



# Climate

## section 1 What is climate?

### ● Before You Read

What do you think of when you hear the word *climate*? On the lines below, describe the climate where you live.

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### What You'll Learn

- what climate is and what determines a region's climate
- how latitude, oceans, and other factors affect climate

### ● Read to Learn

#### Climate

Imagine you are wandering through a rain forest. You see beautiful pink and purple flowers under towering trees. Unusual birds fly through the air, and animals leap through the tree branches. All of these organisms grow well in hot temperatures with plenty of rainfall. Rain forests have a hot, wet climate. **Climate** is the pattern of weather that occurs in an area over many years. An area's climate determines which plants and animals can survive and how people live.

#### Latitude and Climate

Latitude is a measure of how far north or south of the equator a place is. A place's latitude affects its climate.

#### How does latitude affect climate?

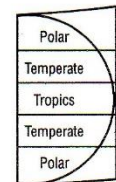
Areas nearest the equator, the tropics, have warmer temperatures than areas farther away from the equator. The **tropics** are the climate zones that get the most radiation from the Sun, or solar radiation. The tropics are located between latitude 23.5° N and latitude 23.5° S. This area receives the most direct solar energy. The tropics have temperatures that are always hot, except in the mountains.

#### Study Coach

**Two-Column Notes** As you read, organize your notes in two columns. In the left-hand column, write the main idea of each paragraph. Next to it, in the right-hand column, write details about the main idea.

#### FOLDABLES™

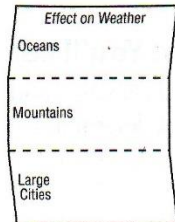
**A Classify** Make a half-book Foldable as shown. Record information about the different zones as you read this section.



## FOLDABLES™

### B Cause and Effect

Divide one sheet of paper into three parts and label as shown. As you read, write down the effect that oceans, mountains, and large cities have on weather.



### Reading Check

1. **Explain** How does a large body of water affect the climate of nearby land?

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### Picture This

2. **Label** On the map, mark the region where you live. Does any large body of water affect your climate?

## Where are the polar and temperate zones?

There are two polar zones. The north polar zone stretches from latitude  $66.5^{\circ}$  N to the north pole. The south polar zone stretches from latitude  $66.5^{\circ}$  S to the south pole. A **polar zone** receives solar radiation at a low angle and is never warm.

There are also two temperate zones. A **temperate zone** is located between the tropics and the polar zones and has a climate with moderate temperatures. Most of the United States is in a temperate zone.

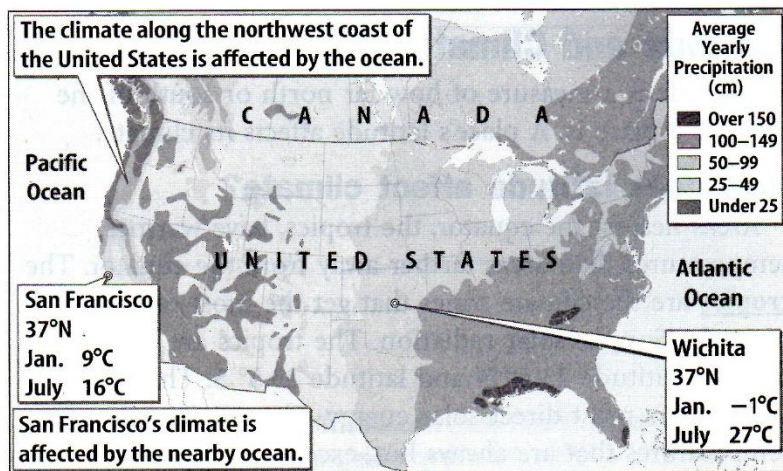
## Other Factors

Besides latitude, other factors influence a region's climate. Some natural features that affect climate are large bodies of water, ocean currents, and mountains. Large cities also can change weather patterns and affect local climate.

## How do large bodies of water affect climate?

Water takes longer to heat up than land. Water also cools down more slowly than land. Large bodies of water affect the climate of nearby areas by absorbing and giving off heat. In general, areas near a large body of water are warmer in the winter and cooler in the summer than areas that are not near a large water body. ✓

Find San Francisco on the map below. Now look inland and find Wichita, Kansas. Although these two cities are at the same latitude, they do not have the same temperatures. San Francisco is warmer in winter and cooler in summer because it is near the ocean.



