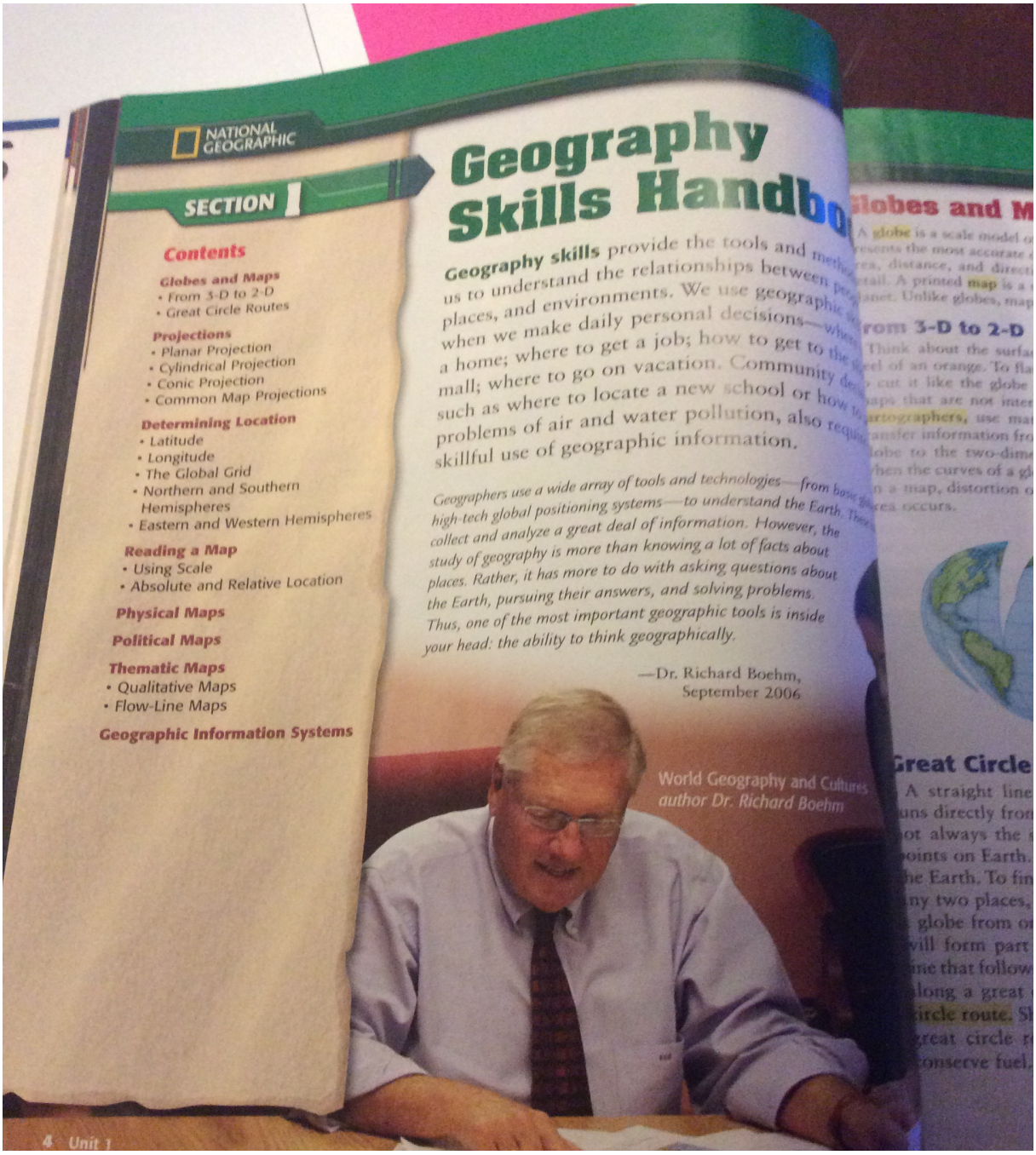
NATIONAL GEOGRAPHIC
SECTION 1
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Globes and Maps
• From 3-D to 2-D
• Great Circle Routes
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• Planar Projection
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• Eastern and Western Hemispheres
Reading a Map
• Using Scale
• Absolute and Relative Location
Physical Maps
Political Maps
Thematic Maps
• Qualitative Maps
• Flow-Line Maps
Geographic Information Systems
Geography Skills Handbo
Geography skills provide the tools and meth
us to understand the relationships between pe
places, and environments. We use geographic
when we make daily personal decisions—whe
a home; where to get a job; how to get to the
mall; where to go on vacation. Community de
such as where to locate a new school or how t
problems of air and water pollution, also requi
skillful use of geographic information.
Geographers use a wide array of tools and technologies—from basic
high-tech global positioning systems—to understand the Earth. The
collect and analyze a great deal of information. However, the
study of geography is more than knowing a lot of facts about
places. Rather, it has more to do with asking questions about
the Earth, pursuing their answers, and solving problems.
Thus, one of the most important geographic tools is inside
your head: the ability to think geographically.
—Dr. Richard Boehm,
September 2006
World Geography and Cultures
author Dr. Richard Boehm
Globes and M
A globe is a scale model o
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ea, distance, and direct
tail. A printed map is a
anet. Unlike globes, map
rom 3-D to 2-D
Think about the surfa
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lobe to the two-dime
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ea occurs.
Great Circle
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globe from o
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4 Unit 1

