Includes:

**LEVELED ASSESSMENT**
- Chapter Review
- Chapter Tests
  - Test A (Below Level) **BL**
  - Test B (On Level) **OL**
  - Test C (Advanced Learner) **AL**

**LABS**
*For leveled labs, use the CD-ROM.*
- Lab worksheets from Student Edition Labs
  - MiniLab
  - Lab: Version A (Below Level) **BL**
  - Lab: Version B (On Level) **OL**
    - (Advanced Learner) **AL**

**UNIVERSAL ACCESS/LEVELED RESOURCES**
- Target Your Reading
- Chapter Content Mastery English (Below Level) **BL**
- Chapter Content Mastery Spanish (Below Level) **BL**
- Reinforcement (On Level) **OL**
- Enrichment (Advanced Learner) **AL**

**READING SUPPORT**
- Content Vocabulary
- Chapter Outline

**TEACHER SUPPORT AND PLANNING**
- Chapter Outline for Teaching
- Teacher Guide and Answers
Photo Credits
Cover: Alamy Images
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**Additional Assessment Resources available with Glencoe Science:**

- ExamView® Assessment Suite
- Assessment Transparencies
- Performance Assessment in the Science Classroom
- Standardized Test Practice Booklet
- MindJogger Videoquizzes
- Vocabulary PuzzleMaker at science.glencoe.com
- Interactive Classroom
- The Glencoe Science Web site at science.glencoe.com
- An interactive version of this textbook along with assessment resources are available online at mhn.com.
Student Lab/Activity Safety Form

Student Name: ______________________________________

Date: ________________________________

Lab/Activity Title: ________________________________

In order to show your teacher that you understand the safety concerns of this lab/activity, the following questions must be answered after the teacher explains the information to you. You must have your teacher initial this form before you can proceed with the activity/lab.

1. How would you describe what you will be doing during this lab/activity?

2. What are the safety concerns associated with this lab/activity (as explained by your teacher)?
   - _____________________________________________
   - _____________________________________________
   - _____________________________________________
   - _____________________________________________
   - _____________________________________________
   - _____________________________________________

3. What additional safety concerns or questions do you have?

MiniLab

How do you interpret a satellite image?

Satellite images show the pattern of clouds and weather systems across a large region. What can you learn about the weather from satellite images?

Procedure

1. Examine the satellite photo in your textbook.
2. Identify the colors that represent clouds, ocean water, and land.
3. Identify the United States and the Great Lakes on the map.
4. Identify the regions of the United States that have cloud cover. Identify regions that have clear skies.

Analysis

1. Describe In which regions of the United States is there most likely a high-pressure system, according to the image? How do you know?

2. Infer Which region of the map is most likely experiencing a low-pressure system? Explain how you know this.

3. Explain why satellite images are helpful to weather forecasters.
MiniLab

How does latitude affect the angle of sunlight?

Investigate to see how different latitudes affect the angle at which the Sun’s rays strike earth.

**Procedure**

1. Complete a lab safety form.
2. Place a **globe** on a table or desktop.
3. Hold a **flashlight** parallel to the floor and aim the beam of light directly at the equator on the globe. Record your observations about how the beam hits the globe.
4. Keep the flashlight parallel to the floor. Aim the beam between 35–40º N latitude. Record your observations about how the beam hits the globe in the table below.
5. With the flashlight parallel to the floor, aim the beam between 35–40º S latitude. Record your observations about how the beam hits the globe in the table below.
6. Find the state of California on the globe.

**Data and Observations**

<table>
<thead>
<tr>
<th>Light Beam</th>
<th>Observations: How Light Hits Globe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aimed between 35–40º N latitude</td>
<td></td>
</tr>
<tr>
<td>Aimed between 35–40º S latitude</td>
<td></td>
</tr>
</tbody>
</table>

**Analysis**

1. **Contrast**  What differences did you observe as the light beams hit the globe at the different latitudes?

____________________________________________________________________________________________________________________

____________________________________________________________________________________________________________________

2. **Infer**  How would the differences you observed affect the climate of the different regions?

____________________________________________________________________________________________________________________

____________________________________________________________________________________________________________________

3. **Describe**  Where is California compared to the latitudes at which light was aimed?

____________________________________________________________________________________________________________________

____________________________________________________________________________________________________________________
MiniLab

How do Santa Ana winds move?

The Santa Ana winds in southwestern California are hot and dry. What can you learn about the path of the Santa Ana winds?

Procedure

1. Build a **clay** plateau in one corner of a **clear plastic tub**. This represents the Great Basin.
2. Make a clay dam around the perimeter of the plateau. This represents the Sierra Nevada, San Gabriel, and other mountains.
3. Put some notches in the clay dam to represent Cajon Pass, the Santa Ana Canyon, and other mountain passes.
4. Fill the tub with **vegetable oil** so it covers the highest mountain peak. This represents low density air.
5. Pour **colored water** into the plateau. This represents high density air from the Mojave Desert (Great Basin).
6. Pour the colored water until it spills over the mountain passes and into the basin below. This is the Los Angeles basin.

Analysis

1. **Evaluate** How does the model you made show the flow of Santa Ana winds from the high plateau into the Los Angeles basin?

2. **Infer** Santa Ana winds are described as hot, dry, dusty winds. What effect do these winds have on southern California?
Lab

How diverse is the natural landscape of California?