### How do ocean currents affect climate?

Ocean currents affect climates near the coast. Warm ocean currents begin near the equator. From the equator, they flow toward the north and south poles, warming the land areas they pass. As they near the poles, the currents cool off. The cool currents flow back toward the equator, cooling the air and climates of nearby land.

Winds blowing from the sea are often moister than those blowing from land. The moist sea air passes over the land, bringing rain. The sea air gives coastal areas a wetter climate than inland areas far from the sea. Look again at the map on the previous page. The northwest coast of the United States, including Washington, Oregon, and northern California, has a wet climate. This area receives a lot of moisture from the Pacific Ocean.

### How do mountains affect climate?

At the same latitude, the climate is colder in the mountains than at sea level. Radiation from the Sun heats Earth's surface. Heat from Earth then warms the atmosphere. Thin mountain air has fewer molecules to absorb heat than air near sea level. As a result, mountain air tends to be cooler than air at sea level.

Mountain ranges have a windward side which faces the wind and a leeward side which faces away from the wind. On the windward side of a mountain range, air rises, cools, and then drops its moisture on the land. On the leeward side, air flows down, heats up, and dries the land. Deserts are common on the leeward side of mountains because of this warm, dry air. ✓

### How do large cities affect climate?

Streets, parking lots, and buildings in large cities absorb the Sun's rays and heat up. The heat is transferred to the air where air pollution traps it. This trapped heat creates what is known as the heat-island effect. Temperatures in large cities can be 5°C higher than in the nearby countryside.



### Think it Over

3. **Explain** Why does mountain air absorb less heat than air at sea level?

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### ✓ Reading Check

4. **Identify** Is the leeward side of a mountain the wet side or the dry side?

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## ● After You Read

### Mini Glossary

**climate:** pattern of weather that occurs in an area over many years

**polar zone:** climate zone that gets the least solar radiation and is never warm

**temperate zone:** climate zone with moderate temperatures that is located between the tropics and the polar zones

**tropics:** climate zones that get the most solar radiation and are always hot, except at high elevations

1. Review the terms and their definitions in the Mini Glossary. Then write a sentence that explains the difference between the tropics and the polar climate zones.

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2. Write a sentence in each box to explain how mountains affect climate.

The cool air releases moisture as rain or snow on the windward side of the mountain.

The dry air passes over the mountain to the leeward side.

The dry air flows down the leeward side of the mountain and heats up.

Moist air flows toward a mountain and is forced upward, where it cools.

#### How Mountains Affect Climate

First

Second

Third

Fourth

3. You organized your notes in two columns, one for main ideas and one for details. How did this help you understand climate?

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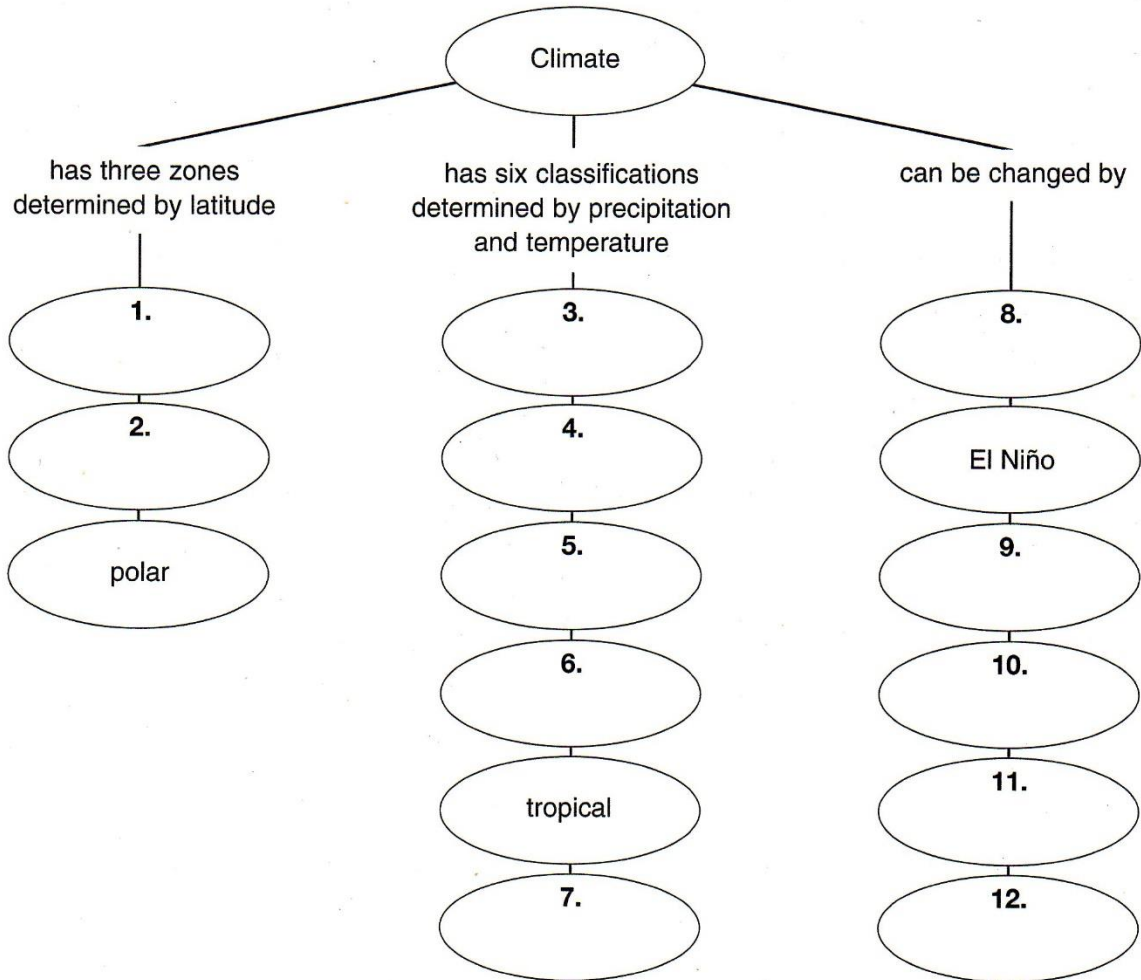
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Directed Reading for **Overview**  
 Content Mastery **Climate**