Globes and Maps

A **globe** is a scale model of the Earth. Because Earth is round, a globe presents the most accurate depiction of geographic information such as area, distance, and direction. However, globes show little close-up detail. A printed **map** is a symbolic representation of all or part of the planet. Unlike globes, maps can show small areas in great detail.

From 3-D to 2-D

Think about the surface of the Earth as the peel of an orange. To flatten the peel, you have to cut it like the globe shown here. To create maps that are not interrupted, mapmakers, or **cartographers,** use mathematical formulas to transfer information from the three-dimensional globe to the two-dimensional map. However, when the curves of a globe become straight lines on a map, distortion of size, shape, distance, or area occurs.

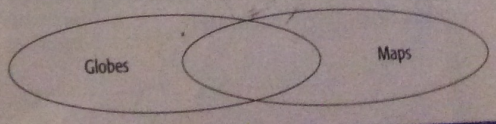
Great Circle Routes

A straight line of true direction—one that runs directly from west to east, for example—is not always the shortest distance between two points on Earth. This is due to the curvature of the Earth. To find the shortest distance between any two places, stretch a piece of string around a globe from one point to the other. The string will form part of a *great circle,* an imaginary line that follows the curve of the Earth. Traveling along a great circle is called following a **great circle route.** Ship captains and airline pilots use great circle routes to reduce travel time and conserve fuel.

The idea of a great circle route is an important difference between globes and maps. A round globe accurately shows a great circle route, as indicated on the map below. However, as shown on the flat map, the great circle distance (dotted line) between Tokyo and Los Angeles appears to be far longer than the true direction distance (solid line). In fact, the great circle distance is 315 miles (507 km) shorter.

PRACTICING THE SKILL

1. **Explain** the significance of: globe, map, cartographer, great circle route.
2. **Describe** the problems that arise when the curves of a globe become straight lines on a map.
3. **Use** a Venn diagram like the one below to identify the similarities and differences between globes and maps.



5

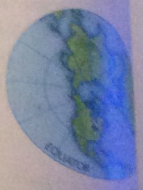
NATIONAL GEOGRAPHIC

Projections

To create maps, cartographers project the round Earth onto a flat surface—making a **map projection**. Distance, shape, direction, or size may be distorted by a projection. As a result, the purpose of the map usually dictates which projection is used. There are many kinds of map projections, some with general names and some named for the cartographers who developed them. Three basic categories of map projections are shown here: **planar**, **cylindrical**, and **conic**.

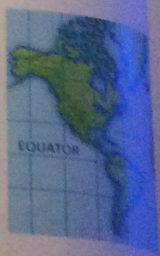
Planar Projection

A planar projection shows the Earth centered in such a way that a straight line coming from the center to any other point represents the shortest distance. Also known as an azimuthal projection, it is most accurate at its center. As a result, it is often used for maps of the Poles.



Cylindrical Projection

A cylindrical projection is based on the projection of the globe onto a cylinder. This projection is most accurate near the Equator, but shapes and distances are distorted near the Poles.



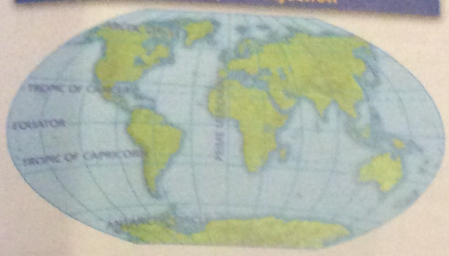
Conic Projection

A conic projection comes from placing a cone over part of a globe. Conic projections are best suited for showing limited east-west areas that are not too far from the Equator. For these uses, a conic projection can indicate distances and directions fairly accurately.

Common Map Projections

Each type of map projection has advantages and some degree of inaccuracy. Four of the most common projections are shown here.

Winkel Tripel Projection



Most general reference world maps are the Winkel Tripel projection. It provides a good balance between the size and shape of land areas as they are shown on the map. Even the polar areas are depicted with little distortion of size and shape.

Goode's Interrupted Equal-Area Projection

An **interrupted projection** resembles a globe that has been cut apart and laid flat. Goode's Interrupted Equal-Area projection shows the true size and shape of Earth's landmasses, but distances are generally distorted.