Problem  The state of California has within its borders deserts, redwood forests, prairies, wetlands, and many other types of natural landscapes. These result from the different kinds of climate that can be found within the state and encompass a variety of factors such as water, temperatures, and compositions of soil. The diversity of life that thrives in the state emerges from the varied weather patterns that can be tracked throughout California.

Hypothesis  You have been assigned the bioregion for your exploration. Write a hypothesis that explains which weather factors bring about the local weather patterns and climatic conditions that are considered normal for the region.

Materials
computer with Internet access
references on California’s bioregions

Collect Data

Directions: Check the boxes below as you complete each step of the procedure.

☐ 1. Locate your assigned bioregion on a map.
   ☐ Use the Internet or library references to find out information about that bioregion.

☐ 2. Research information about the weather factors that affect the area.
   ☐ Include how much precipitation the area receives, and the annual temperature changes.

☐ 3. Research information about the climate conditions of the bioregion.

☐ 4. Find out information about the type of habitats that are found in the bioregion and the type of plants and animals that live in those habitats.

☐ 5. Find out what type of soil exists in the bioregion.

☐ 6. Choose one location in your bioregion, and track the weather patterns for one week.

☐ 7. Construct a data table or use the one shown on the next page.

☐ Post the results of your research at ca6.msscience.com.
### Data and Observations

<table>
<thead>
<tr>
<th>Day of the Week</th>
<th>High Temperature</th>
<th>Low Temperature</th>
<th>Type of Precipitation</th>
<th>Amount of Precipitation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunday</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monday</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tuesday</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wednesday</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thursday</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friday</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saturday</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Analyze and Conclude

1. **Identify** What are the main characteristics of the climate of your bioregion?

2. **Describe** What plants and animals thrive because of these climatic factors?

3. **Identify** the weather factors that are part of the weather and climatic patterns in your region.

4. **Explain** How is the soil affected by the climate in your region?
Lab: Version A  CONTINUED

5. **Evaluate**  How do these local weather patterns fit into the big picture of climate for your bioregion?

Error Analysis
Each bioregion borders on another. Living things and different weather factors merge at those borders. When you researched, were you careful to focus on those factors and living things that were common especially to your region?

**Communicate**
**Write a Report**  Present your findings to your class in the form of a report, including graphs, tables, maps, photographs, and supporting documentation. Describe any changes that occurred during your period of study.
Lab

How diverse is the natural landscape of California?

Problem The state of California has within its borders deserts, redwood forests, prairies, wetlands, and many other types of natural landscapes. These result from the different kinds of climate that can be found within the state and encompass a variety of factors such as water, temperatures, and compositions of soil. The diversity of life that thrives in the state emerges from the varied weather patterns that can be tracked throughout California.

Hypothesis You have been assigned the bioregion for your exploration. Write a hypothesis that explains which weather factors bring about the local weather patterns and climatic conditions that are considered normal for the region.

Materials
computer with Internet access
references on California’s bioregions

Collect Data

Directions: Check the boxes below as you complete each step of the procedure.

☐ 1. Locate your assigned bioregion on a map. Use the Internet or library references to find out information about that bioregion.

☐ 2. Research information about the weather factors that affect the area, including how much precipitation the area receives, and the annual temperature changes.

☐ 3. Research information about the climate conditions of the bioregion.

☐ 4. Find out information about the type of habitats that are found in the bioregion and the type of plants and animals that live in those habitats.

☐ 5. Find out what type of soil exists in the bioregion.

☐ 6. Choose one location in your bioregion and track the weather patterns for one week.

☐ 7. Construct a data table in the space below and post the results of your research at ca6.mssscience.com.

Data and Observations
Lab: Version B CONTINUED

Analyze and Conclude

1. **Identify** What are the main characteristics of the climate of your bioregion?

2. **Describe** What plants and animals thrive because of these climatic factors?

3. **Identify** the weather factors that are part of the weather and climatic patterns in your region.

4. **Explain** How is the soil affected by the climate in your region?

5. **Evaluate** How do these local weather patterns fit into the big picture of climate for your bioregion?

**Error Analysis**

Each bioregion borders on another. Living things and different weather factors merge at those borders. When you researched, were you careful to focus on those factors and living things that were common especially to your region?
Lab: Version B CONTINUED

Going Further

Challenge

6. Analyze What factors influence the weather in your region?

__________________________________________________________

__________________________________________________________

7. Distinguish Which wind systems or patterns influence the climate in your region?

__________________________________________________________

__________________________________________________________

8. Predict Was the weather data you collected what you expected? How would the weather data be different if you were to observe the weather in your area in three months? In six months?

__________________________________________________________

__________________________________________________________

9. Speculate How might a drought affect your region?

__________________________________________________________

__________________________________________________________

10. Analyze Are there any conservation efforts in your region? Are these efforts linked to the climate?

__________________________________________________________

__________________________________________________________

Extension

Create a travel brochure for your region. Include information on the climate, geographical features, places of interest, and other details you think a traveler might like to know.

Communicate

Write a Report Present your findings to your class in the form of a report, including graphs, tables, maps, photographs, and supporting documentation. Describe any changes that occurred during your period of study.
Target Your Reading

Use this to focus on the main ideas as you read the chapter.

1. **Before you read** the chapter, respond to the statements below on your worksheet or on a numbered sheet of paper.
   - Write an **A** if you **agree** with the statement.
   - Write a **D** if you **disagree** with the statement.

2. **After you read** the chapter, look back to this page to see if you’ve changed your mind about any of the statements.
   - If any of your answers changed, explain why.
   - Change any false statements into true statements.
   - Use your revised statements as a study guide.