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

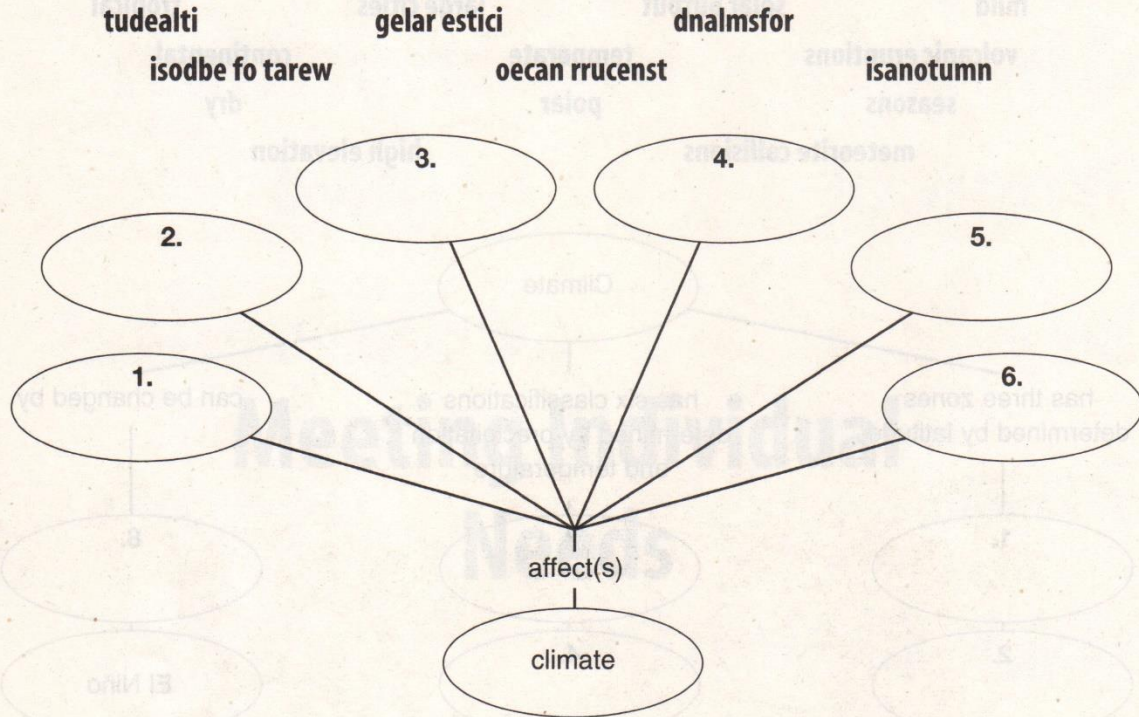
mild solar output large cities tropical  
 volcanic eruptions temperate continental  
 seasons polar dry  
 meteorite collisions high elevation



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.