Robinson Projection

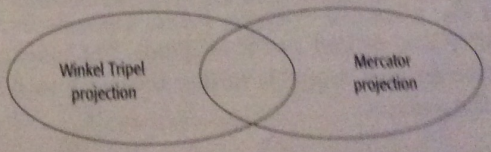
The Robinson projection has minor distortions. The sizes and shapes near the eastern and western edges of the map are accurate, and outlines of the continents appear much as they do on the globe. However, the polar areas are flattened.

Mercator Projection

The Mercator projection increasingly distorts size and distance as it moves away from the Equator. However, Mercator projections do accurately show true directions and the shapes of landmasses, making these maps useful for sea travel.

PRACTICING THE SKILL

1. **Explain** the significance of: map projection, planar, cylindrical, conic, interrupted projection.
2. **Which** of the four common projections described above is the best one to use when showing the entire world? Why?
3. **Draw** a map of the world from memory, labeling continents, oceans, and as many countries as you can. Then trade maps with a partner and look for similarities and differences between your maps. Discuss how each person's spatial perspective is reflected in his or her map.
4. **Use** a Venn diagram like the one below to identify the similarities and differences between the Winkel Tripel and Mercator projections.



NATIONAL GEOGRAPHIC

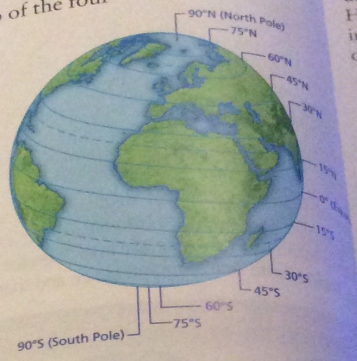
Determining Location

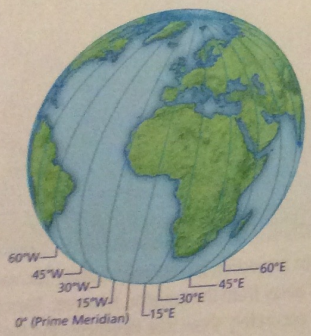
Geography is often said to begin with the question *Where?* The basic tool for answering the question is **location.** Lines on globes and maps provide information that can help you locate places. These lines cross one another forming a pattern called a **grid system,** which helps you find exact places on the Earth's surface.

A **hemisphere** is one of the halves into which the Earth is divided. Geographers divide the Earth into hemispheres to help them classify and describe places on Earth. Most places are located in two of the four hemispheres.

Latitude

Lines of **latitude,** or parallels, circle the Earth parallel to the Equator and measure the distance north or south of the Equator in degrees. The **Equator** is measured at 0° latitude, while the Poles lie at latitudes 90°N (north) and 90°S (south). Parallels north of the Equator are called north latitude. Parallels south of the Equator are called south latitude.



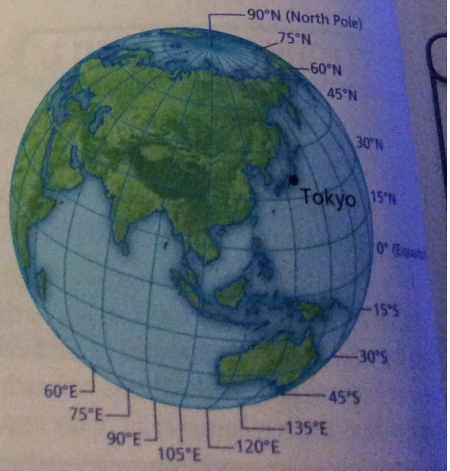


Longitude

Lines of **longitude,** or meridians, circle the Earth from Pole to Pole. These lines measure distance east or west of the **Prime Meridian** at 0° longitude. Meridians east of the Prime Meridian are known as east longitude. Meridians west of the Prime Meridian are known as west longitude. The 180° meridian on the opposite side of the Earth is called the International Date Line.

The Global Grid

Every place has a global address, or **absolute location.** *You can identify the absolute location of a place by naming the latitude and longitude lines that cross exactly at that place. For example, Tokyo, Japan, is located at 36°N latitude and 140°E longitude. For more precise readings, each degree is further divided into 60 units called minutes.*

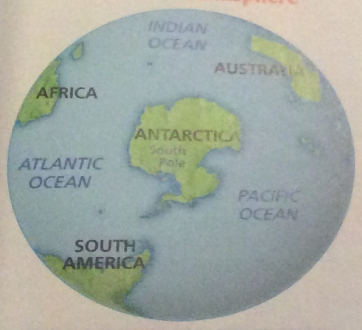


Northern and Southern Hemispheres

The diagram below shows that the Equator divides the Earth into the Northern and Southern Hemispheres. Everything north of the Equator is in the **Northern Hemisphere.** Everything south of the Equator is in the **Southern Hemisphere.**