<table>
<thead>
<tr>
<th>Before You Read A or D</th>
<th>Statement</th>
<th>After You Read A or D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Air temperature is a weather factor.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Air pressure does not affect weather.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Clouds are made of water droplets or ice crystals.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Weather conditions can change quickly.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Excessive rainfall can lead to flooding.</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>There is only one climate region in North America.</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Latitude affects the climate of an area.</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Ocean currents do not affect weather and climate.</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>The area on the lee side (downwind slope) of a mountain experiences high rainfall.</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>During the dry summers in California, the risk of fire increases.</td>
<td></td>
</tr>
</tbody>
</table>
### Direction: Match the descriptions in Column I with the terms in Column II. Write the correct letter in each blank.

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. the atmospheric conditions of a place at a certain time</td>
<td>A. relative humidity</td>
</tr>
<tr>
<td>2. the temperature at which condensation can occur</td>
<td>B. Sun</td>
</tr>
<tr>
<td>3. all the water at Earth’s surface</td>
<td>C. dew point</td>
</tr>
<tr>
<td>4. the never-ending process that Earth’s water follows</td>
<td>D. humidity</td>
</tr>
<tr>
<td>5. the amount of water vapor in the atmosphere</td>
<td>E. fog</td>
</tr>
<tr>
<td>6. drops of water or ice crystals too large to be suspended in a cloud</td>
<td>F. barometer</td>
</tr>
<tr>
<td>7. a measure of the average kinetic energy of air molecules</td>
<td>G. hydrosphere</td>
</tr>
<tr>
<td>8. instrument used to measure air pressure</td>
<td>H. water cycle</td>
</tr>
<tr>
<td>9. the amount of water vapor present in the air relative to the</td>
<td>I. precipitation</td>
</tr>
<tr>
<td>maximum amount of water vapor the air can hold at that temperature</td>
<td>J. weather</td>
</tr>
<tr>
<td>10. water droplets or ice crystals suspended in the atmosphere</td>
<td>K. cloud</td>
</tr>
<tr>
<td>11. the driving energy of the water cycle</td>
<td>L. temperature</td>
</tr>
<tr>
<td>12. water droplets or ice crystals suspended close to Earth’s surface</td>
<td></td>
</tr>
</tbody>
</table>
**Chapter Content Mastery**

**Weather Patterns**

**Directions:** Study the diagrams below and label each as either a warm front or cold front.

1. 

2. 

**Directions:** Name three temperature-related cycles that affect weather.

3. 

4. 

5. 

**Directions:** Decide whether each statement below refers to a high-pressure system or a low-pressure system. Write H (high-pressure) or L (low-pressure) in the blanks provided.

6. Cold air sinks and moves closer to Earth’s surface. 

7. These are associated with fair weather. 

8. These are associated with cloudy, stormy weather. 

9. Warm air rises away from Earth’s surface.
Chapter Content Mastery

Chapter 11

Lesson 3

Climate

Directions: Name three climate controls.

1. __________________________
2. __________________________
3. __________________________

Directions: Choose the answer that completes each sentence below. Write the correct letter on the blank at the left.

4. The________________________ climate is characterized by cool to cold temperatures that occur in mountain areas.
   A. highland
   B. polar tundra
   C. mediterranean
   D. humid subtropical

5. The________________________ climate is characterized by mild, wet winters and hot, dry summers.
   A. highland
   B. polar tundra
   C. mediterranean
   D. humid subtropical

6. The farther a region is from the equator, the________________________ its climate.
   A. drier
   B. wetter
   C. colder
   D. warmer

7. The Gulf Stream is the reason that Great Britain is________________________ than Labrador, Canada.
   A. drier
   B. wetter
   C. colder
   D. warmer

8. Westerlies blow from________________________.
   A. east to west
   B. west to east
   C. west to north
   D. south to west
Chapter Content Mastery

California Climate and Local Weather Patterns

Directions: Answer each question below in complete sentences.

1. What are three important factors that influence California's climate?

2. Why does California's coast have so much fog?

3. What is a rain shadow, and what causes it?

4. In which direction does a valley breeze blow, and at what time of day does it usually occur?

5. What is a Santa Ana wind?

6. Why are Santa Ana winds dangerous during fire season?

7. What are the primary characteristics of California's seasons?

8. What causes sea breezes and land breezes?
El tiempo

Instrucciones: Coincide las descripciones de la izquierda con los términos a la derecha. Escribe la letra correcta en el espacio.

1. las condiciones atmosféricas de un lugar en cierto tiempo
2. la temperatura a la que la condensación puede ocurrir
3. todo el agua en la superficie de la Tierra
4. el proceso interminable que sigue el agua de la Tierra
5. la cantidad del vapor de agua en la atmósfera
6. gotas de agua o cristales de hielo que están muy grandes para estar suspendidas en una nube
7. una medida del promedio de la energía cinética de las moléculas de aire
8. un instrumento que se usa para medir la presión del aire
9. la cantidad de vapor de agua presente en el aire con relación a la cantidad máxima de vapor de agua que el aire puede contener a la temperatura ambiental
10. gotitas de agua o cristales de hielo suspendidos en la atmósfera
11. la energía que mueve el ciclo hidrológico
12. gotitas de agua o cristales de hielo suspendidos cerca de la superficie de la Tierra

A. humedad relativa
B. Sol
C. punto de rocío
D. humedad
E. niebla
F. barómetro
G. hidrosfera
H. ciclo hidrológico
I. precipitación
J. tiempo
K. nube
L. temperatura
Los patrones del tiempo

Instrucciones: Estudia los siguientes diagramas y etiqueta cada uno como un frente caliente o un frente frío.