**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 _____.        | a. temperature, moisture, and amount of sunlight. |
| _____ 8. Water heats up and cools down _____.                | b. it cools.                                      |
| _____ 9. As air rises, _____.                                | c. structural adaptation.                         |
| _____ 10. Climates can be classified based on _____.         | d. leeward side of mountains, away from the wind. |
| _____ 11. Hibernation and estivation are two kinds of _____. | e. more slowly than land.                         |
| _____ 12. Deserts are common on the _____.                   | f. behavioral adaptations.                        |

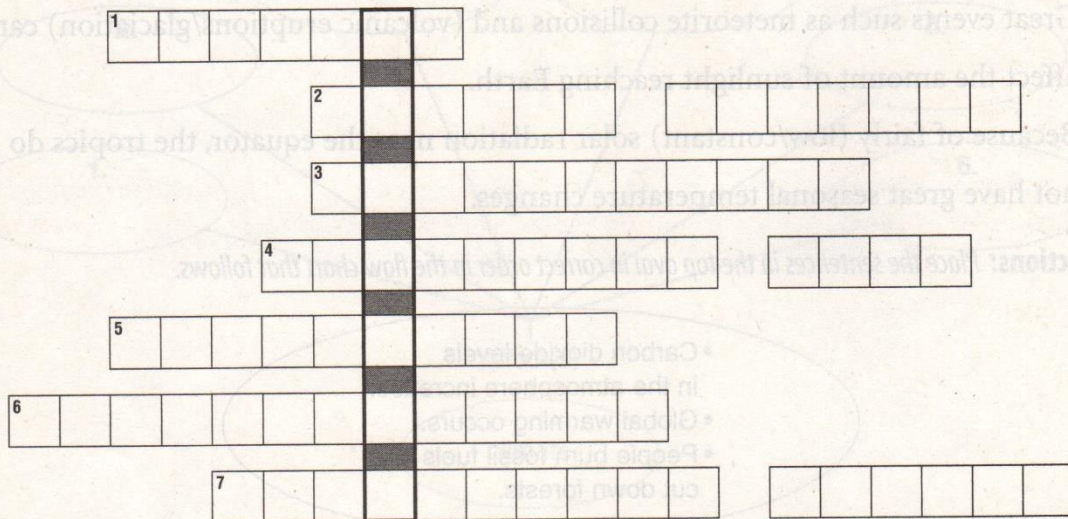


Directed Reading for  
Content Mastery

**Key Terms**  
**Climate**

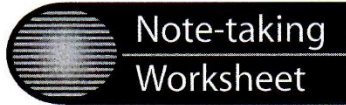
**Directions:** Use the following terms to complete the puzzle below. The letters in the dark vertical box will spell a familiar word.

adaptation      global warming      hibernation  
temperate zone      deforestation      tropics      greenhouse effect



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

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 \_\_\_\_\_.

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.



**Note-taking Worksheet** (continued)**Section 2 Climate Types**

- A. Köppen'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 changes 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 \_\_\_\_\_ and sometimes \_\_\_\_\_
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.
- Solar radiation is blocked by larger numbers of solid and liquid \_\_\_\_\_ entering the atmosphere.
    - Catastrophic events such as \_\_\_\_\_ and \_\_\_\_\_ collisions can cause climatic change.
    - \_\_\_\_\_ can also cause climatic change.
  - Variations in solar radiation, possibly related to the presence of \_\_\_\_\_ can cause climatic change.
  - Earth's movements in space can change the amount of \_\_\_\_\_ reaching it.
    - Earth's \_\_\_\_\_ changes about every 41,000 years.
    - Earth's \_\_\_\_\_ wobbles in space.
    - The shape of Earth's \_\_\_\_\_ changes over a 100,000-year cycle.
  - The movement of Earth's \_\_\_\_\_ affects the transfer of heat on Earth.
- E. Climatic changes today
- Greenhouse effect**—a natural heating process that occurs when certain gases such as \_\_\_\_\_, \_\_\_\_\_, and water vapor in Earth's atmosphere trap heat
  - Global warming**—Earth's average global surface temperature is rising, possibly due to the increase in \_\_\_\_\_ in our atmosphere.
  - Human activities affect the air in Earth's atmosphere.
    - Burning \_\_\_\_\_ increases the amount of carbon dioxide in the atmosphere.
    - \_\_\_\_\_ results in fewer trees to absorb carbon dioxide from the atmosphere.
    - Individuals can help reduce the amount of \_\_\_\_\_ in the atmosphere.