

Climate and Climate Change ▪ *Guided Reading and Study*

What Causes Climate?

This section describes factors that determine climate, or the average weather conditions in an area. The section also explains what causes the seasons.

Use Target Reading Skills

The first column in the chart lists key terms in this section. As you read the section, write a sentence in the second column, using each key term and your own words. The first key term is done for you.

| Key Term | Sentence Using the Key Term |
|---------------------|---|
| Climate | Climate depends on the average, year-after-year amount of precipitation and temperature of an area. |
| Microclimate | |
| Tropical zone | |
| Polar zone | |
| Temperate zone | |
| Marine climate | |
| Continental climate | |
| Windward | |
| Leeward | |
| Monsoon | |

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What Causes Climate? *(continued)*

Introduction

1. The average, year-after-year conditions of temperature, precipitation, winds, and clouds in an area is its _____.
2. A small area with climate conditions that differ from those around it is called a(n) _____.

Factors Affecting Temperature

3. What are the main factors that influence temperature?

4. It is colder at high latitudes because the sun’s rays strike Earth’s surface at a(n) _____ angle there.
5. List the three temperature zones on Earth’s surface that are based on latitude.
 - a. _____
 - b. _____
 - c. _____
6. Complete the following compare-and-contrast table to show the relationship among temperature zones, latitude, and angle of the sun’s rays.

| Temperature Zone | Latitude Is Between | Angle of Sun’s Rays |
|------------------|--------------------------------------|---|
| a. _____ | 23.5° north and b. _____ | Direct or nearly direct all year round |
| Temperate | c. _____ and 23.5° to 66.5° south | More direct in the summer; Less direct in d. _____ |
| e. _____ | f. _____ _____ _____ | Less direct all year round |

- g. Use the chart to write one or two sentences about the relationship between latitude and the angle of the sun’s rays.

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h. Is the climate of a temperate zone in summer more like a polar zone or a tropical zone? Use the information in the table to explain your answer.

7. Is the following sentence true or false? Areas at high altitudes have cool climates, no matter what their latitude. _____

Match the type of climate with its description.

| Type of Climate | Description |
|------------------------------|---|
| _____ 8. marine climate | a. Relatively warm winters and cool summers |
| _____ 9. continental climate | b. Cold winters and warm or hot summers |

10. Circle the letter of each sentence that is true about how ocean currents influence climates.

- a. Ocean currents influence many marine climates.
- b. Only warm ocean currents influence climates.
- c. The North Atlantic Drift gives Ireland a warm climate for its latitude.
- d. The California Current gives the West Coast a warm climate for its latitude.

Factors Affecting Precipitation

11. List the main factors that affect precipitation.

- a. _____ b. _____

12. Is the following sentence true or false? Winds blowing inland from oceans carry less water than winds blowing from land. _____

13. Circle the letter of each sentence that is true about the effect of mountain ranges on precipitation.

- a. Precipitation falls mainly on the leeward side of mountains.
- b. The windward side of mountains is in a rain shadow.
- c. As air rises to pass over a mountain range, its water vapor condenses, forming clouds.
- d. Precipitation usually falls on the side of the mountains that is hit by oncoming wind.

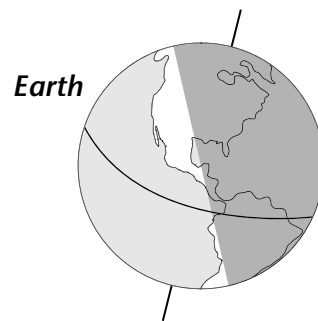
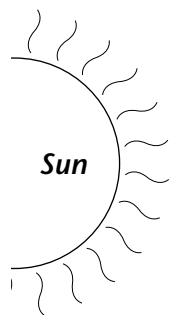
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What Causes Climate? *(continued)*

The Seasons

14. Is the following sentence true or false? It is colder in the winter in the Northern Hemisphere because Earth is farther from the sun then.

15. When Earth is in the position shown in the drawing, what season is it in the Northern Hemisphere?



16. Circle the letter of each sentence that is true about Earth's axis.

- a. The axis always points in the same direction.
- b. The north end of the axis is tilted away from the sun all year.
- c. When it is summer in the Southern Hemisphere, the south end of the axis is tilted toward the sun.
- d. In March and September, neither end of the axis is tilted toward the sun.

17. Why is Earth's surface warmer in the Northern Hemisphere when it is summer there?

Climate and Climate Change ▪ *Section Summary*

What Causes Climate?