1. ________________  
2. ________________

Instrucciones: Nombra tres ciclos relacionados con la temperatura que afectan el tiempo.

3. ________________  
4. ________________  
5. ________________

Instrucciones: Decide si las siguientes oraciones refieren a un sistema de presión alta o a un sistema de presión baja. Escribe A (presión alta) o B (presión baja) en los espacios.

6. __________  El aire frío se hunde y se mueve más cerca de la superficie de la Tierra.
7. __________  Estos están asociados con el tiempo agradable.
8. __________  Estos están asociados con el tiempo nublado y tormentoso.
9. __________  El aire caliente sube y se aleja de la superficie de la Tierra.
**Instrucciones:** Nombra tres controles de la clima.

1. 
2. 
3. 

**Instrucciones:** Escoge la respuesta que completa cada de las siguientes oraciones. Escribe la letra correcta en el espacio a la izquierda.

4. El clima ________________ se caracteriza por temperaturas frescas y frías que ocurren en áreas montañosas.
   A. montañoso  
   B. tundra polar  
   C. mediterránea  
   D. subtropical húmedo

5. El clima ________________ se caracteriza por inviernos templados y lluviosos y veranos calientes y secos.
   A. montañoso  
   B. tundra polar  
   C. mediterránea  
   D. subtropical húmedo

6. En cuanto más lejos una región esté del ecuador, mayormente ________________ es su clima.
   A. seco  
   B. lluvioso  
   C. frío  
   D. caliente

7. La corriente del Golfo es la razón por la cual Gran Bretaña es más ________________ que Labrador, Canada.
   A. seco  
   B. lluvioso  
   C. frío  
   D. caliente

8. Los vientos del poniente soplan del ________________.
   A. este al oeste  
   B. oeste al este  
   C. oeste al norte  
   D. sur a oeste
El tiempo y la clima de California

Dominio del contenido

Instrucciones: Contestar cada pregunta en oraciones completas.

1. ¿Cuáles son tres factores importantes que influyen el clima de California?

2. ¿Por qué tiene tanta niebla la costa de California?

3. ¿Qué es una sombra de lluvia, y qué es causa?

4. ¿Una brisa del valle sopla en qué dirección, y normalmente a qué hora del día ocurre?

5. ¿Qué es un aire de Santa Ana?

6. ¿Por qué son peligrosos los aires de Santa Ana durante la temporada de fuegos?

7. ¿Cuáles son las características principales de las estaciones de California?

8. ¿Qué causa las brisas del mar y las brisas del suelo?


**Reinforcement: Weather**

**Directions:** Choose the correct term to complete each sentence below.

**air pressure**  **cloud**  **dew point**  **humidity**

**precipitation**  **relative humidity**  **temperature**  **weather**

1. A ___________ forms when water droplets or ice crystals are suspended in the atmosphere.

2. ___________ is higher close to Earth’s surface than it is at higher altitudes.

3. When air becomes fully saturated with water vapor, it has reached its ___________.

4. The atmospheric conditions of a certain place at a certain time are known as ___________.

5. Water in liquid or solid form falling from the atmosphere is called ___________.

6. A ___________ of 50 percent means that the amount of water vapor in the air is one-half of the maximum that the air can hold at that temperature.

7. When the ___________ is high, air molecules have a high level of kinetic energy.

8. The amount of water vapor per volume of air is the ___________.

**Directions:** Respond to each question or statement using complete sentences.

9. Describe the water cycle using the terms atmosphere, hydrosphere, evaporation, condensation, and precipitation.

   _____________________________________________________________________________
   _____________________________________________________________________________
   _____________________________________________________________________________
   _____________________________________________________________________________
   _____________________________________________________________________________

10. What forms of precipitation have you seen, and how do they differ?

    _____________________________________________________________________________
    _____________________________________________________________________________
    _____________________________________________________________________________
    _____________________________________________________________________________
Reinforcement Weather Patterns

Directions: Select the letter of the term in Column II that matches the weather condition in Column I.

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. a large body of air that develops over a particular region</td>
<td>A. cold front</td>
</tr>
<tr>
<td>2. warmer, lighter air moving over heavier, colder air</td>
<td>B. flood</td>
</tr>
<tr>
<td>3. sinking air, dry weather, few clouds</td>
<td>C. low pressure</td>
</tr>
<tr>
<td>4. period when precipitation is much lower than normal or absent</td>
<td>D. warm front</td>
</tr>
<tr>
<td>5. colder air advancing toward warm air, pushing the warm air up</td>
<td>E. flash flood</td>
</tr>
<tr>
<td>6. water enters an area faster than it can be taken away or absorbed</td>
<td>F. drought</td>
</tr>
<tr>
<td>7. rising air that cools, forming clouds and precipitation</td>
<td>G. high pressure</td>
</tr>
<tr>
<td>8. the number one reason for weather-related deaths</td>
<td>H. air mass</td>
</tr>
</tbody>
</table>

Directions: Respond to each question or statement on the lines provided.

