California. The next time you visit a grocery store, see if you can discover where your fruits, vegetables, and meat come from.

1. Is the climate of California affected by an ocean? Explain.

_____

_____

2. What is a rain shadow?

_____

_____

3. What is Nevada's climate like? Why? _____

_____

4. Draw a diagram of a rain shadow that shows its effects on the surrounding climates.

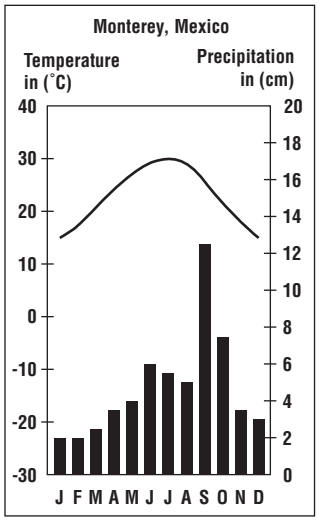
Name Date Class

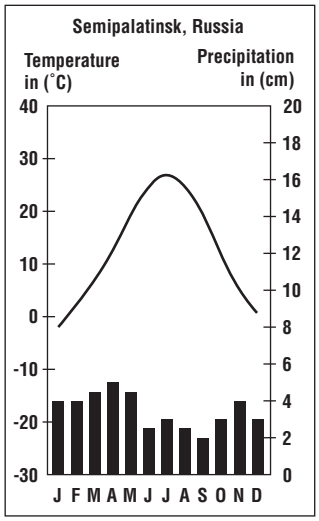
SECTION 2 Enrichment

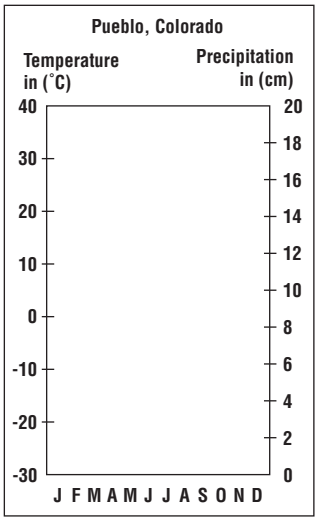
The Steppe Climate

The steppe or semiarid climate zone is located in prairies and grasslands. Steppes are often found surrounding desert areas. Annual rainfall is light, somewhere between the desert and more humid climates. The specific characteristics of each steppe depend on the steppe's latitude and whether it is located near mountains or an ocean.

The graphs below show one way to summarize basic climate information. The line shows how temperature changes over the year. The bar graphs show the monthly precipitation (J is for January, F is for February, and so on). All three places are classified as steppes.







Directions: *Chart the following information on the blank graph for* **Pueblo, Colorado.**

Rainfall:			*Temperature in °C*:	
January—1 cm	July—5 cm		January—0°	July—24°
February—2 cm	August—4.5 cm		February—0°	August—24°
March—2.5 cm	September—3 cm		March—5°	September—18°
April—4 cm	October—2 cm		April—10°	October—11°
May—4 cm	November—1 cm		May—15°	November—5°
June—3.5 cm	December—1.5 cm		June—20°	December—0°

Directions: *Use the information in the graphs to answer the following questions.*

1. How does the rainfall distribution differ between Monterrey and Semipalatinsk?

_____

2. What does the graph indicate about the temperature range in Monterrey?

_____

3. What does the graph show about the temperature range in Semipalatinsk?

_____

4. When is the rainy season in Pueblo, Colorado? _____

5. Compare the climate in Pueblo to the climate in Monterrey.

_____

Meeting Individual Needs

SECTION 3 Enrichment

The Gulf Stream

The Gulf Stream is one of the most important oceanic currents in the world. It is responsible for warmer climates in north Atlantic countries, like Iceland and the countries of western Europe. The Gulf Stream acts as a conveyor belt-moving of warm ocean water into the icy cold waters of the north polar seas while the cold northern waters sink to the ocean bottom because they are very dense. This cold water flows south along the bottom of the ocean to the equator. As the cold waters flow south, the warmer equatorial surface layers of the ocean are pulled to the north. This warm water is pulled up and around the entire Atlantic Ocean, keeping climates relatively warm along the European coasts.

World Traveler

The Gulf Stream begins near Africa as an equatorial current formed when winds blow surface water from Africa westward to the Caribbean Sea. Warm water flowing out of the Gulf of Mexico meets the equatorial current in the Florida Straits between the Caribbean, Cuba, and the tip of Florida. From here, the Gulf Stream is then pulled north by the undertow movement of the cold polar water flowing south. The warm water continues up past Newfoundland, Greenland, Iceland, and Norway. It continues down along the western side of France, Spain, and back to Africa where the winds blow it west again.

Ponce de Leon, a Spanish explorer of the early 1500s, was the first person to describe the Gulf Stream current. Ben Franklin later put together puzzling stories from ship captains about how it took longer to sail from London to America than from America to London. He boarded a ship, sailed the current of the Gulf Stream and charted the first map of the current.

New Information

One of the most recent discoveries about the Gulf Stream is that during the ice ages it "shuts down." A scientist, Jean Lynch-Stieglitz, looked at oxygen levels in the shells of tiny organisms called foraminifera, found in muds that were at least 20,000 years old. Oxygen isotope levels change when climate changes. When it is cold, levels of O^{16} are lower in foraminifera shells, and O^{18} is high. Her study showed that during the ice ages, the Gulf Stream was very slow and did not carry warm water up to the poles as it does today. Whether the shutdown of the Gulf Stream caused the ice ages or the ice ages caused the shutdown is not known.

What we do know is that today the Gulf Stream current has a huge effect on climate in many parts of the world. If the Gulf Stream changes again, so will the climate. Or is that vice versa?

1. Where do winds start the current that will form the Gulf Stream?

_____

2. What causes warm water to be pulled up to the north in the North Atlantic?

_____

3. Has the Gulf Stream current always been as active as it is today? Explain your answer.

_____

4. Why do you think the Gulf Stream current does not flow down into the southern hemisphere?

_____

_____

Note-taking Worksheet

Climate

Section 1 What is climate?

A. Climate is the pattern of weather that occurs in an area over _____

1. Determines the types of plants or animals that can survive, and influences how people live
2. Elements that are averaged to determine climate: _____, precipitation, air pressure, humidity, and days of sunshine

B. Factors that affect climate:

1. Latitude—distance north or south of the _____
   a. **Tropics** (between 23° north and 23° south)—sun shines directly overhead, keeping temperatures _____
   b. _____ **zones** (66° north and 66° south to the poles)—sun shines at a low angle, keeping temperatures low
   c. **Temperate zones** (between the tropics and the polar zones)—_____ temperatures
2. Large bodies of water affect the climate of coastal areas by _____ or giving off heat.
3. Ocean currents can bring cool or warm temperatures and _____ to coastal areas.
4. Mountains affect their own climate as well as the climates of nearby areas.
   a. At the same latitude, the climate on a mountain is _____ than the climate at sea level.
   b. Mountains cause air to rise, cool, and condense, creating a _____ climate on the windward side of the mountain and a much drier climate on the leeward side.
5. Because of their large areas of solar radiation-absorbing pavement, _____ frequently have higher temperatures than surrounding areas.

Meeting Individual Needs

Note-taking Worksheet (continued)

Section 2 Climate Types

A. Koppen's system of climate _____

1. Examined temperature, precipitation, and _____

2. Six types of climate: tropical, mild, dry, continental, polar, and _____

B. **Adaptation**—any structure or behavior that helps an organism _____ in its environment

1. _____ adaptations are body structures that help organisms survive in certain climates.

a. Example: the _____ of mammals insulates them from cold temperatures.

b. Example: a cactus's thick, fleshy _____ helps it hold water.

2. _____ adaptations

a. Example: _____—a period of greatly reduced activity during cold months

b. Example: estivation—state of _____, similar to hibernation, that occurs during periods of intense heat

Section 3 Climatic Changes

A. **Seasons**—short periods of climatic change caused by differences in the amount of _____ an area receives

1. As Earth revolves around the Sun, different areas of Earth are _____ toward the Sun.

2. The _____ do not experience much seasonal temperature change.

3. High latitudes near the poles experience _____ seasonal temperature change.

B. **El Niño—**an occasional climatic event in which strong Pacific winds _____ or _____

1. Effects of El Niño:

a. Ocean temperatures near Peru _____.

b. The position and strength of one of the _____ may be altered, changing wind and precipitation patterns around the world.

c. Africa and Australia may experience _____.

