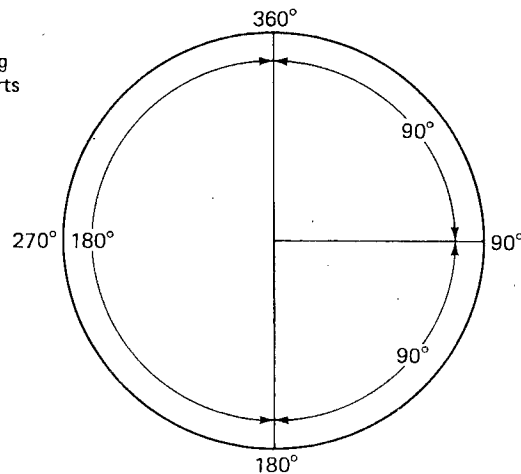# USING LATITUDE AND LONGITUDE

CHAPTER 24
Latitude on Globes and Maps

Introductory Note

Every circle, no matter how big or small, is made up of 360 parts or degrees. The symbol for a degree is °. So 360 degrees is usually written 360°. One half of a circle is 180°. One fourth of a circle is 90°.

360°

90°

270° 180°   90°

90°

180°

The earth is such a large place that directions alone will not help you find exact locations of places. Other guides are also needed. They are supplied by a system of imaginary lines that are drawn on many maps and globes.

You already know of one imaginary line called the equator, which divides the earth into the Northern Hemisphere and the Southern Hemisphere. Picture A shows the location of the equator on the earth. All other imaginary lines in Picture A are used to show distances north or south of the equator. The distance north or south of the equator is called *latitude*. That is why these imaginary lines are called *lines of latitude*. They are also called *parallels of latitude* because they never meet. They

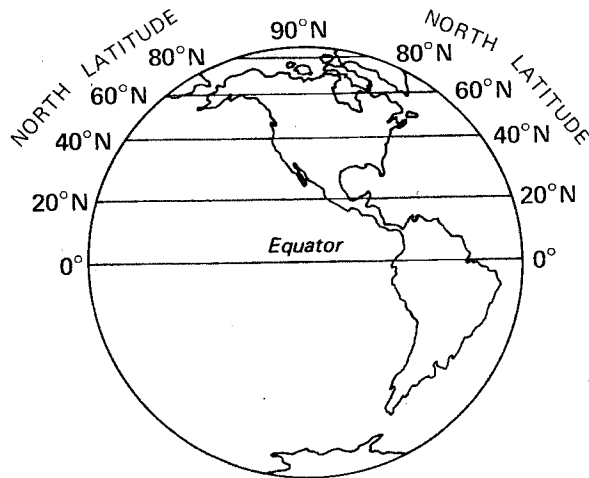North Pole

Equator

South Pole
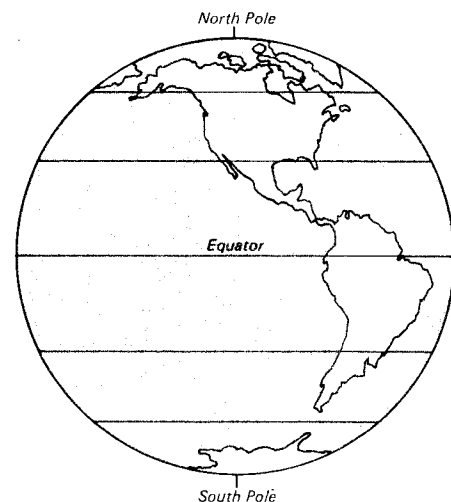
PICTURE A

remain the same distance from the equator all the way around the earth.

Latitude, or distance from the equator, is measured in degrees. Each parallel of latitude is one degree from the parallel above or below it. One degree of latitude equals about 69 miles on the earth's surface. Since latitude measurement starts at the equator, the equator is marked 0°. Every other line of latitude is numbered from 1° to 90°. This represents one-fourth of a circle, or one-fourth of 360°. (See the Introductory Note.)

There are 90° between the equator and the North Pole and 90° between the equator and the South Pole. As a result, 90 lines of latitude could be drawn north of the equator or south of the equator on a map of the earth. But this could make the map too crowded. So maps and globes generally show only some of the lines of latitude. Picture B, of the Western Hemisphere, shows lines of latitude for every 20° north of the equator. Other maps may show different degrees of latitude.
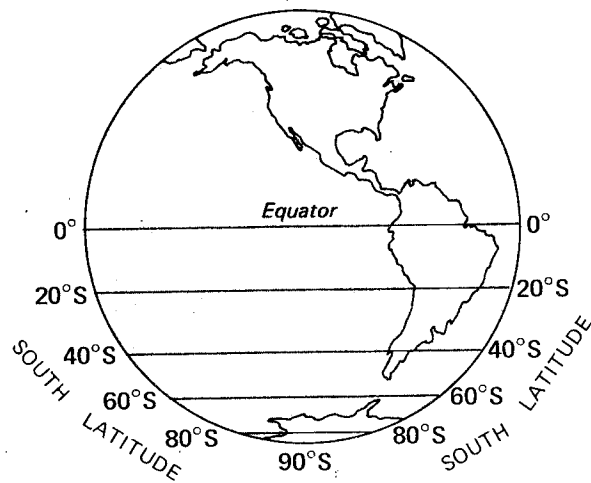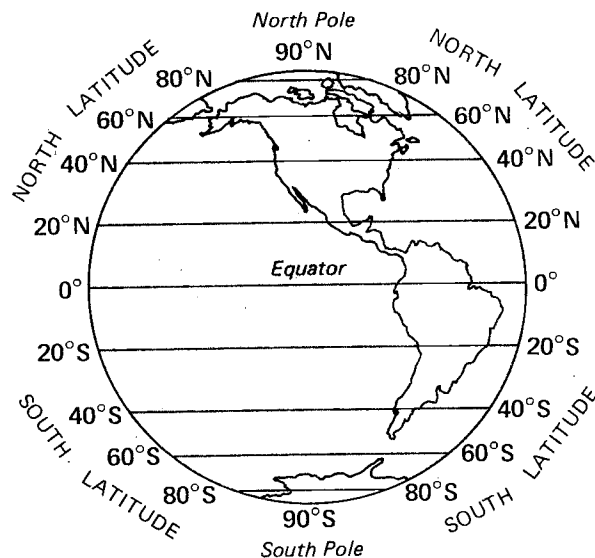

PICTURE C

PICTURE B

A degree of latitude north of the equator may have an N after it. For example, 60°N would mean 60° north of the equator.

Picture C shows that there are also 90° from the equator to the South Pole. A degree of latitude south of the equator may have an S after it. For example, 60°S would mean 60° south of the equator.

Picture D shows why it is important to look for the letter N or S after a degree of latitude. Both the Northern Hemisphere and the Southern Hemisphere contain 0°

PICTURE D

to 90°. The N or S tells you in which hemisphere a degree of latitude is located.