9. What causes the changes in temperature and day length that we call seasons?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

10. Describe the cycle of seasons where you live.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

11. How might you design a town plan to decrease damage from flash floods?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________
**Reinforcement**

**Climate**

_Directions:_ Determine if each of the following statements is true or false. If the statement is true, write a T in the blank. If it is false, replace the italicized term with the term that would make the statement correct.

1. The average of the temperature, winds, and precipitation patterns for a region over a long period of time is known as __weather__. 
2. An increase in the concentration of greenhouse gases could lead to __global warming__.
3. Winds are named for the direction __toward__ which they blow.
4. Areas close to the __poles__ receive more solar radiation than areas at other latitudes.
5. __Land surfaces__ can absorb or lose large amounts of heat without changing temperature.
6. At night, temperatures along the coast are usually __higher__ than those inland.
7. Most of the United States is affected by prevailing winds called the __northerlies__.
8. The Gulf Stream is a large ocean current that carries heat to __lower__ latitudes.
9. The California Current is a __warm__-water current that flows past the coast of California.
10. Ocean currents and prevailing winds help redistribute __heat__ energy around Earth.

_Directions:_ Answer each of the following questions using complete sentences.

11. What two types of climate characterize most of California? Describe each.

   _______________________________________________________________________
   _______________________________________________________________________

12. How would you describe the climate where you live?

   _______________________________________________________________________
   _______________________________________________________________________

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California Climate and Local Weather Patterns

Directions: Describe the local wind systems below, including how each is formed.

1. sea breeze __________________________________________________________
   __________________________________________________________

2. land breeze _________________________________________________________
   __________________________________________________________

3. valley breeze ________________________________________________________
   __________________________________________________________

4. mountain breeze _____________________________________________________
   __________________________________________________________

5. Santa Ana winds _____________________________________________________
   __________________________________________________________

Directions: Indicate whether each factor below is characteristic of California’s mediterranean climate or its highland climate by writing M or H in each blank provided.

6. westerlies in winter ______

7. presence of the Sierra Nevadas ______

8. proximity of the Pacific Ocean ______

9. dry summers ______

10. wet winters ______

11. cooler temperatures ______

12. high altitudes ______

13. Do you live in a mediterranean, highland, or other type of climate? Explain.
   __________________________________________________________
   __________________________________________________________

14. Why is fog so important to California’s stands of coastal redwoods?
   __________________________________________________________
Most clouds occur at altitudes of from 1 to 11 kilometers (1/2 to 7 miles). If clouds occur closer to the ground, they are considered fog. Clouds come in many different shapes and sizes, and they can often be used to predict weather. The three main types of clouds are cumulus, stratus, and cirrus.

**Cumulus**
Cumulus clouds are the familiar fluffy clouds with tops like cotton balls and broad, flat bottoms. People often imagine they can see animal and human shapes in their sharp outlines as they move across the sky. Cumulus clouds tend to form on rapidly rising masses of warm air.

**Stratus**
Stratus clouds look like a mass of solid, high fog. They stretch across the sky in horizontal layers, which may be thick or thin. Stratus clouds tend to form when a large mass of air is rising slowly.

**Cirrus**
Cirrus clouds are the wispy streaks high in the atmosphere, sometimes referred to as "mares' tails." They are made up entirely of ice crystals. Cirrus clouds occur at such great heights that they appear not to be moving.

These three main cloud groups are further divided into subgroups:
- **Stratocumulus** clouds may be loosely packed together or may form an unbroken ceiling.
- **Altoculmulus** clouds are similar to stratocumulus, but move across the sky in groups at different altitudes.
- **Cirrocumulus** clouds are high, thin ice-crystal clouds that look like ripples in sand, and are sometimes referred to as “mackerel sky.”
- **Altostratus** clouds form gray or bluish sheets that may be thick or thin.
- **Cirrostratus** clouds are high-altitude clouds consisting of thin, white veils through which light can shine.
- **Nimbostratus** clouds are low, dark, and thick, often bringing steady rain.
- **Cumulonimbus** clouds are the towering thunderclouds that bring storms.

**Directions:** Use a journal for the activities described below.

1. **Survey** the clouds in your area by keeping a cloud journal. Over a two-week period, write down the types of clouds you see at the same two times each day, once in the morning and once in the evening. Record all observation times. (To determine cloud type, use the information in this passage and additional library reference materials, if necessary.)

2. **Illustrate** your cloud journal by sketching the clouds at each viewing.

3. **Predict** the weather based on cloud cover. At each morning observation, predict the weather for the coming day. At each evening observation, predict the weather for the following day. Write down each prediction. Then, at your next viewing time, see if you were right. In your journal, write down any conclusions you can draw about the relationship between certain types of clouds and weather.
Enrichment Building a Rain Gauge

Meterologists use a variety of instruments to report the weather. You are probably familiar with some of them, such as the thermometer, used to measure temperature, and the barometer, used to measure air pressure. Wind vanes and wind socks are simple instruments used to measure wind direction. Another simple instrument that you can build yourself is called a rain gauge. Rain gauges keep track of how much precipitation has fallen. Follow the directions below to make your own.

Materials
- plastic tennis ball container (or other clear cylindrical container)
- ruler
- 2 markers (1 black and 1 colored)
- water

Procedure
1. Fill the container with several cm of water to weigh it down.
2. Draw a horizontal line on the container with the black marker to indicate this base level.
3. Set the container out in the open, away from trees and buildings. Make sure the surface is level and that it is protected from disturbance by animals.
4. After a rain, measure the level of water in the container from the baseline to the water line. Record the amount of rainfall in millimeters or centimeters.
5. Prepare your rain gauge for the next rainfall by emptying the container and filling it with water to the original base level.