2. La Niña—The winds blowing across the Pacific are _____ than normal.

Note-taking Worksheet (continued)

C. At times in the past, Earth's climate was much warmer or colder than now.

D. Causes of _____ change can operate over short or very long periods of time.

1. Solar radiation is blocked by larger numbers of solid and liquid _____ entering the atmosphere.
   - **a.** Catastrophic events such as _____ and _____ collisions can cause climatic changes.
   - **b.** _____ can also cause climatic changes.
2. Variations in solar radiation, possibly related to the presence of _____ can cause climatic changes.
3. Earth's movements in space can change the amount of _____ reaching it.
   - **a.** Earth's _____ changes about every 41,000 years.
   - **b.** Earth's _____ wobbles in space.
   - **c.** The shape of Earth's _____ changes over a 100,000-year cycle.
4. The movement of Earth's _____ affects the transfer of heat on Earth.

E. Climatic changes today

1. **Greenhouse effect**—heating that occurs when certain gases like _____, _____, and water vapor in Earth's atmosphere trap heat
2. **Global warming**—Earth's average global temperature is rising, possibly due to the increase in _____ in our atmosphere.
3. Human activities affect the air in Earth's atmosphere.
   - **a.** Burning _____ increases the amount of carbon dioxide in the atmosphere.
   - **b.** _____ results in fewer trees to absorb carbon dioxide from the atmosphere.
   - **c.** Individuals can help reduce the amount of _____ in the atmosphere.

Meeting Individual Needs

Assessment

Chapter Review

Climate

Part A. Vocabulary Review

Directions: *Match the terms in Column I with their description in Column II. Write the letter of the correct description in the blank at the left.*

Column I

_____ **1.** adaptation

_____ **2.** climate

_____ **3.** El Niño

_____ **4.** temperate zones

_____ **5.** seasons

_____ **6.** hibernation

_____ **7.** reforestation

_____ **8.** polar zones

_____ **9.** greenhouse effect

_____ **10.** meteorite impact

_____ **11.** global warming

_____ **12.** tropics

_____ **13.** deforestation

Column II

a. the pattern of weather in a region

b. the region that extends from the poles to 66 1/2° north and south latitudes

c. any structure or behavioral feature that helps an organism survive in its environment

d. short-term periods of climate change caused by variations in daylight, temperature, and weather patterns

e. a climate event that starts in the tropical Pacific Ocean and sets off changes in the atmosphere

f. example of a catastrophic event that can affect Earth's climate

g. the region that receives the most solar radiation because the sun shines almost directly overhead

h. rise of worldwide temperatures

i. mass removal of trees

j. the planting of trees

k. natural heating of Earth caused by gases in our atmosphere trapping heat

l. a period of inactivity that some mammals undergo in the winter

m. areas between tropics and polar zones

Part B. Concept Review

Directions: *Answer the following questions on the lines provided.*

1. Describe how the Koppen system classifies climate.

2. List four of the classifications used in the Koppen climate classification system.

Chapter Review (continued)

3. Describe how El Niño affects the climate.

4. How do spiny leaves help a cactus survive in the desert?

5. Explain the difference between the greenhouse effect and global warming. Does one have anything to do with the other? Explain.

6. How has Earth's climate changed in the past?

7. How do mountains affect the climate of nearby areas?

8. Explain how humans add carbon dioxide to the atmosphere and how they can reduce the amount of carbon dioxide in the atmosphere.

Chapter Test

Climate

I. Testing Concepts

Directions: *For each of the following, write the letter of the term or phrase that best completes the sentence.*

_____ **1.** Seasons are caused by _____.
- **a.** changes in the distance from Earth to the sun
- **b.** tropical storms
- **c.** the tilt of Earth's axis with respect to the sun
- **d.** wind patterns

_____ **2.** A major influence on climate is _____.
- **a.** large bodies of water
- **b.** craters
- **c.** moonlight
- **d.** solar wind

_____ **3.** When gas, oil, and coal are burned, _____ is released into the atmosphere.
- **a.** chlorofluorocarbon
- **b.** carbon dioxide
- **c.** hydrogen
- **d.** oxygen

_____ **4.** Moderate temperatures are characteristic of _____.
- **a.** the polar zones
- **b.** areas at low altitude
- **c.** the sides of mountains that are protected from wind
- **d.** the temperate zones

_____ **5.** Very few species can adapt to _____.
- **a.** warm weather conditions
- **b.** extreme cold, as is found in polar regions
- **c.** summer
- **d.** humidity

_____ **6.** One cause of _____ may be deforestation.
a. thunderstorms **b.** global warming **c.** clouds **d.** precipitation

_____ **7.** Changes can occur in the four seasons for a year or two because of _____.
- **a.** tides
- **b.** thunderstorms
- **c.** winds
- **d.** volcanic eruptions

_____ **8.** El Niño causes _____.
- **a.** sea level to fall
- **b.** stronger trade winds
- **c.** ocean temperatures to increase off the coast of Peru
- **d.** climate changes every 100 years

_____ **9.** If there are 24 consecutive hours of daylight, then _____.
- **a.** it is summer near the North Pole
- **b.** you are experiencing a large building's microclimate
- **c.** it is the spring equinox at the equator
- **d.** it is a warm day in a temperate zone

Chapter Test (continued)

_____ **10.** An animal that hibernates _____.
- **a.** is dormant in hot weather
- **b.** is dormant in cold weather
- **c.** has thin fur
- **d.** has a waxy coating

_____ **11.** Opposite extremes of day and night temperatures are associated with _____.
- **a.** deserts
- **b.** areas near the oceans when there are tidal waves
- **c.** the greenhouse effect
- **d.** the tropics

_____ **12.** Many people think corals are dying due to _____.
- **a.** changes in Earth's orbit
- **b.** global warming
- **c.** the greenhouse effect
- **d.** volcanic eruptions

_____ **13.** The climate classification system is based on studies of _____.
- **a.** cities
- **b.** mountains
- **c.** temperature and precipitation
- **d.** oceans

_____ **14.** Geological records indicate _____.
- **a.** Earth was flatter in the past
- **b.** there were no ice ages until one million years ago
- **c.** nothing about the climate in the past
- **d.** Earth was warmer at times in the past

_____ **15.** Carbon dioxide can be reduced in the atmosphere by _____.
- **a.** reforestation
- **b.** deforestation
- **c.** burning fossil fuels
- **d.** melting glaciers

_____ **16.** The greenhouse effect causes _____.
- **a.** the change of the seasons
- **b.** pollution
- **c.** the formation of glaciers
- **d.** Earth to be warm enough to support life

_____ **17.** With regard to the ice ages, _____.
- **a.** we are now in an interglacial interval
- **b.** all were of equal duration
- **c.** the last one wiped out all living things
- **d.** the sun almost burned out at times

_____ **18.** All of the following are examples of behavioral adaptations except _____.
a. people shivering **b.** deforestation **c.** hibernation **d.** estivation

_____ **19.** Changes in the shape of Earth's orbit around the sun _____.
- **a.** cause the seasons to reverse each year
- **b.** happen every 100 years
- **c.** might have caused some of the ice ages
- **d.** have no effect on mammals

_____ **20.** Climate is determined by averaging _____ over a long period of time.
- **a.** tides
- **b.** weather
- **c.** ice ages
- **d.** animal extinctions

Chapter Test (continued)

II. Understanding Concepts

Skill: Classifying

Directions: *On the blank at the left, write the letter of the statement that answers the question.*

_____ **1.** Which of the following might be connected to "temperate climates"?
- **a.** Solar energy hits these regions at a low angle.
- **b.** Year-round temperatures are always hot.
- **c.** Weather generally changes with the seasons—hot in summer, cold in winter, and mild in spring and fall.