Key Concepts

- What factors influence temperature?
- What factors influence precipitation?
- What causes the seasons?

Climate is the average, year-after-year conditions of temperature, precipitation, winds, and clouds in an area. The climate of a region is determined by two main factors: temperature and precipitation.

The same factors that affect climate regions also affect small areas. **Microclimates** are small areas with climate conditions that differ from those around them.

The main factors that influence temperature are latitude, altitude, distance from large bodies of water, and ocean currents. Earth's surface is divided into three temperature zones. The **tropical zone** is the area near the equator, between about 23.5° north latitude and 23.5° south latitude. It has a warm climate because it receives direct sunlight all year. The **polar zones** extend from about 66.5° to 90° north and 66.5° to 90° south latitudes. They have cold climates because the sun strikes the ground at a lower angle. The **temperate zones** are between the tropical and polar zones—from about 23.5° to 66.5° north and 23.5° to 66.5° south latitudes. They have weather that ranges from warm in the summer to cold in the winter. Altitude is an important climate factor because air temperature decreases as altitude increases. Large bodies of water influence temperatures because water heats up and cools down more slowly than land. **Marine climates** have relatively warm winters and cool summers. **Continental climates** occur in inland areas and are often characterized by cold winters and warm or hot summers. Many marine climates are also influenced by ocean currents.

The main factors that affect precipitation are prevailing winds, the presence of mountains, and seasonal winds. A mountain range in the path of prevailing winds influences where precipitation falls. Winds are forced to rise and pass over the mountains. The rising warm air cools, and its water vapor condenses and falls as rain or snow on the **windward** side of the mountains, the side the oncoming wind hits. The land on the **leeward**, or downwind, side of mountains receives little precipitation. Sea and land breezes over a large region that change direction with the seasons are called **monsoons**.

Most places on Earth, outside the tropics, have four seasons. **The seasons are caused by the tilt of Earth's axis as Earth travels around the sun.** The seasons change as the amount of energy each hemisphere receives from the sun changes. For example, in June the north end of Earth's axis is tilted toward the sun. The Northern Hemisphere receives more energy. It is summer in the Northern Hemisphere and winter in the Southern Hemisphere.

Climate and Climate Change ▪ *Review and Reinforce*

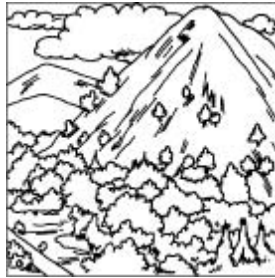
What Causes Climate?

Understanding Main Ideas

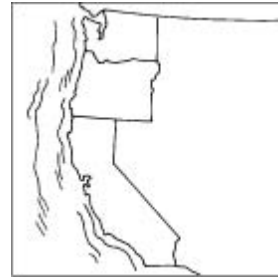
On a separate sheet of paper, identify the climate factor(s) that influence the climate in each picture. Indicate whether the climate factors are affecting temperature, precipitation, or both.



1. Alaska



2. Rocky Mountains



3. West Coast

Answer the following questions on your other sheet of paper.

4. Explain how Earth's tilted axis causes the seasons.
5. At what times of the year do both of Earth's hemispheres receive the same amount of energy from the sun? Explain why this occurs.

Building Vocabulary

Match each term with its definition by writing the letter of the correct definition on the line beside the term.

- | | |
|---------------------------|--|
| _____ 6. leeward | a. the average year-after-year conditions of temperature, precipitation, winds, and clouds |
| _____ 7. polar zones | b. an area near the equator that receives direct sunlight all year round |
| _____ 8. climate | c. the side of a mountain that faces the oncoming wind |
| _____ 9. windward | d. a small area with climate conditions different from those around it |
| _____ 10. tropical zone | e. areas that extend from about 66.5° to 90° north and south latitudes |
| _____ 11. microclimate | f. the side of a mountain that is downwind |
| _____ 12. temperate zones | g. sea and land breezes over a large region that change direction with the season |
| _____ 13. monsoon | h. areas located from about 23.5° to 66.5° north and south latitudes |

Climate and Climate Change ▪ *Enrich***Earth's Deserts**

Although they all have arid climates, not all deserts are the same. They are classified as trade wind, midlatitude, rain shadow, coastal, monsoon, or polar deserts.