Northern Hemisphere

Southern Hemisphere

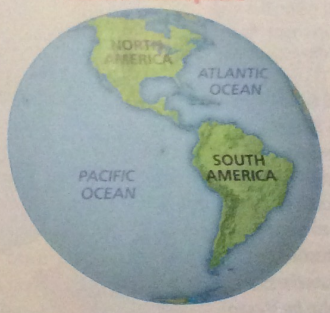


Eastern and Western Hemispheres

The Prime Meridian and the International Date Line divide the Earth into the Eastern and Western Hemispheres. Everything east of the Prime Meridian for 180° is in the **Eastern Hemisphere.** Everything west of the Prime Meridian for 180° is in the **Western Hemisphere.**

Eastern Hemisphere

Western Hemisphere



PRACTICING THE SKILL

1. **Explain** the significance of: location, grid system, hemisphere, latitude, Equator, longitude, Prime Meridian, absolute location, Northern Hemisphere, Southern Hemisphere, Eastern Hemisphere, Western Hemisphere.
2. **Which** lines of latitude and longitude divide the Earth into hemispheres?
3. **Use** the Reference Atlas maps to create a chart listing the latitude and longitude of three world cities. Have a partner try to identify the cities.
4. **Use** a chart like the one below to identify the continents in each hemisphere. Continents will appear in more than one hemisphere.

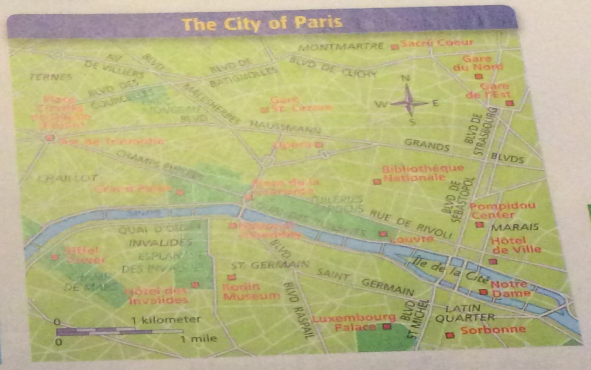
Hemisphere	Continents
Northern	
Southern	
Eastern	
Western	

Using Scale

All maps are drawn to a certain scale. **Scale** is a consistent, proportional relationship between the measurements shown on the map and the measurement of the Earth's surface.

Small-Scale Maps A small-scale map, like this political map of France, can show a large area but little detail. Note that the scale bar on this map indicates that about 1 inch is equal to 200 miles.

Large-Scale Maps A large-scale map, like this map of Paris, can show a small area with a great amount of detail. Study the scale bar. Note that the map measurements correspond to much smaller distances than on the map of France.

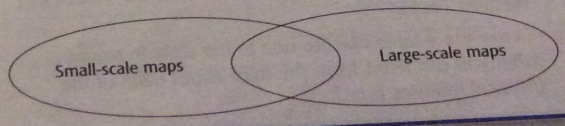


Absolute and Relative Location

As you learned on page 8, absolute location is the exact point where a line of latitude crosses a line of longitude. Another way to indicate location is by **relative location,** or the location of one place in relation to another. To find relative location, find a reference point—a location you already know—on a map. Then look in the appropriate direction for the new location. For example, locate Paris (your reference point) on the map of France above. The relative location of Lyon can be described as southeast of Paris.

PRACTICING THE SKILL

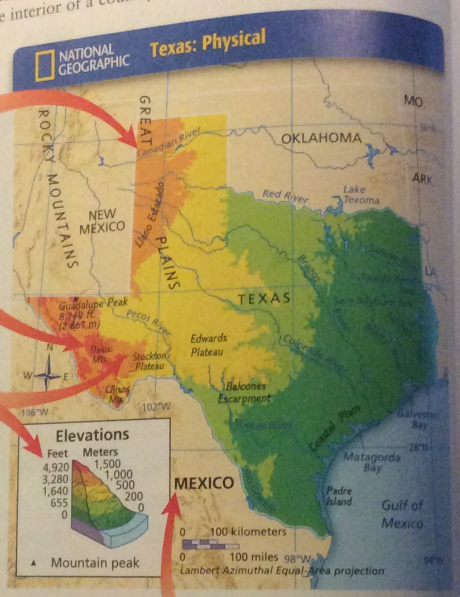
1. **Explain** the significance of: key, compass rose, cardinal directions, intermediate directions, scale bar, scale, relative location.
2. **Describe** the elements of a map that help you interpret the information displayed on the map.
3. **How** does the scale bar help you determine distances on the Earth's surface?
4. **Describe** the relative location of your school in two different ways.
5. **Use** a Venn diagram to identify the similarities and differences between small-scale maps and large-scale maps.



NATIONAL GEOGRAPHIC

Physical Maps

A **physical map** shows the location and the **topography**, or shape of the Earth's physical features. A study of a country's physical features often helps to explain the historical development of the country. For example, mountains may be barriers to transportation, and rivers and streams can provide access into the interior of a country.