Directions: *Answer the following question on the lines provided.*

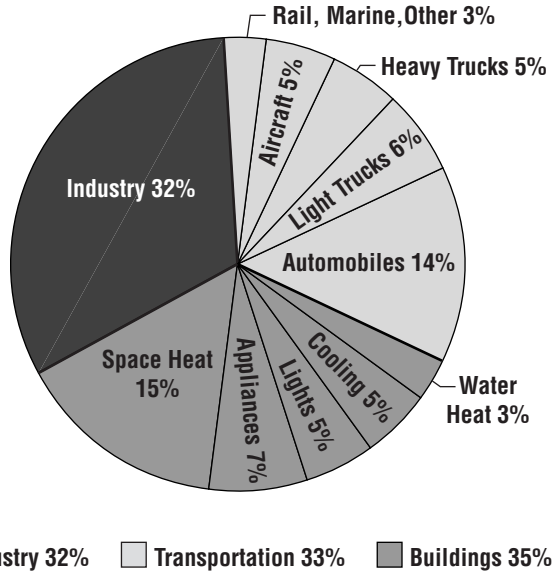
Skill: Comparing and Contrasting

2. Compare and contrast the greenhouse effect and global warming.

Skill: Using Charts

3. Study the chart. Then come up with three ideas for reducing carbon dioxide emissions.

Sources of CO_2 in the United States



Skill: Hypothesizing

4. There is a rain forest in the United States. It is found in a narrow strip of land on the West Coast and extends from northern California through Oregon and Washington state. On one side of this rain forest is the Pacific Ocean. On the other side are steep upthrust Cascade Mountains. Given what you know about winds that blow in off oceans and how mountains affect climate, hypothesize about why there is a rain forest in this particular place.

Chapter Test (continued)

Skill: Recognizing Cause and Effect

5. How does the changing angle of incoming sunlight explain why temperatures tend to become cooler as one moves from the equator toward either pole?

6. What effect do large bodies of water have on climate?

7. How do some animals adapt behaviorally to a dry climate?

8. What is the relationship between global warming and deforestation?

Skill: Observing and Inferring

9. Where would you expect to find more animal and plant species—in the tropics, or in the polar zones?

III. Applying Concepts

Writing Skills

Directions: *Answer the following questions using complete sentences.*

1. What might cause global warming?

2. Why would you expect the climate of a large city to be similar to that of the area surrounding it? Why would you expect it to be different?

Transparency Activities

Name Date Class

SECTION 1 Section Focus Transparency Activity

City Heat

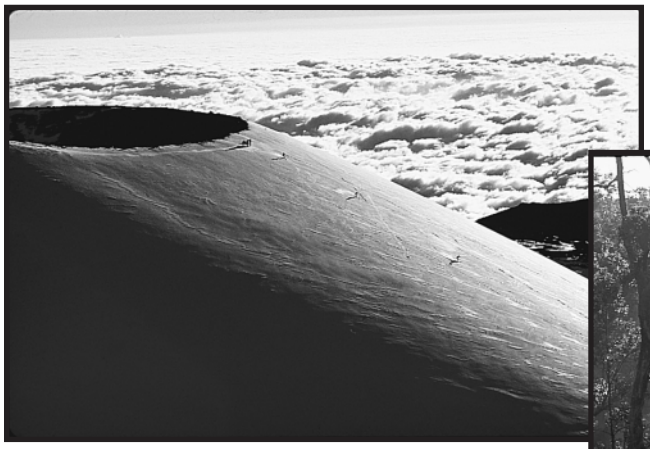
Have you ever gone from the country into a city and noticed that the temperature felt warmer? Streets lined with buildings and large asphalt parking lots can actually have an effect on the temperature. The map below shows heat levels in different parts of a large city. Reds and yellows show where the temperatures are higher, and blues and greens show cooler temperatures.

1. **What areas of this picture are hot? What areas are cooler?**
2. **What features might you find in the red areas? What different characteristics would you expect to find in the blue and green areas?**
3. **If you were planning a city, what features would you include?**

SECTION 2 Section Focus Transparency Activity

Where *are* we?

You can drive around this place in just a few hours, but as you ride, you travel through many different climates. Cool mountains, dry deserts, tropical rainforests, and brilliant beaches are all just around the corner. So where *are* we?



1. Describe the climates you see in these four pictures.
2. How is it possible to have snow close to a desert?
3. In general, what physical features do you think affect climate?

Name Date Class

SECTION 3 Section Focus Transparency Activity

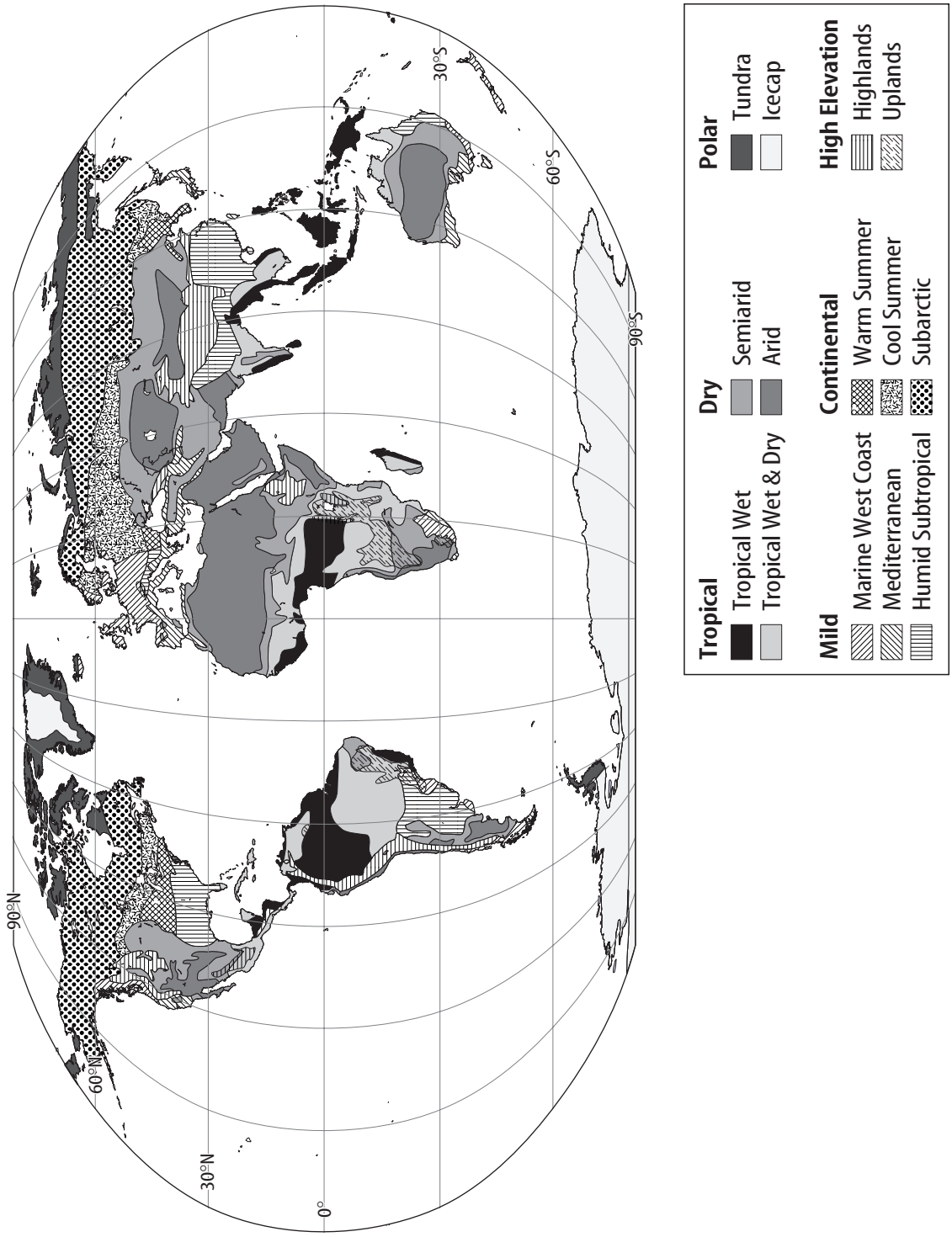
Informative Fruit

Up-to-the minute weather and climate information is used to plan a day's events or to know when to take cover from a storm. However, information about Earth's past climate is also very useful to scientists. Ice cores, fossils, and sediments provide a lot of data about the climate long ago, but what about grapes? One study used the recorded dates of the French grape harvest to infer summer temperatures in Paris between 1370 and 1879!