Trade wind deserts occur near the equator. As trade winds blow toward the equator, they heat up and dry out. The result is little or no cloud cover or precipitation and more sunlight heating the ground. Most of Earth's large deserts are in areas affected by trade winds. The world's largest desert, the Sahara in North Africa, is a trade wind desert.

Midlatitude deserts occur mostly in Earth's temperate zones. These deserts are far from oceans and are sometimes called "cold" deserts, although they may have a wide temperature range. The Sonoran Desert in southwestern North America is a midlatitude desert.

Coastal deserts are usually found on the western edge of continents near the Tropics of Cancer and Capricorn. The Atacama of South America is a coastal desert. In the Atacama, measurable rainfall—one millimeter or more of rain—is rare, occurring only about every 5–20 years.

Monsoon deserts form when warm ocean water evaporates, forms clouds, and is blown over hot, dry land. The result is heavy rainfall. As the air mass moves and drops its moisture, it dries out completely. Land located farther inland receives no rain. The Rajasthan Desert of India is a monsoon desert.

Polar deserts receive less than 250 millimeters of precipitation a year. Instead of sand dunes, snow dunes are sometimes common. Antarctica is an example of a polar desert.

Answer the questions below on a separate sheet of paper.

1. Why is Antarctica classified as a desert even though it has snow and ice?

2. Where do most of Earth's large deserts occur?

3. Where are coastal deserts usually found?

4. Compare and contrast two of the desert classifications described above.

Climate and Climate Change ▪ *Skills Lab*

Sunny Rays and Angles

Problem

How does the angle of a light source affect the rate at which the temperature of a surface changes?

Skills Focus

controlling variables, graphing, interpreting data, making models

Materials

books

scissors

watch or clock

100-W incandescent lamp

black construction paper

graph paper

ruler

3 thermometers or temperature probes


pencil

clear tape

protractor

Procedure

Review the safety guidelines in Appendix A in your textbook.

1. Cut a strip of black construction paper 5 cm by 10 cm. Fold the paper in half and tape two sides to form a pocket.
2. Repeat Step 1 to make two more pockets.
3.  Place the bulb of a thermometer inside each pocket. If you are using a temperature probe, see your teacher for instructions.
4. Place the pockets with thermometers close together as shown in in your textbook. Place one thermometer in a vertical position (90° angle), one at a 45° angle, and the third one in a horizontal position (0° angle). Use a protractor to measure the angles. Support the thermometers with books.
5. Position the lamp so that it is 30 cm from each of the thermometer bulbs. Make sure the lamp will not move during the activity.
6. Examine the data table on the next page.
7. In the data table, record the temperature on all three thermometers. (All three temperatures should be the same.)
8. Switch on the lamp. In the data table, record the temperature on each thermometer every minute for 15 minutes. **CAUTION:** *Be careful not to touch the hot lampshade or lightbulb.*
9. After 15 minutes, switch off the lamp.

Climate and Climate Change ▪ *Skills Lab*

Sunny Rays and Angles *(continued)*

Data Table

| Time (min.) | Temperature (°C) | | |
|--------------|------------------|-----------|-----------|
| | 0° Angle | 45° Angle | 90° Angle |
| <i>Start</i> | | | |
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |
| 7 | | | |
| 8 | | | |
| 9 | | | |
| 10 | | | |
| 11 | | | |
| 12 | | | |
| 13 | | | |
| 14 | | | |
| 15 | | | |

Climate and Climate Change ▪ *Skills Lab***Analyze and Conclude**

Write an answer for each question on a separate piece of paper.

- 1. Controlling Variables** In this experiment, what was the manipulated variable? What was the responding variable?
- 2. Graphing** Graph your data. Label the horizontal axis and vertical axis of your graph, as shown in the sample graph in your textbook. Use solid, dashed, and dotted lines to show the results from each thermometer, as shown in the key in your textbook.
- 3. Interpreting Data** According to your data, at which angle did the temperature increase most?
- 4. Interpreting Data** At which angle did the temperature increase least?
- 5. Making Models** What part of Earth's surface does each thermometer represent?
- 6. Drawing Conclusions** Why is air at the North Pole still very cold in the summer even though the Northern Hemisphere is tilted towards the sun?
- 7. Communicating** Write a paragraph explaining what variables were held constant in the three parts of this experiment.

Design an Experiment

Design an experiment to find out how the results of the investigation would change if the lamp were placed farther from the thermometers. Later, design another experiment to find out what would happen if the lamp were placed closer to the thermometers.