Use the information you have learned in this chapter to answer the following questions.

1. Lines of latitude are used on a map

_____ (a) to show that maps are better than globes.

_____ (b) to find distances north or south of the equator.

_____ (c) to find distances west or east of the equator.

Which answer did you choose? A line of latitude alone means nothing. It has mean-

ing only when it is used along with the equator. This is because a line of latitude tells you only one thing—how far some place is north or south of the equator. Therefore, the answer to question 1 is (*b*).

2. Lines of latitude are also called parallel lines because

_____ (*a*) they cross one another halfway around the earth.

_____ (*b*) they meet at the North Pole.

_____ (*c*) they remain the same distance from the equator all the way around the earth.

Which answer did you choose? Lines of latitude never meet. They remain the same distance from one another all around the earth, which is why they are called parallel lines. Therefore, the best answer to question 2 is (*c*).

3. Look at the diagram. Then decide which ship is in trouble at 45°N.

_____ (*a*) Ship A

_____ (*b*) Ship B

_____ (*c*) Ship C

Which answer did you choose this time? You are looking for the ship that is in
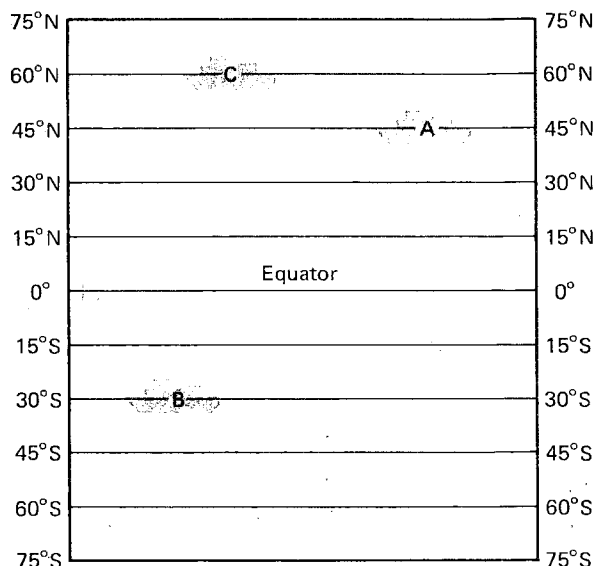
trouble at 45°N. The N after 45°N tells you that you must look north of the equator. Starting at the equator, move your finger north. Stop when you come to the line marked 45°N. You will see that it is Ship A that is on the 45°N line of latitude. Therefore, the answer to question 3 is (*a*).

The following exercises will give you practice in finding distances and locations with the help of latitude.

USING WHAT YOU HAVE LEARNED

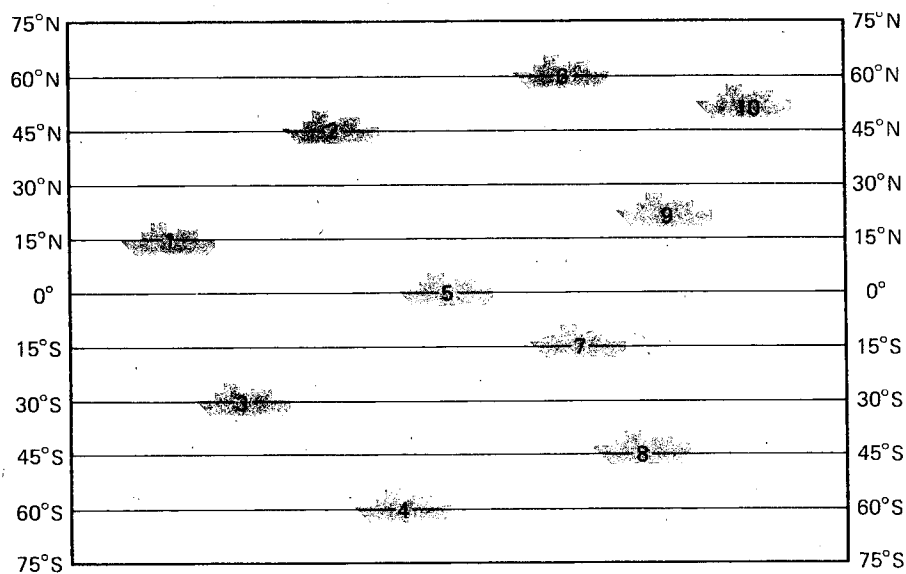**A.** Place a check mark next to the correct answers to questions 1 to 10.