1. How might scientists use information about Earth's past climate?
2. What factors might affect temperature?

SECTION 2 Teaching Transparency Activity

Climate Classification System



Teaching Transparency Activity (continued)

1. Define weather.

2. Define climate.

3. What allows organisms to survive in certain climates?

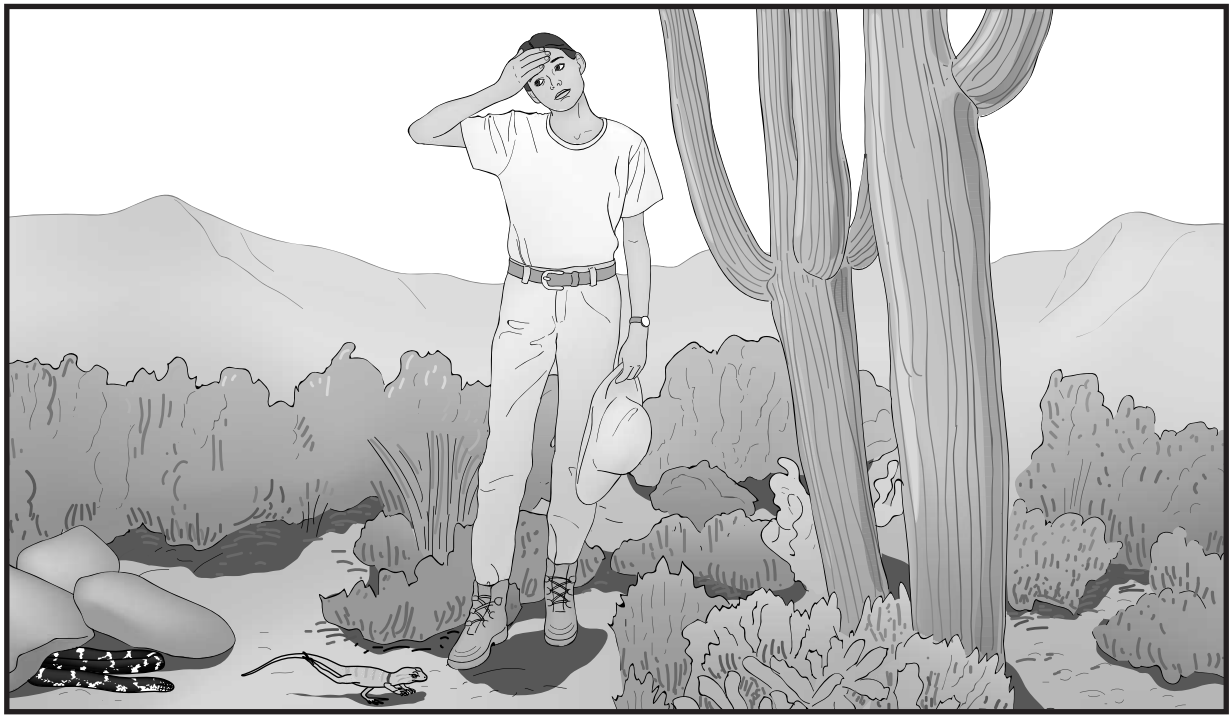
4. Wladimir Köppen, a climatologist, developed a climate classification system in 1918. What two elements did Köppen base his system on?

5. What type of climate does the southeastern United States have?

Assessment Transparency Activity

Climate

Directions: *Carefully review the picture and answer the following questions.*



1. Which organism can probably most efficiently handle being exposed to the sunlight and heat?

A cactus **B** girl **C** lizard **D** snake

2. The most likely benefit of the adaptation of the snake shown in the picture is to ___.

F keep it cool during the day
G hide from predators
H surprise attack its prey
J get enough rest

3. When a human's body temperature rises too high, the body produces sweat. Which of these is most likely the main purpose of this adaptation?

A To clean the body of dirt
B To cure illness
C To save energy
D To cool the body

Teacher Support and Planning

Teacher Support and Planning

Content Outline for Teaching

Climate

Section 1 What is climate?

Underlined words and phrases are to be filled in by students on the Note-taking Worksheet.

A. Climate is the pattern of weather that occurs in an area over many years.

1. Determines the types of plants or animals that can survive, and influences how people live
2. Elements that are averaged to determine climate: temperature, precipitation, air pressure, humidity, and days of sunshine

B. Factors that affect climate

1. Latitude—distance north or south of the equator
   - **a. Tropics** (between 23° north and 23° south)—sun shines directly overhead, keeping temperatures high
   - **b. Polar zones** (66° north and 66° south to the poles)—sun shines at a low angle, keeping temperatures low
   - **c. Temperate zones** (between the tropics and the polar zones)—moderate temperatures
2. Large bodies of water affect the climate of coastal areas by absorbing or giving off heat.
3. Ocean currents can bring cool or warm temperatures and moisture to coastal areas.
4. Mountains affect their own climate as well as the climates of nearby areas.
   - **a.** At the same latitude, the climate on a mountain is colder than the climate at sea level.
   - **b.** Mountains cause air to rise, cool, and condense, creating a wetter climate on the windward side of the mountain and a much drier climate on the leeward side.
5. Because of their large areas of solar radiation-absorbing pavement, cities frequently have higher temperatures than surrounding areas.

DISCUSSION QUESTION:

Which of these factors affect the climate where you live? *Answers will vary but should reflect an understanding of climate-influencing factors such as large areas of paved surfaces or the proximity of oceans or other large bodies of water.*

Section 2 Climate Types

A. Köppen's system of climate classification

1. Examined at temperature, precipitation, and plant types

2. Six types of climate: tropical, mild, dry, continental, polar, and high elevation

B. Adaptation—any structure or behavior that helps an organism survive in its environment

1. Structural adaptations are body structures that help organisms survive in certain climates.

a. Example: the fur of mammals insulates them from cold temperatures.

b. Example: a cactus's thick, fleshy stem helps it hold water.

2. Behavioral adaptations

a. Example: **hibernation**—a period of greatly reduced activity during cold months

b. Example: estivation—state of reduced activity, similar to hibernation, that occurs during periods of intense heat

DISCUSSION QUESTION:
How have people in your area adapted to their climate? Can you think of structural and behavioral adaptations? *Structurally, humans have sweat glands to release water onto our skin. When the water evaporates, it takes some heat with it, making us cooler. Some behavioral adaptations using heaters and warm clothing.*

Section 3 Climatic Changes

A. Seasons—short periods of climatic change caused by differences in the amount of solar radiation an area receives

1. As Earth revolves around the Sun, different areas of Earth are tilted toward the Sun.

2. The tropics do not experience much seasonal temperature change.

3. High latitudes near the poles experience great seasonal temperature change.

B. El Niño—an occasional climatic event in which strong Pacific winds weaken or reverse

1. Effects of El Niño:

a. Ocean temperatures near Peru heat up.

b. The position and strength of one of the jet streams may be altered, changing wind and precipitation patterns around the world.

c. Africa and Australia may experience drought.

2. La Niña—The winds blowing across the Pacific are stronger than normal.

Content Outline for Teaching (continued)

C. At times in the past, Earth's climate was much warmer or colder than now.

D. Causes of climatic change can operate over short or very long periods of time.

1. Solar radiation is blocked by larger numbers of solid and liquid particles entering the atmosphere.
   - **a.** Catastrophic events such as volcanic eruptions and meteorite collisions can cause climatic change.
   - **b.** Pollution can also cause climatic change.
2. Variations in solar radiation, possibly related to the presence of sunspots, can cause climatic change.
3. Earth's movements in space can change the amount of solar radiation reaching it.
   - **a.** Earth's tilt changes about every 41,000 years.
   - **b.** Earth's axis wobbles in space.
   - **c.** The shape of Earth's orbit changes over a 100,000-year cycle.
4. The movement of Earth's crustal plates affects the transfer of heat on Earth.

E. Climatic changes today

1. **Greenhouse effect**—heating that occurs when certain gases like carbon dioxide, methane, and water vapor in Earth's atmosphere trap heat
2. **Global warming**—Earth's average global temperature is rising, possibly due to the increase in greenhouse gases in our atmosphere.
3. Human activities affect the air in Earth's atmosphere.
   - **a.** Burning fossil fuels increases the amount of carbon dioxide in the atmosphere.
   - **b.** **Deforestation** results in fewer trees to absorb carbon dioxide from the atmosphere.
   - **c.** Individuals can help reduce the amount of carbon dioxide in the atmosphere.