Data and Observations
1. Compare your rainfall results with those of others in your class. Were all the amounts the same? If not, how might you account for the differences?

2. Calculate the mean of your class’s results to determine average rainfall for your area.

3. Develop a graph of rainfall over time by using your gauge every time it rains for a week or a month. Use a separate sheet of graph paper.

4. Speculate as to how you might measure snowfall. Do you think a centimeter of snow has the same amount of water as a centimeter of rain? If you live in an area that receives snowfall, use your rain gauge to find out. Write your thoughts on a separate sheet of paper.
Enrichment  Ice Ages

For most of Earth’s 4.6 billion years, the climate has been warm. Scientists, however, have identified seven periods in which large portions of the planet have been covered by ice. These periods, marked by advance and retreat of huge ice sheets, are known as ice eras. Ice eras are broken down into shorter periods called ice epochs, and within those epochs are even shorter subdivisions called ice ages. The coldest part of the Ice Age that shaped the world as we know it today occurred about 21,000 years ago.

Climate in the Ice Age
During Earth’s most recent Ice Age, half of the ocean water was covered in ice. Temperatures both on land and in the ocean were much colder, and there was less rainfall in most areas. Lower levels of precipitation made it difficult for forests to grow, so much of the land was grassland instead. Some areas of North America that are relatively dry today received abundant rainfall, however. Vast forests stretched across the Great Plains, and lakes flourished throughout the American Southwest.

Causes of Ice Ages
One of the first explanations for what caused the Ice Ages was presented by a French mathematician named Joseph A. Adhémar in 1842. His theory was that the Ice Age was brought about by changes in Earth’s orbit. His argument was supported by the fact that the colder climate of 11,000 years ago occurred when the northern hemisphere was at its farthest distance from the Sun. Other scientists followed with variations on Adhémar’s theory, but none were able to fully match their theories with known information about ice age frequency. Today, many scientists believe that glacial cycles occur because of a combination of factors, which include not only the Earth’s tilt, orbit, and spin, but also interactions between the ocean, atmosphere, and Sun activity.

Future Climate Change
Will the ice return? Many scientists believe we are in an interglacial period, and Earth could be heading toward another ice age. The last four interglacial periods lasted 8,000 to 12,000 years, and ours has already lasted 11,000 years. Glacial cycles could also be affected by other climate controls, however, such as the movement of Earth’s plates and by gases in the atmosphere. Currently, human activity is increasing the amount of carbon dioxide and other greenhouse gases, which could warm the climate and prevent another ice age. Many fear, however, that global warming could result in climate changes as devastating as any ice age.

Directions: Respond to each statement in the space provided.

1. Compare the climate during the last Ice Age with Earth’s global climate today.

2. Predict how life on Earth would be affected by another ice age.

3. Assess whether you think it is important for people to do what they can to prevent global climate change. Explain your answer on a separate sheet of paper.
You learned in Chapter 11 that most of California has a fairly mild Mediterranean or highland climate. California has some areas, however, where the climate is as extreme as any in the world. Death Valley is one of those places.

**Climate**

Death Valley, located in southeastern California and straddling the border with Nevada, is one of the hottest, driest places in the world. At 282 feet below sea level, it also is the point with the lowest altitude in the entire western hemisphere. Summer temperatures average well over 100°F, and average annual rainfall is less than 5 cm per year. For five months of the year, the valley floor endures almost constant heat, which lessens only slightly during the other seven.

The landscape of Death Valley includes sand dunes, canyons, and badlands surrounded by snow-covered mountains. These peaks prevent most rain from entering the valley.

**Life in Death Valley**

Despite the extreme nature of the climate, more than 1,000 species of plants live within Death Valley National Park, which encompasses the 156-mile-long Death Valley. From February to March, parts of Death Valley are transformed into a garden of bloom that includes cactus species and many plants that grow only in the Death Valley region. Valley plants have adapted to the sparse rainfall by developing root systems and leaves that trap moisture in a variety of ways. The roots of some plants go deeper than ten times a person’s height. Other root systems are just below the surface but spread out extensively in all directions. Some leaves and stems allow very little evaporation.

Numerous mammals also make their homes in this desert environment, including mice, ground squirrels, kangaroo rats, porcupines, bobcats, foxes, and even wild burros and horses. Most species are nocturnal, meaning they come out only after sunset. At night, the temperatures fall quickly because the air has very little humidity.

More than a million people visit Death Valley every year to view this natural wonder, alongside the resident Native Americans. Humans have adapted to this harsh environment throughout history, however, as evidenced by archeological sites and waves of gold prospectors, miners, and homesteaders.

**Directions:** Respond to each question or statement below.

1. **Infer** why Death Valley has a desert climate when so much of California has a mild climate.

   ____________________________________________________________

2. **Conclude** why so many living things can survive the harsh climate of Death Valley.

   ____________________________________________________________

3. **Find out** about other areas in California with climates other than Mediterranean and highland climates. What types of climates are they, and where are they located? Write up your findings and prepare individual or group presentations for the class.