1. The imaginary line that goes around the center of the earth is

_____ (*a*) an axis.

_____ (*b*) a pole.

_____ (*c*) the equator.

2. The imaginary lines used on a map to show distance north or south of the equator are called

_____ (*a*) lines, or parallels, of latitude.

_____ (*b*) degrees.

_____ (*c*) circles.

3. Latitude is measured in

_____ (*a*) miles.

_____ (*b*) inches.

_____ (*c*) degrees.

4. The symbol for a degree is

_____ (a) +.

_____ (b) °.

_____ (c) '.

5. How many degrees are in a circle?

_____ (a) 90°

_____ (b) 180°

_____ (c) 360°

6. How many degrees are in a large circle?

_____ (a) 360°

_____ (b) 400°

_____ (c) 460°

7. From the equator to the North Pole, there are

_____ (a) 90°.

_____ (b) 180°.

_____ (c) 360°.

8. From the equator to the South Pole, there are

_____ (a) 90°.

_____ (b) 180°.

_____ (c) 360°.

9. From the North Pole to the South Pole, there are

_____ (a) 90°.

_____ (b) 180°.

_____ (c) 360°.

10. A degree of latitude north or south of the equator

_____ (a) touches the North Pole or the South Pole.

_____ (b) runs from the North Pole to the South Pole.
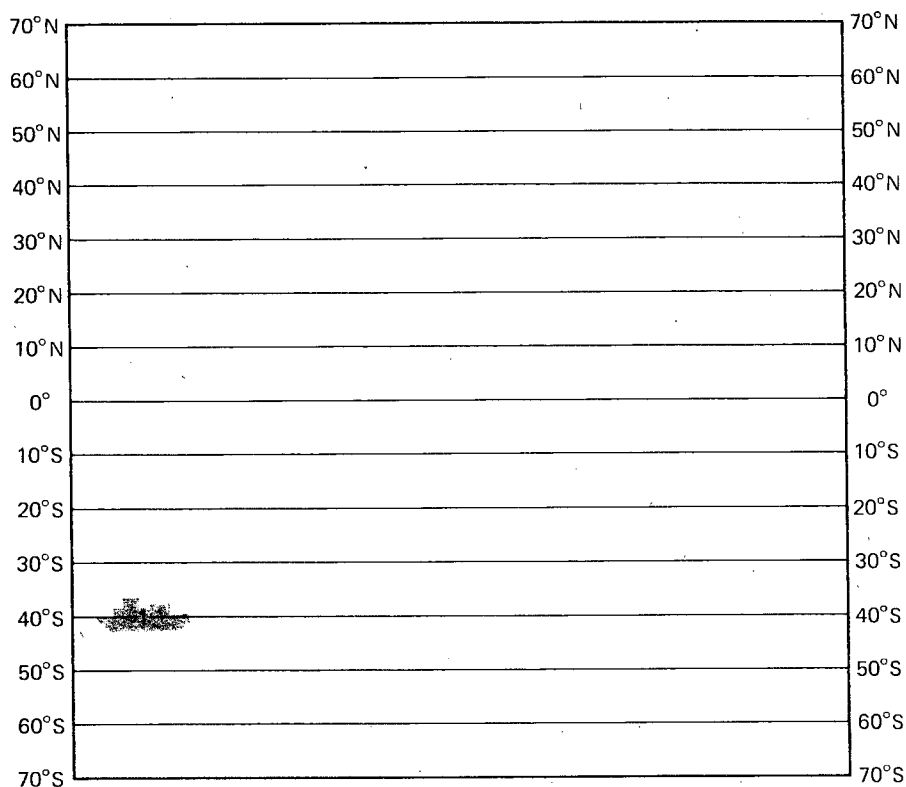
_____ (c) is often followed by an N or an S.

B. Latitude and Location.

In the spaces provided, write the degrees of latitude at which ships 1 to 10 are located. (See top of page 201.) The first one is done for you.

Ship 1 _____15°N_____   Ship 6 _____

Ship 2 _____   Ship 7 _____

Ship 3 _____   Ship 8 _____

Ship 4 _____   Ship 9 _____

Ship 5 _____   Ship 10 _____

75°N 75°N
60°N 60°N
45°N 45°N
30°N 30°N
15°N 15°N
0° 0°
15°S 15°S
30°S 30°S
45°S 45°S
60°S 60°S
75°S 75°S

C. Latitude and Location.

70°N 70°N
60°N 60°N
50°N 50°N
40°N 40°N
30°N 30°N
20°N 20°N
10°N 10°N
0° 0°
10°S 10°S
20°S 20°S
30°S 30°S
40°S 40°S
50°S 50°S
60°S 60°S
70°S 70°S

Locate the following degrees of latitude on the chart above by placing the number before each degree on the correct line of latitude. The first one is done for you.

1. 40°S
2. 60°N
3. 30°N
4. 20°N
5. 70°N

6. 0°
7. 25°S
8. 48°N
9. 5°N
10. 60°S

11. 30°S
12. 55°S
13. 18°N
14. 62°S
15. 27°N

D. In this chapter, you learned that every degree of latitude on a map equals 69 miles on the earth. If two cities are one degree apart on a map, then they are 69 miles apart on the earth. If two cities are two degrees apart on a map, then they are 138 miles apart on the earth. Here is how it is done: 69 miles × 2 degrees = 138 miles. Look at the map of Chile in South America. Use this map to answer the following questions on finding distances.
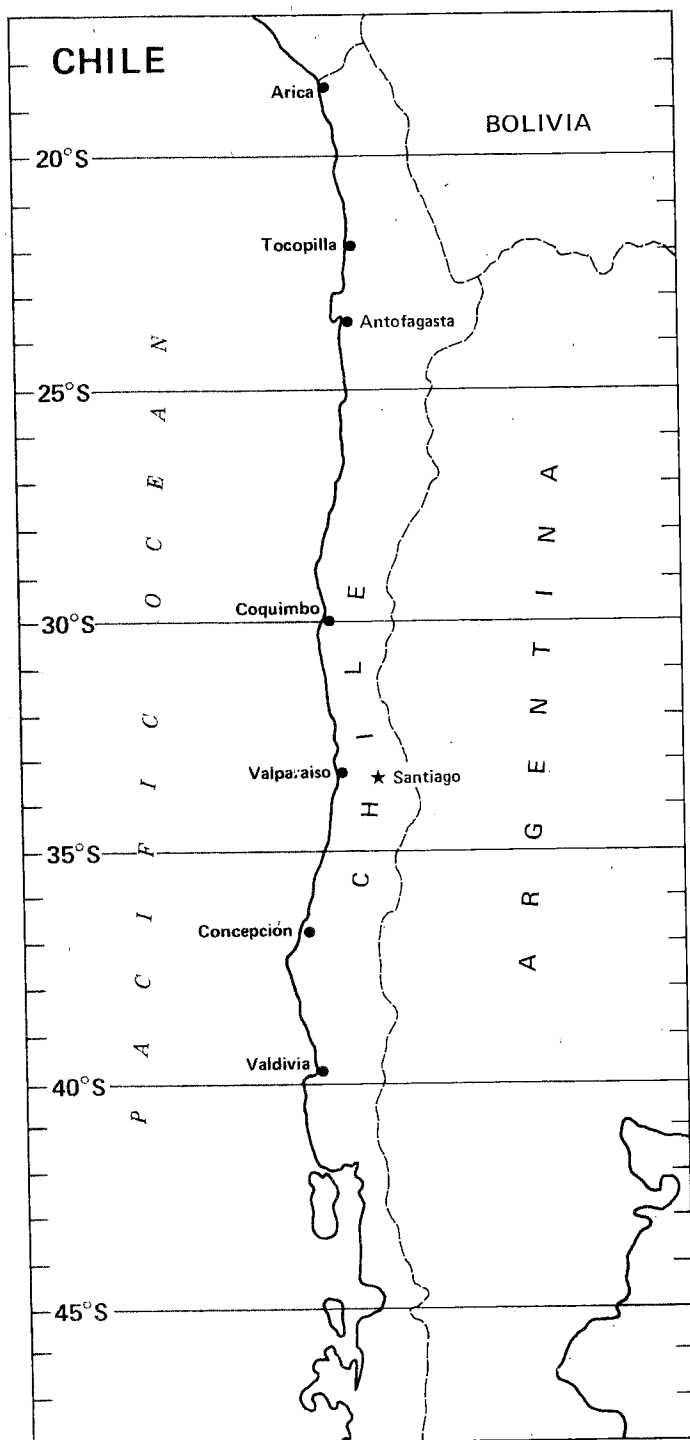
1. Each degree on a map is equal to

   _____ (a) 52 miles on the earth.

   _____ (b) 69 miles on the earth.

   _____ (c) 100 miles on the earth.

2. If two cities are three degrees apart on a map, they are

   _____ (a) 69 miles apart on the earth.

   _____ (b) 138 miles apart on the earth.

   _____ (c) 207 miles apart on the earth.

3. If two cities are five degrees apart on a map, they are

   _____ (a) 69 miles apart on the earth.

   _____ (b) 345 miles apart on the earth.

   _____ (c) 690 miles apart on the earth.

4. The city of Santiago can be found at about

   _____ (a) 23°S.

   _____ (b) 33°S.

   _____ (c) 37°S.

5. The city of Arica is located

   _____ (a) 690 miles south of the equator.

   _____ (b) 1,276 miles south of the equator.

   _____ (c) 1,380 miles south of the equator.

For questions 6-8, you should mark two answers. One is to show how many degrees apart the cities are. The second is to show how many miles apart the cities are.