DISCUSSION QUESTION:

What can we do about global warming? *It is possible that there is nothing we can do about global warming. Earth's climate has changed many times in the past due to factors beyond our control. If humans are contributing to global warming, we can try to use less electricity, plant vegetation, and limit the amount of pollutants we release into the air.*

Spanish Resources

Clima

Página 490

SECCIÓN 1 ¿Qué es el clima?

Lo que aprenderás

- A describir cómo se determina el clima.
- A explicar cómo la latitud y otros factores afectan el clima de una región.

Vocabulario

climate / clima: patrón de tiempo promedio en un área a lo largo de un período largo de tiempo; puede clasificarse según la temperatura, la humedad, la precipitación y la vegetación. (Cap. 17, Sec. 1, pág. 490)

tropics / trópicos: zona climática que recibe la mayor cantidad de radiación solar; está ubicada entre los 23°N y los 23°S y en donde siempre hace calor, con excepción de las altas elevaciones. (Cap. 17, Sec. 1, pág. 490)

polar zones / zonas polares: zona climática que recibe la radiación solar a un ángulo bajo; se extiende desde la latitud 66° N y 66° S hasta los polos y en donde nunca hace calor. (Cap. 17, Sec. 1, pág. 490)

temperate zones / zona templada: zonas climáticas con temperaturas moderadas; se encuentran entre los trópicos y las zonas polares. (Cap. 17, Sec. 1, pág. 490)

Por qué es importante

El clima afecta la manera en que vives.

Página 494

SECCIÓN 2 Tipos de climas

Lo que aprenderás

- A describir un sistema de clasificación de climas.
- A explicar cómo los organismos se adaptan a ciertos climas.

Vocabulario

adaptation / adaptación: todo cambio estructural o de comportamiento que le ayuda a un organismo a sobrevivir en un ambiente en particular. (Cap. 17, Sec. 2, pág. 494)

hibernation / hibernación: adaptación del comportamiento para sobrevivir el invierno en que un animal disminuye considerablemente sus actividades corporales, la temperatura de su cuerpo baja y los procesos corporales se vuelven más lentos. (Cap. 17, Sec. 2, pág. 496)

Por qué es importante

Muchos organismos pueden sobrevivir sólo en los climas a los que se han adaptado.

Página 498

SECCIÓN 3 Cambios climáticos

Lo que aprenderás

- A explicar qué causa las estaciones.
- A describir cómo afecta el clima El Niño.
- A explorar causas posibles de cambios climáticos.

Vocabulario

season / estación: período corto de cambio climático en un área causado por la inclinación de eje terrestre a medida que la Tierra gira alrededor del Sol. (Cap. 17, Sec. 3, pág. 498)

El Niño / El Niño: fenómeno climático que comienza en el océano Pacífico tropical; puede ocurrir debido al debilitamiento o inversión de los vientos alisios, y puede interrumpir los patrones normales de temperatura y precipitación por todo el mundo. (Cap. 17, Sec. 3, pág. 499)

greenhouse effect / efecto de invernadero: calentamiento natural que ocurre cuando ciertos gases en la atmósfera de la Tierra, por ejemplo, el metano, el CO_2 y el vapor de agua, atrapan el calor. (Cap. 17, Sec. 3, pág. 505)

global warming / calentamiento global: aumento en el promedio de la temperatura global de la Tierra. (Cap. 17, Sec. 3, pág. 506)

deforestation / deforestación: destrucción y tala de bosques en que a menudo se despeja la

tierra para la minería, la construcción de caminos y el pastoreo del ganado y la cual resulta en aumentos en los niveles atmosféricos de CO_2. (Cap. 17, Sec. 3, pág. 507)

Por qué es importante

Los cambios climáticos pueden afectar el nivel del mar y la vida en la Tierra.

Página 509

Actividad El efecto de invernadero

¿Recuerdas haber entrado al auto en un día caluroso y soleado? ¿Por qué estaba tan caliente dentro del auto cuando no estaba tan caliente afuera? Estaba más caliente dentro del auto porque el auto funcionó como un invernadero. Experimentaste el efecto de invernadero.

Lo que investigarás

¿Cómo puedes demostrar el efecto de invernadero?

Materiales

frascos de vidrio vacíos grandes e idénticos (2)
tapa para un frasco
termómetros que no sean de mercurio (3)

Metas

- Modelar el efecto de invernadero.
- Medir y graficar los cambios de temperatura.

Medidas de seguridad

Debes ser cuidadoso cuando manejes termómetros de vidrio. Si un termómetro se rompe, no lo toques. Tu maestro(a) desechará el vidrio con cuidado.

Procedimiento

1. Coloca un termómetro dentro de cada frasco.
2. Acomoda los frascos uno junto a otro cerca de una ventana soleada. Coloca el tercer termómetro entre los frascos.
3. Registra las temperaturas de los tres termómetros. Deberían estar iguales.
4. Cierra con tapa uno de los frascos.
5. Registra la temperatura de los tres termómetros al final de 5, 10 y 15 min.
6. Haz una gráfica de línea que muestre las temperaturas de los tres termómetros a los 15 min del experimento.

Concluye y aplica

1. Explica por qué colocaste un termómetro entre los dos frascos.
2. ¿Cuáles fueron las constantes en este experimento ? ¿Cuál fue la variable?
3. ¿Qué termómetro experimentó el mayor cambio de temperatura durante tu experimento?
4. Analiza qué ocurrió en este experimento. ¿En qué se parece la tapa en este experimento a los gases de invernadero de la atmósfera?
5. Infiere a partir de este experimento por qué en tiempo caluroso nunca deberías dejar una mascota dentro de un auto cerrado.

Página 510

Actividad Microclimas

Un microclima es un clima localizado que difiere del clima principal de la región. Los edificios en una ciudad, por ejemplo, pueden afectar el clima del área circundante.

Lo que investigarás

¿Crea tu escuela microclimas?

Materiales

termómetros
sicrómetro
tira de papel o calceta de viento
latas grandes (4 ó 5)
papel sin líneas
* *tazones o medidores de lluvia (4 ó 5)*

* *Materiales alternativos*

Metas

- Observar la temperatura, la velocidad del viento, la humedad relativa y la precipitación en áreas afuera de la escuela.
- Identificar microclimas locales.

Humedad relativa										
Bulbo seco	**Temperatura del bulbo seco menos temperatura del bulbo húmedo (°C)**									
Temperatura °C	1	2	3	4	5	6	7	8	9	10
14	90	79	70	60	51	42	34	26	18	10
15	90	80	71	61	53	44	36	27	20	13
16	90	81	71	63	54	46	38	30	23	15
17	90	81	72	64	55	47	40	32	25	18
18	91	82	73	65	57	49	41	34	27	20
19	91	82	74	65	58	50	43	36	29	22
20	91	83	74	66	59	51	44	37	31	24
21	91	83	75	67	60	53	46	39	32	26
22	92	83	76	68	61	54	47	40	34	28
23	92	84	76	69	62	55	48	42	36	30
24	92	84	77	69	62	56	49	43	37	31
25	92	84	77	70	63	57	50	44	39	33

Medidas de seguridad 

PRECAUCIÓN: *Si un termómetro se rompe, no lo toques. Tu maestro(a) desecherá el vidrio con cuidado.*

Página 511

Usa métodos científicos

Procedimiento

1. Selecciona cuatro o cinco sitios alrededor del edificio de tu escuela. También, selecciona un sitio control lejos de tu escuela.
2. Fija un termómetro a un objeto cerca de cada una de las locaciones que seleccionaste. Coloca un pluviómetro, un tazón o una lata para recoger la precipitación.
3. Visita cada sitio a dos horas predeterminadas, una en la mañana y una en la tarde, todos los días durante una semana. Anota la temperatura y mide cualquier precipitación que haya caído. Usa una manga de viento o tira de papel para determinar la dirección del viento.
4. Para encontrar la humedad relativa, necesitarás usar un sicrómetro. Un sicrómetro es un instrumento con dos termómetros, uno húmedo y otro seco. Al evaporarse la humedad del termómetro húmedo, este toma energía calórica de su ambiente y el ambiente inmediatamente alrededor del termómetro húmedo se enfría. El termómetro registra una temperatura más baja. La humedad relativa puede calcularse al encontrar la diferencia entre el termómetro húmedo y el termómetro seco y usando la tabla de la página anterior. Anota todos tus datos del clima.
5. Analiza tus datos para encontrar patrones. Haz gráficas de línea separadas para la temperatura, humedad relativa y precipitación para los datos de la mañana y de la tarde. Haz una tabla que muestre los datos sobre dirección del viento.