Water Features

Physical maps show rivers, streams, lakes, and other water features.

Landforms

Physical maps may show landforms such as mountains, plains, plateaus, and valleys.

Relief and Elevation

Physical maps use shading and texture to show general **relief**—the differences in **elevation**, or height, of landforms. An elevation key uses colors to indicate specific measured differences in elevation above sea level.

Political Features

Some physical maps also show political features such as boundary lines, countries, and states.

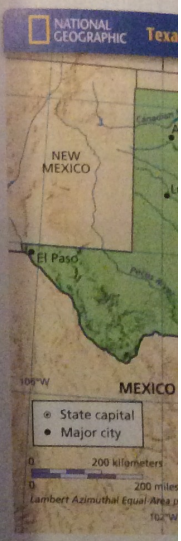
PRACTICING THE SKILL

1. **Explain** the significance of: physical map, topography, relief, elevation.
2. **What** is the approximate elevation of central Texas? Of western Texas?
3. **Complete** a table like the one to the right to explain what you can learn from the map about each of the physical features listed.

Physical Feature	What You Can Learn from the Map
Davis Mountains	
Red River	
Gulf Coastal Plains	

Political Maps

A political map shows the l
such as countries, states, co
depicted on a political map a
rather than by nature. Politic
that exist within and betwee



Nonsubject A

Areas surrounding the
a different color to set
you a context for the

PRACTICING TH

1. **Explain** the significance of
2. **What** types of informatio
map that would not appe
3. **Complete** a table like the
what you can learn from
human-made features list

5

Guide to Reading

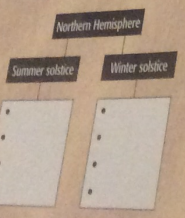
Section Preview
Earth's position in relation to the sun affects temperatures, day and night, and seasons on Earth.

Content Vocabulary
- weather (p. 51)
- climate (p. 51)
- axis (p. 51)
- temperature (p. 51)
- revolution (p. 51)
- equinox (p. 51)
- solstice (p. 51)
- greenhouse effect (p. 52)
- global warming (p. 53)

Academic Vocabulary
- contrast (p. 51)
- affects (p. 51)
- regulated (p. 52)

Places to Locate
- Tropic of Cancer (p. 51)
- Tropic of Capricorn (p. 52)

Reading Strategy
Categorizing Complete a graphic organizer similar to the one below by listing the major characteristics of the summer and winter solstices.



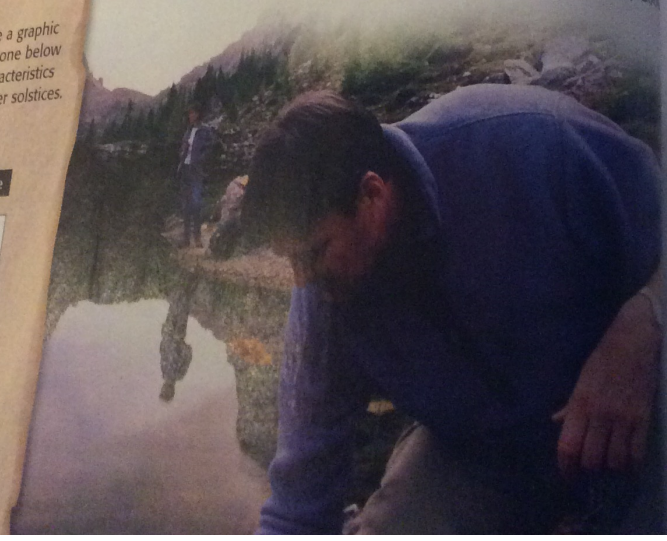
Earth-Sun Relationships

From the Alps in the heart of Europe, scientists gathe data about melting glaciers and changes in the snow line. Their research reveals information about the Earth's atmosphere and the warming effects of the sun. Such dynamic relationships between the Earth and the sun influence all life on Earth.

NATIONAL GEOGRAPHIC VOICES AROUND THE WORLD

"We marvel at the mountains, but it's the water that everything depends on. . . . Snow, glaciers, permafrost, surging hot springs, aquamarine ramparts of ice—the very capillaries of the rock itself are permeated with water. It comes sleeking down black rock faces, it drips into hidden cavern pools. If the Alps had a voice, it would be the musical notes of water. Water is what is literally holding the high mountains together, and if the ice and permafrost begin to lose their grip, as is already happening, the mountains start to crumble."