6. The city of Tocopilla and the city of Antofagasta are about

_____ (a) one degree apart.   _____ (d) 138 miles apart.

_____ (b) two degrees apart.   _____ (e) 69 miles apart.

_____ (c) three degrees apart.   _____ (f) 207 miles apart.

7. The city of Coquimbo and the city of Valparaiso are about

_____ (a) one degree apart.   _____ (d) 207 miles apart.

_____ (b) two degrees apart.   _____ (e) 69 miles apart.

_____ (c) three degrees apart.   _____ (f) 138 miles apart.

8. The city of Valdivia and the city of Concepción are about

_____ (a) three degrees apart.   _____ (d) 207 miles apart.

_____ (b) four degrees apart.   _____ (e) 345 miles apart.

_____ (c) five degrees apart.   _____ (f) 276 miles apart.

9. What do we mean when we say that Concepción is located at 37°S? (Answer in one or two sentences.)

_____

_____

_____

_____

10. Imagine that the degrees on the map had been written without the letter S. For example, the map showed 30° instead of 30°S. How would you still be able to tell by the degrees that Chile is in the Southern Hemisphere? (Answer in 2 or 3 sentences.)

_____

_____

_____

_____

_____

_____

CHAPTER 25
Latitude and Climate

Is there one line of latitude that is more important than any other line of latitude? By now you should be able to answer that the equator is the most important line of latitude. All other lines of latitude are drawn parallel to the equator.

In addition to the equator, there are several other important parallels of latitude. (See Picture A.) They are: the *Tropic of Cancer*, the *Tropic of Capricorn*, the *Arctic Circle*, and the *Antarctic Circle*. These imaginary lines are used to show different climate areas on the earth. (Climate is the weather in an area over a long period of time.)
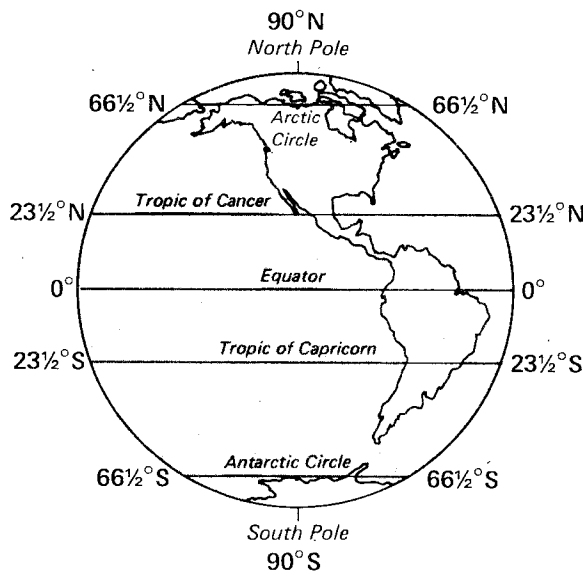
Let us look first at the Tropic of Cancer and the Tropic of Capricorn. The Tropic of Cancer is a line of latitude 23½°N of the

equator. The Tropic of Capricorn is a line of latitude 23½°S of the equator. As shown in Picture B, the area of the earth between these two parallel lines is called the *low latitudes*. The climate in this area is almost always warm or hot.
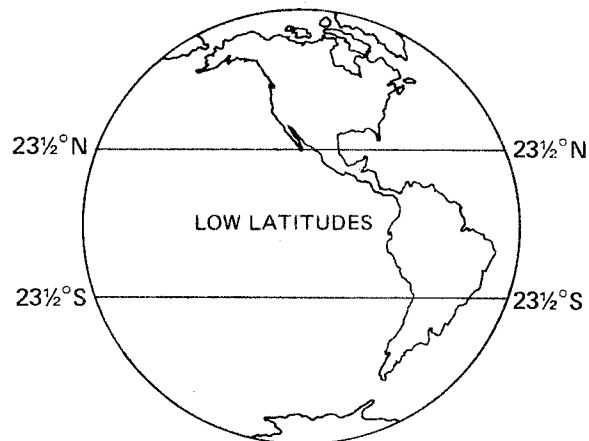
Two other important parallels are the Arctic Circle and the Antarctic Circle. The Arctic Circle is a line of latitude 66½°N of the equator. Between 66½°N and the North Pole is the area called the Arctic. The North Pole is the center of the Arctic, as shown in Picture C.

The Antarctic Circle is a line of latitude 66½°S of the equator. The area between 66½°S and the South Pole is called the Antarctic. At the center of the Antarctic is the South Pole, as shown in Picture C.

The areas of the Arctic and the Antarctic are called the *high latitudes*, or the *polar zones*. Few people live in the high latitudes because of the extreme (very great) cold.
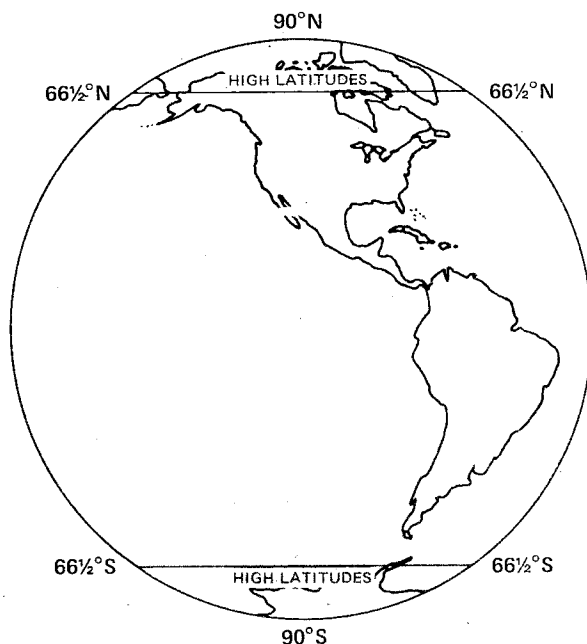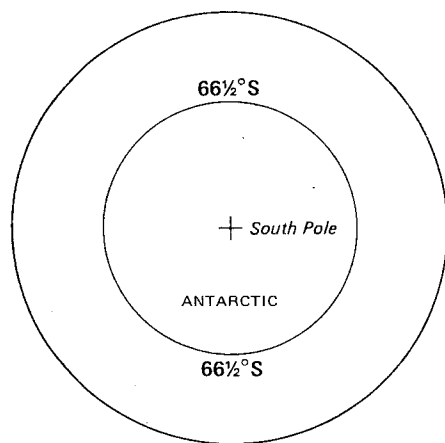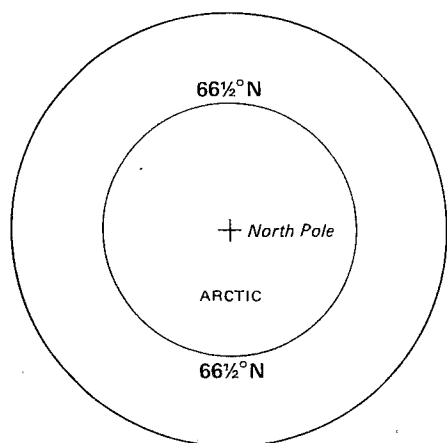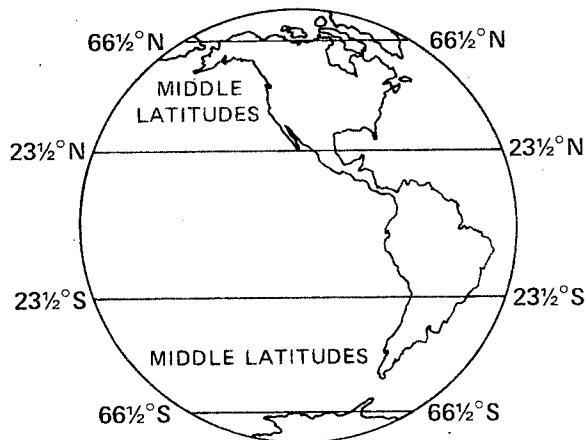