Concluye y aplica

1. ¿Por qué tomaste datos del clima en un sitio control lejos de tu escuela? ¿Cómo te ayudó el control a analizar e interpretar los datos?
2. Compara y contrasta datos del clima para cada uno de tus sitios. ¿Qué microclimas identificaste alrededor del edificio de la escuela? ¿Cómo difieren estos climas del sitio control? ¿Cómo difieren entre ellos?
3. Infiere qué condiciones pueden haber causado los microclimas que identificaste. ¿Son tus microclimas similares a aquellos que pueden existir en una gran ciudad? Explica.

Página 514

Guía de estudio

Repasa las ideas principales

Refiérete a las figuras de tu libro de texto.

Sección 1 ¿Qué es el clima?

1. El clima de un área es el tiempo promedio durante un período prolongado, como por ejemplo, 30 años.
2. Las tres principales zonas climáticas son tropical, polar y templada.
3. Características como océanos, montañas, e incluso grandes ciudades afectan el clima. *¿Por qué podría ser diferente el clima a ambos lados de esta montaña?*

Sección 2 Tipos de clima

1. Los climas se clasifican según varias características, como temperatura, precipitación y vegetación. Los climas del mundo se separan comúnmente en seis grandes grupos.
2. Los organismos tienen adaptaciones estructurales y de comportamiento que les ayudan a sobrevivir en climas particulares. Muchos organismos sólo pueden sobrevivir en el clima al que se han adaptado.
3. Las adaptaciones se desarrollan en una población a través de un largo período de tiempo.

Sección 3 Cambios climáticos

1. La inclinación del eje de la Tierra al girar alrededor del Sol causa las estaciones.
2. El Niño rompe los patrones normales de temperatura y precipitación alrededor del mundo. *¿Cómo puede El Niño ser causa de torrentes de lodo como este en California?*
3. Algunos registros geológicos muestran que durante los últimos millones de años, el clima de la Tierra ha alternado entre glaciaciones y períodos cálidos llamados interglaciales.
4. El efecto de invernadero ocurre cuando ciertos gases atrapan calor en la atmósfera de la Tierra.
5. Los seres humanos pueden estar contribuyendo al calentamiento global produciendo gases de invernadero. El dióxido de carbono entra a la atmósfera cuando se queman combustibles fósiles como petróleo y carbón. *¿De qué forma plantar vegetación como este árbol puede hacer disminuir los gases de invernadero en la atmósfera?*

Climate

Hands-On Activities

MiniLab (page 3)

1. The size of the area lit by the beam increases. The shape changes from fairly circular to more oval.
2. As latitude increases, light is more indirect and solar radiation is spread over a larger area. Thus, higher latitudes receive less concentrated solar radiation than lower latitudes.

MiniLab: Try at Home (page 4)

1. Water moved in ripples toward the opposite end of the pan; the water moved in the same direction with less force; water moved in the opposite direction.
2. Winds weaken and can reverse, causing surface currents to switch direction.

Activity (page 5)

Lab Preview

1. glass jars, thermometers
2. Replace the lid.

Conclude and Apply

1. It is the control.
2. Constants: identical jars and thermometers, exposure to the Sun's radiation; variable: presence of jars and a glass lid on one jar
3. the one inside the jar with the lid; Heat could not escape as easily.
4. Similar to greenhouse gases in the atmosphere, the glass let radiation, but heat could not escape due to the lid.
5. Trapped heat can sicken or kill pets.

Activity (page 6)

Lab Preview

1. Ask teacher to dispose of the glass.
2. Streets, parking lots, and buildings absorb radiation and radiate heat into the atmosphere. Cities also affect wind and precipitation patterns.

Draw Conclusions

1. To see what the climate was like when not influenced by the building; when test sites were compared to the control, climatic effects caused by the building could be determined.
2. Answers will be subjective and based on the student's individual research.
3. Possible answers: shaded areas, walls blocking wind or rainfall. Students may infer that a large city would have similar microclimates because of the effects of the buildings.

Laboratory Activity 1 (page 9)

Data and Observations Table

1. Data will vary.

Questions and Conclusions

1. The empty bottle had the greatest temperature change.
2. A large amount of heat energy can be absorbed by water so its temperature increase is relatively small. The water is able to absorb the heat from the Sun. The air does not absorb the heat energy like water. Its temperature will rise more quickly as a result of solar energy input.
3. The bottle that is full of water is more like a warm, coastal climate. The empty bottle is more like the flat, inland climates.
4. The angle of incoming sunlight is less direct in these regions. As a result, both the land masses and the surrounding waters are cold.

Laboratory Activity 2 (page 13)

Data and Observations Table

1. Data will vary, but data table and graph should reflect the idea that the gravel lost heat more quickly than the water.

Questions and Conclusions

1. the gravel; The temperature increased at a faster rate.
2. the gravel; The temperature decreased at a faster rate.
3. water; The water stored more heat and released the heat at a slower rate.
4. 3726 L
5. Under the building in a crawl space is one possibility.
6. Add insulation around the storage container. Use a solid that is smaller than rocks but stores heat; for example, aluminum chips.

Meeting Individual Needs

Directed Reading for Content Mastery (page 19)

Overview

1–2, 3–7, 8–12 can be in any order.

1. temperate
2. tropical
3. dry
4. high elevation
5. polar
6. continental
7. mild
8. seasons
9. meteorite collisions
10. volcanic eruptions
11. solar output
12. large cities

Sections 1 and 2

1–6 can be in any order.

1. latitude
2. large cities
3. mountains
4. ocean currents
5. bodies of water
6. landforms
7. c
8. e
9. b
10. a
11. f
12. d

Section 3

1. Earth's tilt
2. wind
3. carbon dioxide
4. volcanic eruptions
5. constant
6. People burn fossil fuels and cut down forests.
7. Carbon dioxide is released into the atmosphere.
8. Global warming occurs.

Key Terms

1. tropics
2. global warming
3. hibernation
4. temperate zone
5. adaptation
6. deforestation
7. greenhouse effect
8. climate

Lectura dirigida para Dominio del contenido (pág. 23)

Sinopsis

1–2, 3–7, 8–12 pueden estar en cualquier orden.

1. moderado
2. tropical
3. seco
4. alta elevación
5. polar
6. continental
7. moderado
8. estaciones
9. colisiones de meteoritos
10. erupciones volcánicas
11. potencia solar
12. ciudades grandes

Secciones 1 y 2

1–6 pueden estar en cualquier orden.

1. latitud
2. ciudades grandes
3. montañas
4. corrientes oceánicas
5. masas de agua
6. relieves
7. c
8. e
9. b
10. a
11. f
12. d

Sección 3

1. inclinación de la Tierra
2. viento
3. dióxido de carbono
4. erupciones volcánicas
5. constante
6. Se queman combustibles fósiles y se talan los árboles.
7. Se libera dióxido de carbono en la atmósfera.
8. Ocurre el calentamiento global.

Términos claves

1. trópicos
2. calentamiento global
3. hibernación
4. zona templada
5. adaptación
6. tala
7. efecto de invernadero
8. clima

Reinforcement (page 27)

Section 1

1–3 can be in any order.

1. ocean; Near large bodies of water, the climate is less extreme because the water heats up and cools down more slowly than land does. Warm ocean currents make nearby land warmer, and cold currents make nearby land cooler.
2. mountain; The climate on the side of a mountain facing the wind is usually rainy or snowy; the climate on the other side is likely to be dry.
3. city; in large cities, pavement and buildings absorb heat and radiate it into the air. Pollutants can trap the heat, creating "heat islands." Tall buildings change wind and precipitation patterns.

Section 2

1. climate
2. insulates
3. adaptation
4. food
5. hibernation
6. estivation
7. structural
8. precipitation
9. any structure or behavior that helps a plant or animal survive in its environment
10. During hot, sunny days, desert snakes hide in the shade, under rocks. They look for food at night, when it is cooler.
11. spiny leaves, thick fleshy stem, waxy covering over the stem
12. The structures help the plants conserve moisture.