—Erla Zwingle, "Meltdown: The Alps Under Pressure," *National Geographic*, February 200



Climate

MAIN Idea The and the sun affects Earth in dramatic

GEOGRAPHY AND are sitting in geog parts of the world relationship cause

Climate is ofte is a short-term condition of the a limited period the window or they need um checking the w

Climate is the an area typically time. People in frequently use climate. In co climate of Pho to protect then

Earth's Ti

Earth's tilt i light. As the **axis**—an ima Pole to the So ter—is curre 23½°. Becau places on the direct sunligh

For this re **temperature**– place is. Area sunlight hav that receive usually meas most comm

Climate and Weather

MAIN Idea The relationship between the Earth and the sun affects climate, which influences life on Earth in dramatic ways.

GEOGRAPHY AND YOU Did you know that as you are sitting in geography class it is nighttime in some parts of the world? Read to learn how the Earth-sun relationship causes night and day.

Climate is often confused with weather, which is a short-term aspect of climate. **Weather** is the condition of the atmosphere in one place during a limited period of time. When people look out the window or watch the news to see whether they need umbrellas or sunscreen, they are checking the weather.

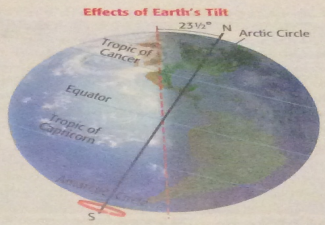
Climate is the term for the weather patterns that an area typically experiences over a long period of time. People in Seattle, Washington, for example, frequently use umbrellas because of the rainy, wet climate. In **contrast,** people in the dry, desert climate of Phoenix, Arizona, must use sunscreen to protect themselves from the sun.

Earth's Tilt and Rotation

Earth's tilt is one reason for variations in sunlight. As the diagram above shows, the Earth's **axis**—an imaginary line running from the North Pole to the South Pole through the planet's center—is currently tilted at an angle of about 23½°. Because of the tilt of this axis, not all places on the planet receive the same amount of direct sunlight at the same time.

For this reason, the angle of tilt **affects** the **temperature**—the measure of how hot or cold a place is. Areas that receive a large amount of direct sunlight have warmer temperatures than places that receive little direct sunlight. Temperature is usually measured in degrees on a set scale. The most common scales for measuring temperature are Fahrenheit (°F) and Celsius (°C).

Whether or not a particular place on Earth receives light also depends on the side of the planet that is facing the sun. Earth rotates on its axis, making one complete rotation every 24 hours. Rotating from west to east, the Earth faces first one hemisphere and then the other toward the sun, alternating between the light of day and the darkness of night.



Earth's Revolution

While planet Earth is rotating on its axis, it is also traveling in an orbit around the sun, our nearest star. It takes the Earth a few hours more than 365 days—one year—to complete one **revolution,** or trip around the sun.

The Earth's revolution and its tilt cause changes in the angle and amount of sunlight that reach different locations on the planet. These changes follow a regular progression known as the seasons. During the course of a year, people on most parts of the Earth experience distinct differences in the length of days and the daily temperature as the seasons change.

The seasons are reversed north and south of the Equator. When it is spring in the Northern Hemisphere, it is fall in the Southern Hemisphere. When it is winter in the Southern Hemisphere, it is summer in the Northern Hemisphere. Around March 21, the sun's rays fall directly on the Equator. This day is called an **equinox** (meaning "equal night") because daylight and nighttime hours are equal.

The Tropics of Cancer and Capricorn As the Earth continues its revolution around the sun, it moves so that eventually the sun's rays directly strike the **Tropic of Cancer** at 23½° N, the northernmost point on the Earth to receive the direct rays of the sun. These direct rays reach the Tropic of Cancer about June 21, bringing the Northern Hemisphere its longest day of sunlight. This date, known as the summer **solstice,** marks the beginning of summer in the Northern Hemisphere.

By about September 23, the Earth has revolved so that the sun's rays directly strike the Equator again. This equinox marks the beginning of fall in the Northern Hemisphere. Gradually the sun's direct rays strike farther south, reaching their southernmost latitude of 23½° S, at the **Tropic of Capricorn** about December 22. The winter solstice is the day of shortest daylight in the Northern Hemisphere, beginning the season of winter.

The Poles The most dramatic variation in the amount of sunlight occurs at the Poles. For six months of the year, one Pole is tilted toward the sun and receives continuous sunlight, while the other Pole is tilted away from the sun and receives little to no sunlight.

At the North Pole, the sun never sets from about March 20 to September 23. At the South Pole, continuous daylight lasts from about September 23 to March 20. The tilt of the Earth's axis as it revolves around the sun causes this natural phenomenon, known as the midnight sun. The occurrence of the midnight sun goes almost unnoticed in sparsely populated Antarctica. Parts of northern North America (including Alaska) and northern Europe in the Arctic, however, have become popular tourist destinations as lands of the midnight sun.

READING Check **Regions** What factor distinguishes weather from climate?

The Greenhouse Effe

MAIN Idea The natural process of the greenh effect has been influenced by human activity.

GEOGRAPHY AND YOU Have you heard accounts of the dangers of global warming? Re learn how global warming can affect Earth.