PICTURE A

PICTURE B

204

66½°N

+ North Pole

ARCTIC

66½°N

66½°S

+ South Pole

ANTARCTIC

66½°S

90°N

66½°N   HIGH LATITUDES   66½°N

66½°S   HIGH LATITUDES   66½°S

90°S

PICTURE C

Picture C shows where the high latitudes are located on the earth.

The areas between 23½° and 66½° in both the Northern Hemisphere and the Southern Hemisphere are called the *middle latitudes*. (See Picture D.) They have this name because they are between the high latitudes and the low latitudes. The middle latitudes have four seasons—spring, summer, fall, and winter. Most of the people in the world live in the middle latitudes because of the favorable (good, pleasing) climate.

66½°N   66½°N

MIDDLE LATITUDES

23½°N   23½°N

23½°S   23½°S

MIDDLE LATITUDES

66½°S   66½°S

PICTURE D

Using the information you learned in this chapter, answer the following questions.

1. In this chapter, you have seen that certain lines of latitude are used

_____ (a) to show the time.

_____ (b) to locate sinking ships.

_____ (c) to show different climate areas on the earth.

Which answer did you choose? Different areas of the earth have different climates. You have read in this chapter that lines of latitude are used to show where these climate areas are located on the earth. Therefore, the answer to question 1 is (c).

_____ 2. True or False: Few people live in the high latitudes because the climate is extremely cold.

What was your answer? The high latitudes are found between the Arctic Circle and the North Pole and between the Antarctic Circle and the South Pole. The areas

of the earth around the North Pole and the South Pole are extremely cold. This is why few people live in the high latitudes. Therefore, the answer to question 2 is True.

3. A city located on the earth between the Tropic of Cancer and the Arctic Circle is likely to have

_____ (a) only a hot climate.

_____ (b) only a cold climate.

_____ (c) a climate with four seasons.

Which answer did you choose this time? The area on the earth between the Tropic of Cancer and the Arctic Circle is called the middle latitudes. The middle latitudes do not have the extreme heat of the low latitudes or the extreme cold of the high latitudes. Instead, the middle latitudes have four seasons with changing temperatures. Therefore, the answer to question 3 is (c).

You have seen in this chapter how certain lines of latitude are used to show climate areas on the earth. The following exercises will give you more practice in learning about latitude and climate.

USING WHAT YOU HAVE LEARNED

A. Place a check mark next to the correct answers to questions 1 to 5.

1. The name given to the line of latitude at 23½°N is

_____ (a) the Arctic Circle.

_____ (b) the Tropic of Cancer.

_____ (c) the equator.

2. The name given to the line of latitude at 66½°S is

_____ (a) the Tropic of Capricorn.

_____ (b) the Antarctic Circle.

_____ (c) the Arctic Circle.

3. The Tropic of Capricorn is located at

_____ (a) 23½°.

_____ (b) 23½°N.

_____ (c) 23½°S.

4. The Arctic Circle is located at

_____ (a) 66½°.

_____ (b) 66½°N.

_____ (c) 66½°S.

5. The term "middle latitudes" refers to the area of the earth between

_____ (a) 23½°N to 66½° N and 23½°S to 66½°S.

_____ (b) 23½°N to 66½°N only.

_____ (c) 23½°S to 66½°S only.

B. True or False: If every part of the statement is true, write **T.**
If any part of the statement is false, write **F.**

_____ 1. The area of the earth between 23½°N and 23½°S is called the middle latitudes.

_____ 2. The climate of the low latitudes is generally extremely cold.

_____ 3. The area of the earth north of 66½°N is called both the Arctic and the high latitudes.

_____ 4. A city on the earth between 66½°S and the South Pole is likely to have only a hot season.

_____ 5. The area on the earth that has four seasons is called the middle latitudes.

C. Important Lines of Latitude and Climate Areas.
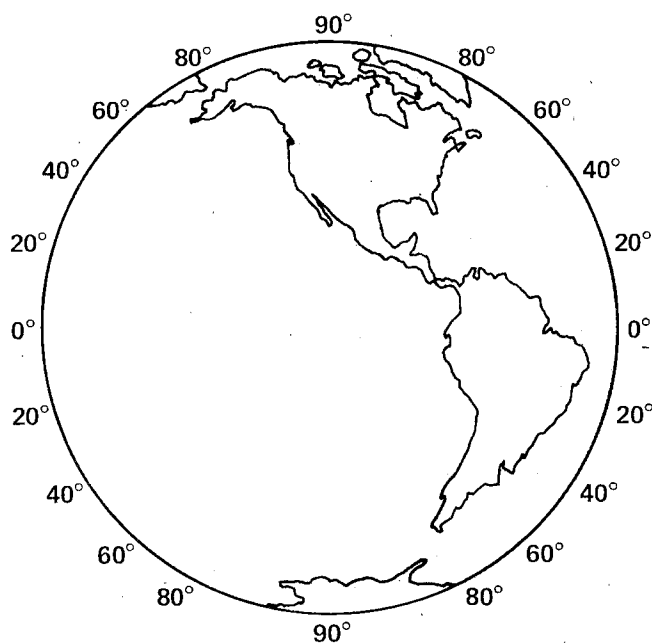
C-1. On the map, draw and label the following important lines of latitude:

| Equator | Arctic Circle |
| Tropic of Cancer | Antarctic Circle |
| Tropic of Capricorn | |