13. tropical, dry, mild, continental, polar, and high elevations

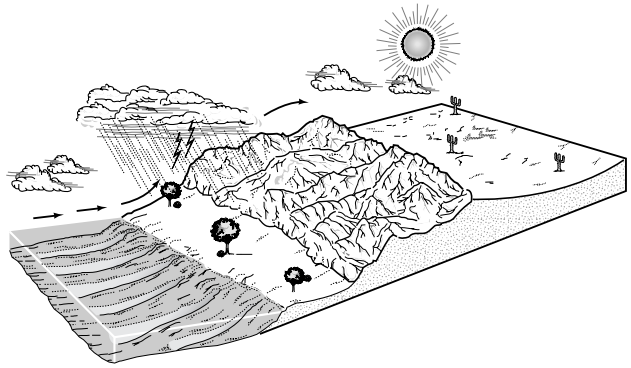
Section 3

1. summer, northern hemisphere; winter, southern hemisphere
2. Seasonal differences are usually greatest in the high latitudes and least near the equator.
3. El Niño causes changes in the way the trade winds blow and ocean temperatures rise near South America. Changes in the atmosphere make stormy weather more likely in California and change wind and precipitation around the world.
4. Global warming might result in flooding of low-lying areas due to rising sea level and death of sea life due to rising water temperature.
5. meteorite impacts, volcanic eruptions, variations in sun's energy, movement of Earth's plates, change in Earth's tilt toward the sun or in the shape of the orbit, heavy cloud or dust cover.
6. global temperatures increase due to an increase in the amount of the gases in the atmosphere that cause the greenhouse effect.
7. Gases in the atmosphere trap heat from Earth's surface.
8. Without the greenhouse effect, Earth would be too cold for living things.
9. Fossils of tropical plants near the poles indicate at times in Earth's past the climate was warmer. Evidence of glacial activity over large parts of Earth's surface indicate the climate was colder.

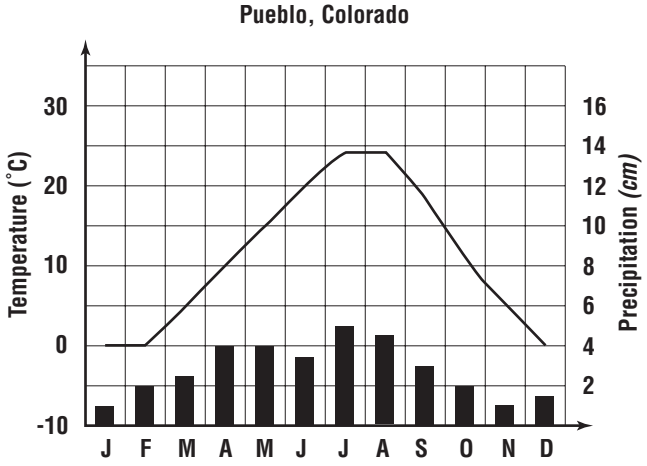
Enrichment (page 30)

Section 1

1. Yes, warm water puts moisture into the air which then blows toward land. As the air reaches the mountains, it rises, cools, and expands. The rain will fall on the western side of the mountains. The dry air will continue over the mountains.
2. A rain shadow is where mountains take out all the rain from the clouds. The land on the other side of the mountain is in a "shadow" where there is little rain.
3. Nevada's climate is desert-like because the Sierra Nevada mountains are so high that very little moisture gets past them.



4. Student drawings will vary, but should include the following information.



Section 2

1. In Monterrey, Mexico, the rainfall is higher in summer. In Semipalatinsk, Russia, rainfall is higher in winter. Students may also not that Semipalatinsk has a more even distribution of rain than Monterrey.
2. The highest temperature is about 30°C and the lowest is about 15°C. The range is about 15°C.
3. The highest temperature is about 30°C and the lowest is about 0°C. The range is about 30°C.
4. It is in the summer.
5. The climate in Pueblo is more severe with colder winters and drier summers.

Section 3

1. Near Africa at the Equator.
2. Cold water from the poles is more dense and sinks. It flows down to the equator. This sinking and flowing pulls the upper warm water toward the north like a conveyor belt.
3. No. During the Ice Age it slowed down or stopped. This was discovered when a scientist found different oxygen isotopes in shells of animals called formaninifera.
4. The winds blow from Africa to the Caribbean at the equator. This keeps the water from going south.

Note-taking Worksheet (page 33)

Refer to Teacher Outline, student answers are underlined.

Assessment

Chapter Review (page 37)

Part A. Vocabulary Review

1. c (4/2)
2. a (1/1)
3. e (6/3)
4. m (2/1)

5. d (5/3)
6. l (4/2)
7. j (7/3)
8. b (2/1)
9. k (7/3)
10. f (7/3)
11. h (7/3)
12. g (2/1)
13. i (7/3)

Part B. Concept Review

1. Weather conditions are averaged over a long period, such as 30 years. Some weather conditions that are averaged include temperature, precipitation, humidity, and days of sunshine. (3/2)
2. Students should list four of the following six groups: tropical, mild, dry, continental, polar, and high elevation. (3/2)
3. In El Niño, the Pacific Ocean warms along the equator. Near the equator, trade winds that blow east to west weaken and sometimes reverse, instead of cold water rising off the coast of Peru, warm water flows east to South America and sea level rises. El Niño makes stormy weather more likely in California, and causes changes in wind and precipitation around the world. (6/3)
4. Plants lose water through evaporation from their leaves. The amount of evaporation depends on the size of the leaves' surface, and spiny leaves have a small surface area. So cacti lose relatively little water through their leaves, which helps them survive in the dry desert climate. (4/2)
5. The greenhouse effect is natural heating caused by gases in our atmosphere trapping heat. This makes Earth's climate warmer than it would otherwise be and allows living things to survive. Global warming is a worldwide increase in temperatures caused by an increase of greenhouse gases in our atmosphere. (7/3)
6. Tropical fossils found in polar regions show that at one time, Earth's climate was much warmer. Glacial erosion and deposition around the world show that at one time, much of Earth was covered with glaciers. For the past three million years, warm spells have alternated with cooler glacial periods. (7/3)
7. On the side of the mountains facing the wind, air rises, cools, and drops its moisture as precipitation. On the side of the mountains away from the wind, the air descends and dries out the land, often forming deserts. (2/1)
8. Humans add carbon dioxide to the atmosphere by burning fossil fuels and by removing trees. We can reduce the amount of carbon dioxide in the atmosphere by conserving electricity, using alternative forms of transportation so fewer cars are releasing carbon dioxide into the atmosphere, and by planting more vegetation. (7/3)

Chapter Test (page 39)

I. Testing Concepts

1. c (5/3)
2. a (2/1)
3. b (7/3)
4. d (2/1)
5. b (4/2)
6. b (7/3)
7. d (7/3)
8. c (6/3)
9. a (2/1)
10. b (4/2)
11. a (2/1)
12. b (7/3)
13. c (3/2)
14. d (7/3)
15. a (7/3)
16. d (7/3)
17. a (7/3)
18. b (4/2)
19. c (7/3)
20. b (1/1)

II. Understanding Concepts

1. c (2/1)
2. These are two distinct things. The greenhouse effect is a natural effect caused by gases in the atmosphere trapping heat. Global warming refers to the theory that average worldwide temperatures are increasing, perhaps as a result of various human activities that increase certain atmospheric gases. Some of those gases, such as carbon dioxide, are the same ones responsible for the greenhouse effect. (7/3)
3. Answers will vary. Examples might include: (1) reducing use of private automobiles by carpooling, substituting public transportation, or biking; (2) establishing tighter controls on industrial emissions and finding ways to recycle carbon dioxide wastes; (3) reducing the temperature to which buildings are heated and/or reducing the number of hours that they are heated (7/3)
4. When moisture-laden wind comes off the ocean and runs into mountains, the winds rise, cool, and lose their moisture as rain. The fact that the strip of land is so narrow means that the rain falls in a small area. That might be why there is a rain forest in this area. (2/1)
5. As one moves toward higher latitudes, sunlight strikes Earth from an angle closer to the horizon. The same amount of heat from solar radiation is therefore spread over a larger area of Earth's surface, meaning that it cannot raise that area's temperature as much. (2/1)
6. The water's temperature does not rise or fall as rapidly as the temperature of the surrounding land. This leads to breezes from the water to the land and vice versa. This results in a moderating influence on the temperatures of land that border

the body of water: they are warmer in the winter and at night, and cooler in the summer and during the day, as compared to inland areas. Bodies of water also affect the amount of precipitation. (2/1)