   ____________________________________________________________

   ____________________________________________________________
### Content Vocabulary
#### Weather and Climate

**Directions:** Use the terms below to fill in the blanks in the following paragraph.

<table>
<thead>
<tr>
<th>climate</th>
<th>dew point</th>
<th>humidity</th>
<th>hydrosphere</th>
</tr>
</thead>
<tbody>
<tr>
<td>precipitation</td>
<td>relative humidity</td>
<td>water cycle</td>
<td>weather</td>
</tr>
</tbody>
</table>

Air pressure, wind, temperature, and moisture are some of the factors used to describe (1) ______________________. (2) ________________________ is the amount of moisture, or water vapor, in the air. The amount of water vapor in the air relative to the maximum amount the air can hold at that temperature is the (3) ________________________. At the (4) ________________________, water vapor condenses and forms droplets. Weather and the (5) ________________________ are driven by the Sun’s energy. As water moves between the (6) ________________________ and the atmosphere, water evaporates, clouds form, and (7) ________________________ falls. (8) ________________________ is the average of weather patterns in an area over a long period of time.

**Directions:** Complete each of the following sentences by circling the correct term in parentheses.

9. When lighter, warmer air moves over heavier, colder air, a (cold front/warm front) forms.  
10. A (cold front/warm front) occurs when colder air moves toward warm air.  
11. A (cold front/warm front) often brings severe storms.  
12. A (cold front/warm front) usually results in steady rain.  
13. Mild, wet winters and hot, dry summers characterize a (highland/mediterranean) climate.  
14. A (highland/mediterranean) climate has cool to cold temperatures.  
15. (Highland/Mediterranean) climates occur at high altitudes.  
16. Summer fires are likely to occur in a (highland/mediterranean) climate.  
17. (Sea/land) breezes occur when air pressure over the ocean is higher than that over the land.  
18. The cooling of air over land at night produces (sea/land) breezes.  
19. (Valley/Mountain) breezes usually occur during the daytime, when the land is hot.  
20. The sinking of cool, dense mountain air into the valley produces (valley/mountain) breezes.
**Content Vocabulary CONTINUED**

**Directions:** Define each of the terms below. Use complete sentences.

21. air mass

________________________________________________________________________

________________________________________________________________________

22. seasons

________________________________________________________________________

________________________________________________________________________

23. drought

________________________________________________________________________

________________________________________________________________________

24. flash flood

________________________________________________________________________

________________________________________________________________________

25. rain shadow

________________________________________________________________________

________________________________________________________________________

26. Santa Ana winds

________________________________________________________________________

________________________________________________________________________
**Chapter Review**

**Weather and Climate**

**Part A. Vocabulary Review**

**Directions:** Write each term next to its definition below.

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>air mass</td>
<td>the atmospheric conditions at a particular place and time</td>
</tr>
<tr>
<td>climate</td>
<td>a period of time when precipitation is much lower than normal or absent</td>
</tr>
<tr>
<td>cold front</td>
<td>hot, dry winds blowing from the east or northeast toward the coast</td>
</tr>
<tr>
<td>dew point</td>
<td>colder air moving toward warm air</td>
</tr>
<tr>
<td>drought</td>
<td>sudden inundation of water due to heavy rains</td>
</tr>
<tr>
<td>flash flood</td>
<td>body of air that has consistent temperature and relative humidity</td>
</tr>
<tr>
<td>rain shadow</td>
<td>the temperature at which air becomes fully saturated with water vapor</td>
</tr>
<tr>
<td>Santa Ana winds</td>
<td>lighter, warmer air moving over heavier, colder air</td>
</tr>
<tr>
<td>warm front</td>
<td>the average temperature, humidity, wind, and precipitation patterns over a long period of time</td>
</tr>
<tr>
<td>weather</td>
<td>area of low rainfall on the downwind slope of a mountain</td>
</tr>
</tbody>
</table>

**Part B. Concept Review**

**Directions:** Compare and contrast the terms in each of the questions below using complete sentences.

1. humidity, relative humidity

2. mediterranean climate, highland climate
Chapter Review CONTINUED

3. valley breeze, mountain breeze

Directions: Respond to each of the statements or questions below using complete sentences.

4. **Distinguish** between high-pressure and low-pressure systems, and describe the type of weather associated with each.

5. **Consider** the climate controls in your own region. What are they, and how do they contribute to the climate you experience?

6. **Imagine** that you were asked to predict the weather in your area. What factors would you need to observe and measure?

Directions: Diagram the water cycle by filling in the terms for the processes illustrated below.
Lesson 1: Weather

A. __________________________ describes the atmospheric conditions of a certain place at a certain time.

1. Temperature, rainfall, barometric pressure, __________________________, cloud coverage, visibility, and wind are all weather factors.

2. Air __________________________ is a measure of the average kinetic energy of air molecules.

3. Air __________________________ is the pressure a column of air exerts on the air below.
   a. Air pressure is __________________________ close to Earth’s surface and lower at higher altitudes.
   b. A __________________________ is used to measure air pressure, or barometric pressure.

4. __________________________ is the amount of water vapor per volume of air.

5. The amount of water vapor present in the air compared to the maximum amount of water vapor the air can hold at that temperature is the __________________________.
   a. Relative humidity is measured in __________________________.
   b. For example, 50 percent relative humidity means __________________________ the amount of water vapor that the air can hold at that temperature is in the air.

6. The __________________________ is the temperature at which air becomes fully saturated with water vapor.
   a. If the temperature is above freezing, water droplets will condense, forming __________________________.
   b. If the temperature is below freezing, ice crystals or __________________________ will form.

7. __________________________ are water droplets or ice crystals that are suspended in the atmosphere.
   a. __________________________ is a suspension of water droplets or ice crystals that form close to Earth’s surface.