C-2. Then label on the map the following climate areas:

    Low latitudes   Middle latitudes   High latitudes

CHAPTER 26
Longitude on Globes and Maps

Lines of latitude show only distances north and south of the equator. To measure east and west distances, it is necessary to have another system of imaginary lines on the earth. Distance east or west is called *longitude*, and the lines to measure this distance are called *meridians of longitude*. In Picture A, you see that lines of longitude run north and south between the North Pole and the South Pole.
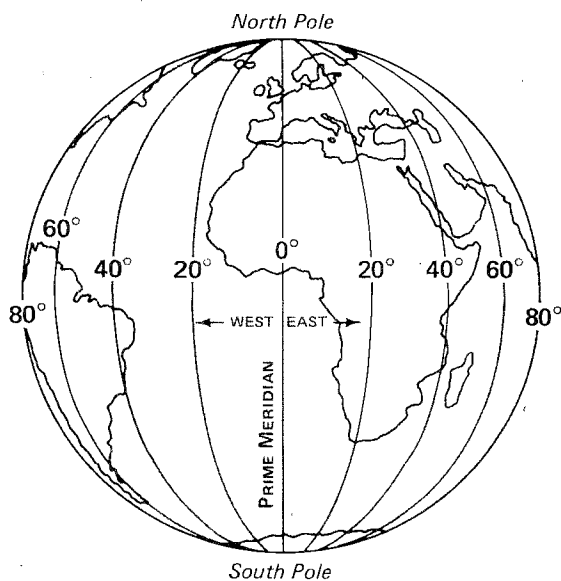
PICTURE A

To measure longitude, you need a starting line. You learned that parallels of latitude are measured north or south from the equator. The equator is the starting line for measuring latitude. For measuring longitude, the starting line is the *Prime Meridian*, a line of longitude that runs through Green-

wich, England. Picture A shows where the Prime Meridian is located on the earth.

All lines of longitude are measured in degrees east or west of the Prime Meridian. Each meridian is one degree from the meridian next to it. Starting from the Prime Meridian, which is marked 0°, meridians are marked going east from 1° to 180°E. Going west, the meridians are marked from 1° to 180°W.

It is important to use W (west) or E (east) after a degree of longitude. For example, if you were told to find 120° on the map, you would have trouble because 120° appears twice on the map. The W or E tells you if you are looking for 120° west or 120° east of the Prime Meridian.

Meridians are not parallel lines; that is, they are not always the same distance from one another. Look again at Picture A, and you will see that the meridians are farthest apart at the equator and closest together at the poles. At the equator, one degree of longitude equals about 69 miles on the earth. Near the poles, one degree of longitude equals only a few miles.

In Picture A you see nearly one half of the earth and less than one half of 360°. You see 80° west of the Prime Meridian and 80° east of the Prime Meridian. Both parts add up to 160°. On a different kind of map of the earth, a Mollweide map, for example, all 360° can be shown. In Picture B you can see 180° west of the Prime Meridian and 180° east of the Prime Meridian.

Understanding how to use lines of longitude is an important Social Studies skill. But it would be impossible to find the exact location of a place on the earth with only a line of longitude. To find the exact location
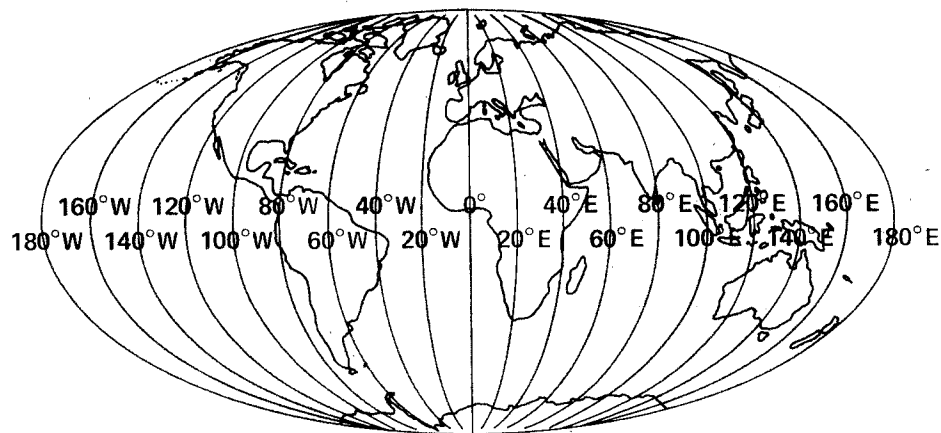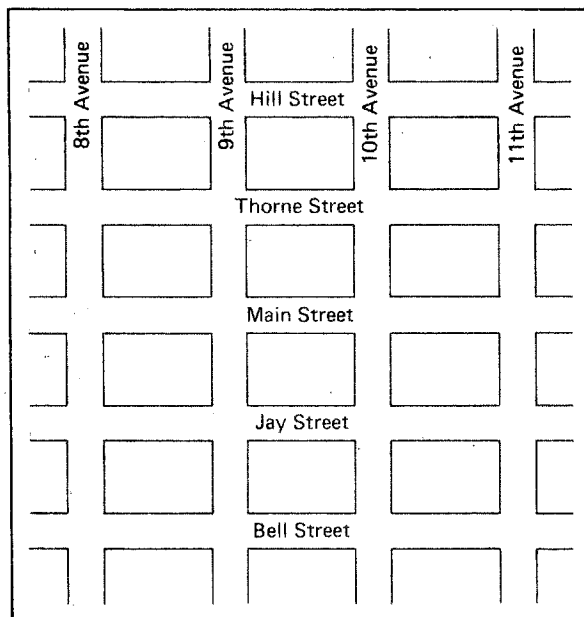
PICTURE B

of a place, it is necessary to use both a line of latitude and a line of longitude. Here is an example to show why you need the two lines.

Suppose you live in a town that has the streets mapped in Picture C. You asked your friend to meet you on 10th Avenue. Would it be easy for your friend to find you? Probably not. Since 10th Avenue runs for at least five blocks, your friend would have to walk all five blocks to find you. But what if you told your friend to meet you where 10th Avenue meets Jay Street, or at the intersection of 10th and Jay. Your friend would walk along 10th Avenue until he got to Jay Street. Then he would stop and wait for you. By using the intersection of two streets or two lines in giving your location, your friend would be able to find you easily.

Picture D shows how latitude and longitude lines look when they are put together on the same map. They meet and cross like street intersections. Let us use the lines of latitude and longitude in Picture D to locate something on the earth. Imagine that a ship is sinking. It sends out a radio message that it is at 20°N 40°W. This means that the ship is 20° north of the equator and 40° west of the Prime Meridian. It is located where the 20°N latitude line meets and crosses the 40°W longitude line. Latitude is always given first and longitude second.