Even on the sunniest days in the warmest mates, only part of the sun's radiation pa through the Earth's atmosphere. The atmosp reflects some radiation back into space. Enou radiation, however, reaches the Earth to wa the land, water, and air.

Because the atmosphere traps some heat keeps it from escaping back into space quickly, Earth's atmosphere is like the glass greenhouse—it traps the sun's energy for gr ing plants even in cold weather. Without **greenhouse effect**, the Earth would be too c for most living things.

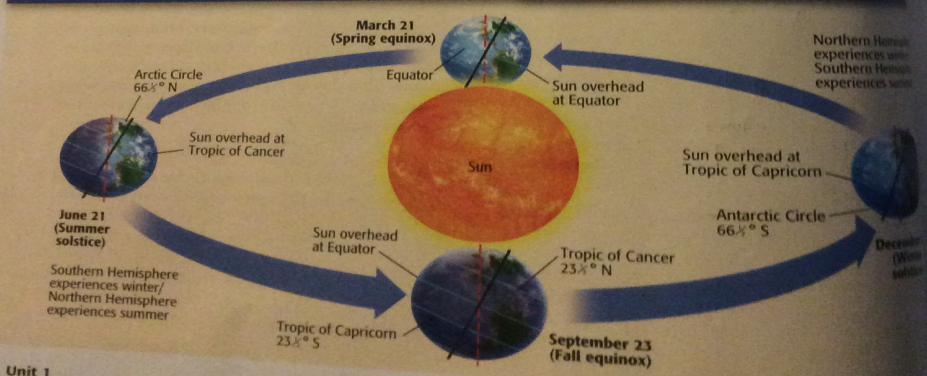
In order to support plant growth, condit in a greenhouse must be **regulated.** If too m

DIAGRAM STUDY

1. **Regions** Why are the seasons reversed in the Northern and Southern Hemispheres?
2. **Place** Explain the difference between the equinox and the solstices.

Concepts in Motion Use StudentWorks™ Plus or glencoe.

NATIONAL GEOGRAPHIC **The Earth's Seasons**



heat escapes, the plants will
heat is trapped, the plants w
The greenhouse effect of E
lows some of the same ge
the atmosphere provides jus
insulation to promote life
50 percent of the sun's radi
Earth is converted into infr
Clouds and greenhouse ga
ponents such as water vap
(CO_2)—absorb the heat re
radiate it back again so th
Many scientists, howev
decades a rise in atmosph
cided with a general rise
This trend—known a
believed to be caused in
such as the burning of c
These fossil fuels release
house gas, in the atmosp
Some scientists report
make weather patterns
example, will evaporate
increasing humidity an
water evaporation fro
land to dry out more q
areas may even becom

SECTION 1 R

Vocabulary

1. Explain the significance
revolution, equinox, so
warming.

Main Ideas

2. Explain the greenhou
process has been infl
3. Use a chart like the o
ship between the Ea
characteristics of the
effects on climate.

Earth-Sun Relationship
Tilt
Rotation
Revolution

NATIONAL GEOGRAPHIC

Reading a Map

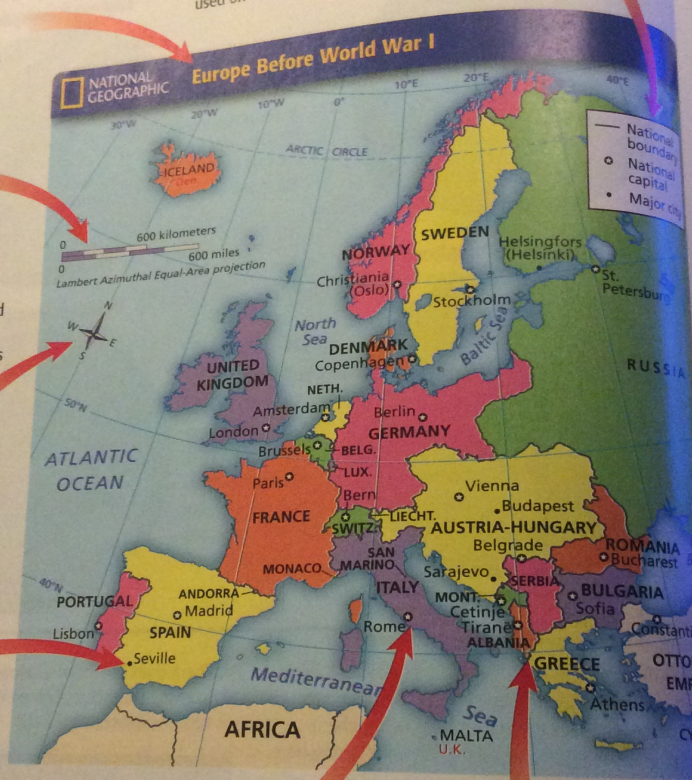
In addition to latitude and longitude, maps feature other important tools to help you interpret the information they contain. Learning to use these map tools will help you read the symbolic language of maps more easily.