8. When water in liquid or solid form falls from the atmosphere, it is called __________________________.
   a. Rain, snow, sleet, and __________________________ are all forms of precipitation.
Chapter Outline CONTINUED

B. The ____________ describes the movement of water between the hydrosphere and atmosphere.

1. The Sun’s energy causes water in the ____________ to evaporate.
2. Plants release water vapor through ________________.
3. Air masses rise, air expands and cools, and water vapor ________________ into clouds.
4. __________________ falls from the clouds back to the hydrosphere of Earth’s surface.

Lesson 2: Weather Patterns

A. Weather conditions change rapidly due to the movement of ________________.

1. An air mass is a body of air with consistent weather features, such as ________________ and humidity.
2. The boundary between two air masses of different density, moisture, and temperature is called a ________________.
   a. A ________________ forms when a mass of colder air moves toward warm air.
   b. As cold air pushes warm air up, it cools, forming clouds and often causing ________________.
   c. A ________________ forms when lighter, warmer air moves over heavier, colder air.
   d. The warm air ________________, resulting in steady rain.
3. Low-pressure systems occur when warm air ________________; high-pressure systems occur when cold air ________________.
   a. ________________ systems are associated with cloudy, stormy weather.
   b. ________________ systems are associated with fair weather.
4. Weather ________________ provide information about pressure systems and weather fronts.

B. ________________ regularly affecting weather include day and night, El Niño and La Niña, and seasons.

1. The Sun warms the air and ground during the ________________, and at night, the air and ground ________________.
2. The regular changes in temperature and length of day resulting from the tilt of Earth’s axis are _________________.

3. ________________ and La Niña cycles affect weather worldwide.
   a. During an El Niño period, ________________ surface water in the eastern equatorial Pacific Ocean leads to more water vapor in the air.
   b. El Niño results in increased ________________ across California, the southeastern United States, and parts of South America, and ________________ rainfall in Australia, Indonesia, and southeast Africa.
   c. During a ________________ period, sea surface temperatures in the eastern equatorial Pacific are ________________, producing colder than normal winter temperatures in the northwestern United States.

C. ________________ weather can pose a threat to all living things.
   1. A ________________ is a period of time when precipitation is much lower than normal or absent.
   2. Excessive rainfall or melting snow can lead to ________________.
      a. A ________________ is a flood that takes place suddenly.
      b. Flash floods are the number one reason for weather-related ________________ in the United States.

Lesson 3: Climate

A. The ________________ of a region affects all of the organisms that live there.
   1. The ________________ of the weather patterns of an area over a long period of time is the climate.
   2. The classification of climate ________________ involves temperature, precipitation, and vegetation.
      a. Most of ________________ has either a mediterranean climate or a highland climate.
      b. A ________________ climate is characterized by mild, wet winters and hot, dry summers.
      c. A ________________ climate is characterized by cool to cold temperatures and high altitudes.
Chapter Outline CONTINUED

B. Climates are shaped by the ________________, latitude, altitude, proximity to water bodies and mountain barriers, winds, and ocean currents.

1. The farther a region is from the equatorial ________________, the colder its climate.

2. Climates in ________________ regions are often milder, because water can absorb or lose large amounts of heat without changing temperature.

3. Ocean ________________ affect climate by redistributing the Sun’s energy in the form of heat.
   a. The ________________ affects the climate of Great Britain by carrying warm water from the equator.
   b. The ________________ affects the California climate by carrying cold water from polar regions.

4. The global system of ________________ winds significantly affects climate.
   a. Most of the United States, including California, is influenced by the ________________.
   b. California ________________ bring heat waves during summer and mild temperatures in winter.

5. Human activities, such as the burning of fossil fuels, can affect climate by increasing the presence of greenhouse gases that could lead to ________________.

Lesson 4: California Climate and Local Weather Patterns

A. The westerlies, ________________, and mountains all strongly influence California’s climate.

1. ________________ are found at high-altitude locations, which are cooler and have more precipitation than lower-altitude areas.

2. Dry summers and rainy winters are characteristic of ________________.
   a. California’s seasons are characterized as ________________ and ________________, rather than hot and cold.
   b. California is dry in summer due to an offshore high-pressure system, the ________________.
   c. California’s rainy season is typically from ________________ to March.
3. Much of California’s coast is known for the presence of _________________.
   a. Warm, moist air blown by the ________________ passes over the cold California Current and condenses.
   b. The ________________ of northern California depend on the moisture from fog to survive dry summers.
   c. Fog is also present in the Great Central Valley during California’s ________________ season.

4. An area of low rainfall on the downwind slope of a mountain is called ________________.
   a. Because the water vapor condenses as the air mass rises, most ________________ falls before the clouds can pass over the mountain.

B. Winds blow from ________________ to low-pressure regions and are named for the direction from which they blow.
   1. ________________ blow from sea to land when the air above land is heated during the day.
   2. ________________ blow from land to sea as air cools and sinks over the land at night.
   3. ________________ blow upward from the valley to the mountain slopes during the day when the land is hot.
   4. ________________ blow downward from the mountains after sunset as the mountain air cools more rapidly than the valley air.
   5. ________________ are hot, dry winds that blow from the east or northeast in southern California and continue toward the ________________.
      a. The air starts out cool and dense but becomes hot and dry as it is ________________ and forced down-slope through narrow canyons.
      b. Santa Ana winds can influence the start of ________________ and increase their spread.