The captain of the rescue ship finds the

PICTURE C
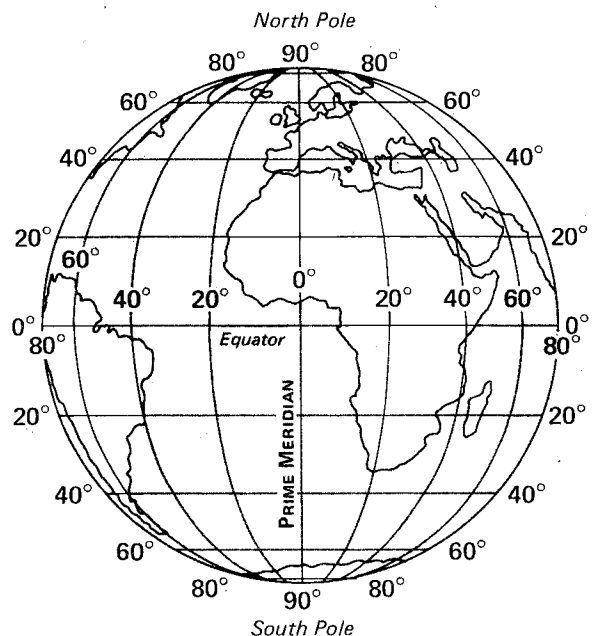
PICTURE D

20°N line on a map. (Remember that latitude lines run east and west across a map, or from left to right.) The captain knows to look north of the equator because of the N after 20°. After the captain finds 20°N, he looks for the 40°W line of longitude. (Lines of longitude run north and south, or from the top to the bottom of the map.) The captain knows that there are two 40° lines on the map, but he wants the 40° line that is west of the Prime Meridian, or 40°W. He puts one finger on the 40°W line and another finger on the 20°N line and moves his fingers along the two lines until they meet. At the place where the two lines meet (20°N 40°W), the captain will find the sinking ship.

Let us see if you can use lines of latitude and longitude to locate a ship. A ship is in trouble at 40°S 60°E. Mark an X on the map in Picture D where you think this ship can be found.

Where did you place the X? The first degree (40°S) is a line of latitude. The S tells you that it is a line of latitude south of the equator. The second degree (60°E) is a line of longitude. The E tells you that it is a line of longitude east of the Prime Meridian. You
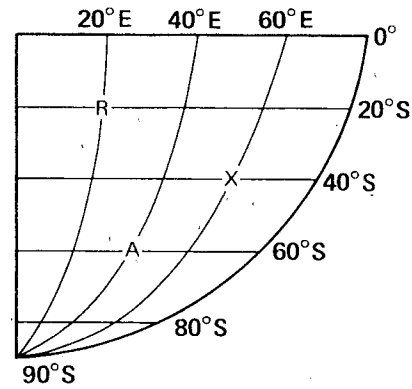
PICTURE E

will find the ship where these two lines meet. If you put an X on the map in Picture D in the same place as the letter X in Picture E, then you found the ship.

You have seen in this chapter that it is necessary to use two lines on a map to find the exact location of a thing or a place. These two lines are a parallel of latitude and a meridian of longitude. The following exercises will give you more practice in finding the exact location of places on the earth.

USING WHAT YOU HAVE LEARNED

A. Place a check mark next to the correct answers to questions 1 to 8.

1. Lines of longitude are used

_____ (a) to find distance east or west of the Prime Meridian.

_____ (b) to find distance north or south of the equator.

_____ (c) to find distance north or south of the Prime Meridian.

2. The most important line of longitude is

_____ (a) the equator.

_____ (b) the axis.

_____ (c) the Prime Meridian.

3. Lines of longitude are also called

_____ (a) parallels.

_____ (b) meridians.

_____ (c) latitudes.

4. Lines of longitude run

_____ (a) north to south.

_____ (b) east to west around the earth.

_____ (c) west to east around the earth.

5. Lines of longitude are NOT parallel lines because

_____ (a) they run in the same direction.

_____ (b) they get closer to one another as they near the poles.

_____ (c) they never meet.

6. On a map, the Prime Meridian is at

_____ (a) 0°.

_____ (b) 15°W.

_____ (c) 30°E.

7. The Prime Meridian runs through

_____ (a) Bombay, India.

_____ (b) Chicago, Illinois.

_____ (c) Greenwich, England.

8. If an oil spill is located at 60°W, this means that the spill is

_____ (a) 60° west of the equator.

_____ (b) 60 miles west of the Prime Meridian.

_____ (c) 60° west of the Prime Meridian.

9. Is the following statement true or false? "It is not necessary to write W (west) or E (east) after a degree showing longitude." (Explain in one or two sentences.)

_____

_____

_____

_____

10. Is the following statement true or false? Explain your answer in one or two sentences. "You need to know only the degree of longitude of a place to know its exact location."
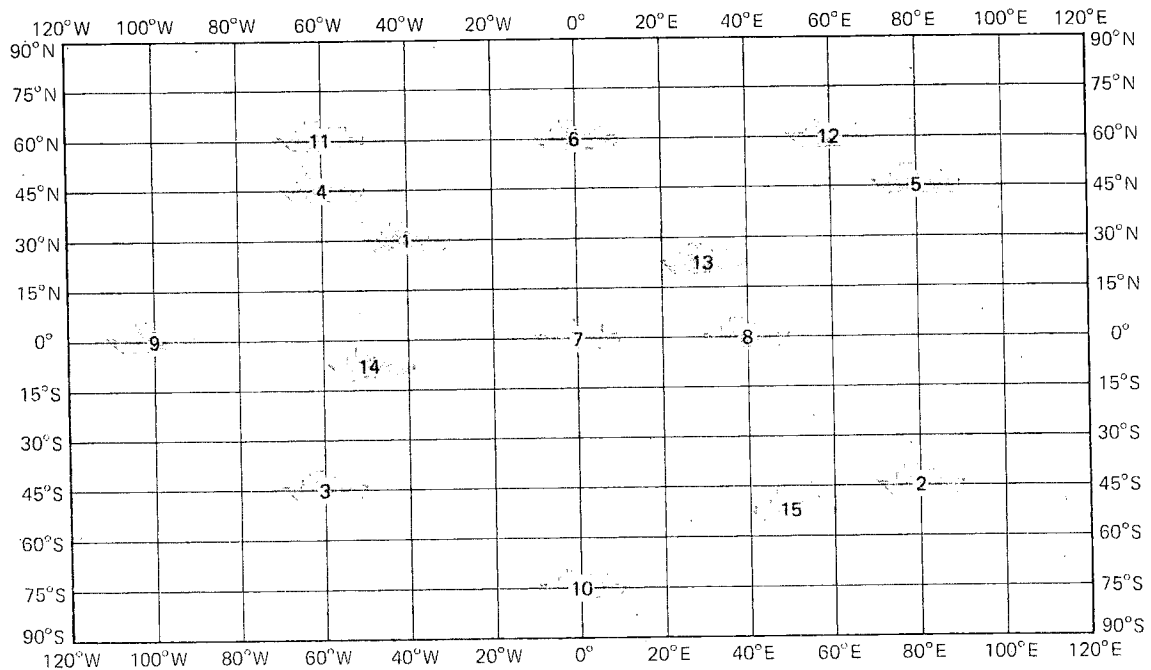
_____