Key

The **key** lists and explains the symbols, colors, and lines used on the map. The key is sometimes called a legend.

Title

The title tells you what kind of information the map is showing.



Scale Bar

The **scale bar** shows the relationship between map measurements and actual distances on the Earth. By laying a ruler along the scale bar, you can calculate how many miles or kilometers are represented per inch or centimeter. The map projection used to create the map is often listed near the scale bar.

Compass Rose

The **compass rose** indicates directions. The four **cardinal directions**—north, south, east, and west—are usually indicated with arrows or the points of a star. The **intermediate directions**—northeast, northwest, southeast, and southwest—may also be shown.

Cities

Cities are represented by a dot. Sometimes the relative sizes of cities are shown using dots of different sizes.

Capitals

National capitals are often represented by a star within a circle.

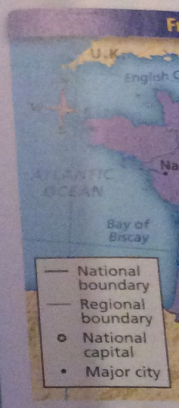
Boundary Lines

On political maps of large areas, boundary lines highlight the borders between different countries and states.

Using Scale

All maps are drawn to a proportional relationship between the measurement of the map and the measurement of the actual area.

Small-Scale Maps A small-scale map is a political map of France. It shows little detail. Notice that the scale on this map indicates that 1 inch equals 200 miles.



Absolute

As you learn the exact point line of longitude tion is by relat place in relati

PRACTI

1. **Explain** th directions tive locati
2. **Describe** the infor
3. **How** do the Earth

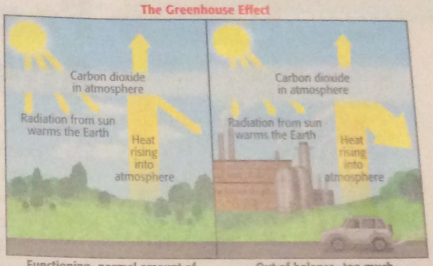
heat escapes, the plants will freeze. If too much heat is trapped, the plants will wilt or dry out.

The greenhouse effect of Earth's atmosphere follows some of the same general rules. Normally, the atmosphere provides just the right amount of insulation to promote life on the planet. The 50 percent of the sun's radiation that reaches the Earth is converted into infrared radiation, or heat. Clouds and greenhouse gases—atmospheric components such as water vapor and carbon dioxide (CO_2)—absorb the heat reflected by the Earth and radiate it back again so that a balance is created.

Many scientists, however, claim that in recent decades a rise in atmospheric CO_2 levels has coincided with a general rise in global temperatures. This trend—known as global warming—is believed to be caused in part by human activities, such as the burning of coal, oil, and natural gas. These fossil fuels release carbon dioxide, a greenhouse gas, in the atmosphere that traps more heat.

Some scientists report that global warming will make weather patterns more extreme. Water, for example, will evaporate more rapidly from oceans, increasing humidity and rainfall generally. Rapid water evaporation from soil, however, will cause land to dry out more quickly between rains. Some areas may even become drier than before.

The Greenhouse Effect



Functioning–normal amount of carbon dioxide in atmosphere

Out of balance–too much carbon dioxide in atmosphere

Scientists do not all agree on the nature of global warming and its effects. Some claim that a natural cycle, not human activity, is causing rising temperatures. Others claim that the evidence for global warming is inconclusive and that it is too early to forecast future effects.

READING Check **Human-Environment Interaction** How has human activity contributed to global warming?

THE WORLD

SECTION 1 REVIEW

Vocabulary

1. Explain the significance of: weather, climate, axis, temperature, revolution, equinox, solstice, greenhouse effect, global warming.

Main Ideas

2. Explain the greenhouse effect. Then describe how this natural process has been influenced by human activity.
3. Use a chart like the one below to describe how the relationship between the Earth and the sun affects climate. List characteristics of the Earth-sun relationship and describe their effects on climate.

Earth-Sun Relationship	Effects on Climate
Tilt	
Rotation	
Revolution	

Critical Thinking

4. BIG Ideas What effects does the Earth's tilt on its axis have on your daily life?
5. **Comparing and Contrasting** Explain the differences in the weather you would expect in Alaska and in Florida.
6. **Analyzing Information** What would you pack if you were visiting Argentina in December?
7. **Analyzing Visuals** Study the diagram of the Earth's seasons on page 52. In what months do the sun's rays directly strike the Equator? The Tropics of Cancer and Capricorn?

Writing About Geography

8. **Expository Writing** Review the text in Section 1 about global warming. Then write a paragraph explaining the ways in which agriculture may be affected.

Geography ONLINE
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