7. These animals avoid moving around during the heat of the day, and when there is little water available to drink, they consume large amounts of vegetation, from which they meet their needs for water. (4/2)
8. Trees take in carbon dioxide. When trees are cut down, more carbon dioxide remains in the atmosphere. Carbon dioxide is one of the greenhouse gases that may lead to global warming. (7/3)
9. In the tropics, because water is more plentiful, there is no extreme cold, and an organism can adapt to temperature that does not vary greatly throughout the year. On the other hand, since there are so many species in the tropics, many "niches" are filled and there is competition for available resources. (2/1, 4/2)

III. Applying Concepts

1. Burning fossil fuels, which releases carbon dioxide into the atmosphere, is one cause. Deforestation may be another because trees take in carbon dioxide naturally. When trees are removed, carbon dioxide remains in the atmosphere. When trees are burned, carbon dioxide is released into the atmosphere. (7/3)
2. On one hand, the city's climate will be similar because it has the same altitude and the same relationship to bodies of water and mountain ranges. On the other hand, it will be different for various reasons. More solar radiation is absorbed in the city than in the country because of streets, parking lots, and buildings, causing heat to build up. Industrial and automobile pollutants in the air tend to trap this heat. Also, skyscrapers affect wind and precipitation patterns. (2/1)

Transparency Activities

Section Focus Transparency 1 (page 44)

City Heat

Transparency Teaching Tips

- This transparency may be used to introduce climate. Ask the students to identify what the colors pictured represent. (Parks or wooded areas are the cool colors, and the paved lots and buildings are the warm colors.)
- Explain that many factors, such as large bodies of water, ocean currents, mountains, and latitude, affect climate. Ask the students how a city can affect the climate.

Content Background

- The thermal image, shown on the transparency, is of Salt Lake City, Utah. The image was taken in 1998 using ATLAS (Airborne Terrestrial Land Application Sensor).
- A part of the energy from the Sun's rays is reradiated by Earth's surface. Paved surfaces and buildings radiate much more heat than do plant-covered surfaces.
- Pollution, caused by the use of fossil fuels, absorbs heat energy, trapping it near the surface, aggravating the greenhouse effect.
- Between the paved surfaces, pollution, and lack of park space, a city can be up to five degrees warmer than the surrounding countryside.

Answers to Student Worksheet

1. The red areas to the left are very hot. The blue and green areas are cooler.
2. The red areas are toward the center of the city where there is a lot of asphalt, pavement, and buildings. The blue and green areas would have more grass and water.
3. Answer will vary. Planning parks, trees, fountains, and green areas could help keep cities cooler and more pleasant.

Section Focus Transparency 2 (page 45)

Where *are* we?

Transparency Teaching Tips

- This transparency is about climate and how topographical features affect it. Ask the students to consider how it's possible to have so many climates on one island.
- The transparency shows scenes from the Big Island of Hawaii. Ask students for examples of the effects of oceans and mountains on climate. Discuss different areas that contain scenes like the ones shown.

Content Background

- Hawaii's diverse geographic makeup can be attributed to its location on a hot spot in Earth's mantle. Geologists believe that hot spots are areas away from fault lines where magma forces its way up and through the crust. The Hawaiian islands were formed through a series of these volcanic episodes. The Hawaiian topography is a series of varied hills, mountains, and valleys.
- The climate of the Big Island of Hawaii (pictured on the transparency) is complex. In addition to being surrounded by the ocean, the island has five volcanic mountains of differing altitudes. Naturally, it becomes colder in the mountains due to the higher altitude. The mountains, however, also affect the climate of the surrounding land. The prevailing wind blows from northeast to southwest, so it rains more in Hilo on the windward side of the mountain. The island is dry in the

west and northwest, the leeward side of the mountain. While temperatures in Honolulu range between 14°C (57°F) and 31°C (88°F), the record low on Mauna Kea is –17°C (1.4°F).
- Hawaii consists of eight islands. It became a state in 1959.

Answers to Student Worksheet

1. The climates include a snowy mountain, a tropical rain forest, a sunny beach, and a hot desertlike area.
2. Snow can be found at higher elevations in mountains, while deserts can form on the leeward side of the mountains.
3. Mountains, oceans, and even large cities are among the physical features that affect climate.

Section Focus Transparency 3 (page 46)

Informative Fruit

Transparency Teaching Tips

- This is an introduction to climatic changes. Ask the students how grape harvests could be indicators of summer temperatures. Explain that grapes need long, hot, dry summers to ensure a good harvest. (The better the harvest, the higher the probability that the summer temperatures were within a certain range.)
- Point out that two of the primary factors affecting climate are how much sunlight reaches Earth and how much of its radiant energy is absorbed or reflected. Within that context, ask the students which events of the last three hundred years may have affected climate. (Answers include volcanic eruptions; population increases, which mean more respirated carbon dioxide; industrialization and invention of the automobile, both burning fossil fuels and increasing CO_2 emissions; deforestation, which removes CO_2 absorbing plants and trees; and increased pollution, which traps the heat.)

Content Background

- The increase of CO_2 in the environment may intensify the greenhouse effect and trigger an increase in surface temperatures.
- Sun spots appear to affect climate and temperature as well. For example, between 1645 and 1715 very few sunspots were recorded. This was the time of some of the coldest winters in recorded history.

Answers to Student Worksheet

1. Answers will vary. Scientists might use the information to make long range predictions about climate. Historical climatic information could be used to understand plant and animal life from the past.
2. Answer will vary. Temperatures change with the changing of the seasons. Increases in CO_2 will also affect temperatures. These increases might be triggered by volcanic activity, pollution, an increase in population, deforestation, or a change in fossil fuel-burning technology. Interactions between oceans and the atmosphere can also affect the temperatures.

Teaching Transparency (Page 47)

Classification System

Section 2

Transparency Teaching Tips

- Point out to students that the three main climate zones—tropics, temperate, and polar—are determined by the amount of solar energy each receives. The climate classification regions are refinements of these zones and take into account differences in the way land and water retain solar energy and how altitude affects prevailing weather conditions.
- Discuss with students the terms: weather, climatologist, climate, and classification system.

Reteaching Suggestion

- Suggest that students collect magazine pictures of vegetation from a variety of climates. Have them post the pictures, identifying both the location and climate shown in the picture.

Extensions

Activity: Have pairs of students develop 10 riddles based on the climate map. Suggest pairs exchange and answer one another's riddles.

Challenge: Suggest students compare the climate map to a world population density map. Have them use their comparison to determine which types of climate regions are likely to have the greatest population density.

Answers to Student Worksheet

1. Weather is the present condition of the atmosphere. This includes temperature, wind, amount of moisture in the air, and air pressure.
2. Climate is the average weather condition of an area or region over a long period of time.
3. Their body structures help them in certain climates. An example would be a mammal's fur insulates it in cold temperatures.
4. temperature and precipitation
5. humid subtropical

Assessment Transparency (Page 49)

Climate

Section 3

Answers

1. **A.** For this question, students need to deduce the information from the picture.
   Choice A: Yes, the cactus is the organism that can most efficiently withstand constant and direct exposure to the sun.
   Choice B: No, the picture shows the girl uncomfortable and sweaty. Students will be able to eliminate this choice.
   Choice C: No, although many lizards can handle the heat, they cannot handle exposure to sunlight as well as a cactus can. Students can eliminate this answer.
   Choice D: No, the picture shows that the snake has taken shelter from the sun because it cannot withstand the heat. Students should be able to eliminate this choice.
2. **F.** Students must use the main theme of the picture to make an inference. Although all of the choices are possible, only choice F, *keep it cool during the day,* is probable considering the context of the picture.
3. **D.** This question tests students' understanding of the interactions between organisms and their environment. Students need to use deductive reasoning in order to identify the best answer.

Test-Taking Tip

When new and especially long vocabulary words are introduced, such as *adaptation,* ask the students to use the word in relation to themselves. This encourages permanent understanding of the words rather than short-term memorization.