_____

_____

_____

B. Longitude and Location.
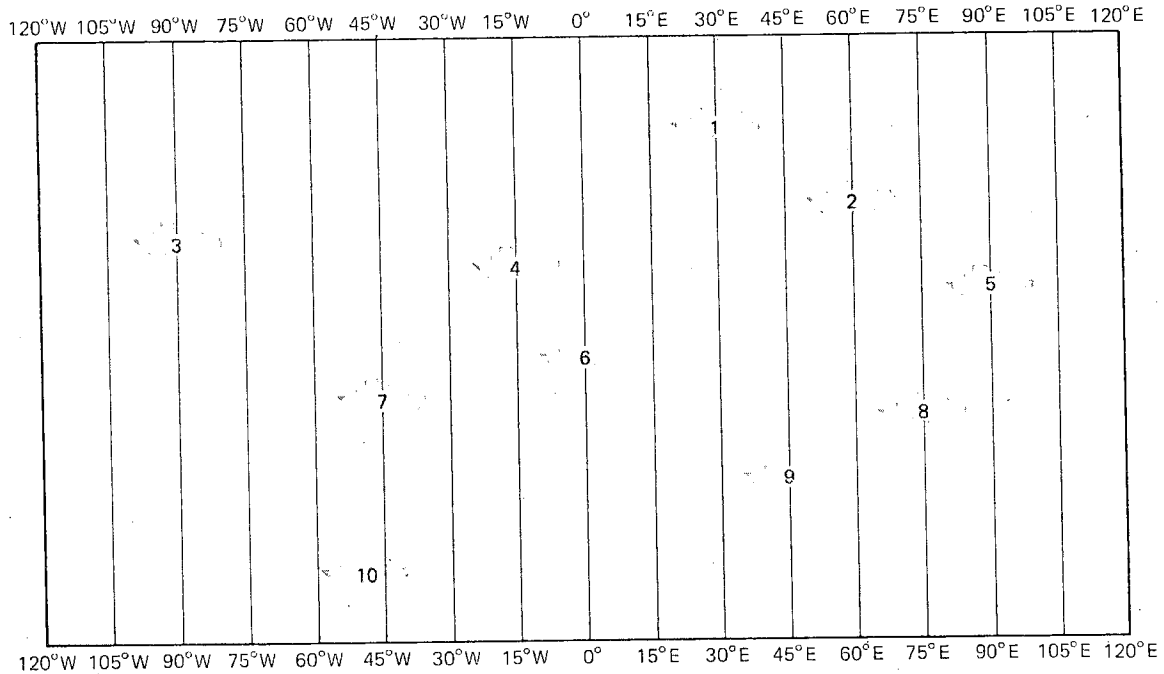
In the spaces provided, write the degrees of longitude where ships 1 to 10 are located. The first one is done for you.

Ship 1 _____30°E_____   Ship 5 _____   Ship 8 _____

Ship 2 _____   Ship 6 _____   Ship 9 _____

Ship 3 _____   Ship 7 _____   Ship 10 _____

Ship 4 _____

C. Latitude, Longitude, and Location.

In the spaces provided, write the latitude and longitude of ships 1 to 15 shown on the graph at the bottom of page 212. The first two are done for you.

	Latitude	Longitude
Ship 1	30°N	40°W
Ship 2	45°S	80°E
Ship 3		
Ship 4		
Ship 5		
Ship 6		
Ship 7		
Ship 8		
Ship 9		
Ship 10		
Ship 11		
Ship 12		
Ship 13		
Ship 14		
Ship 15		

D. Degrees of Latitude and Longitude.
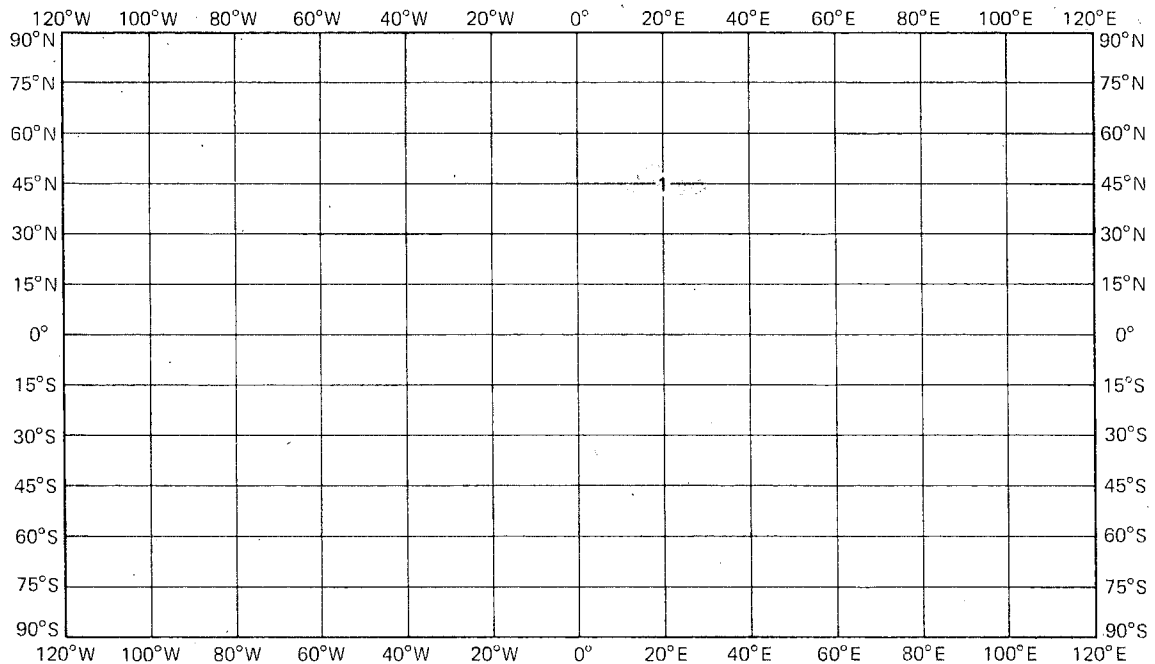
Locate the following degrees of latitude and longitude on the above graph. Write the number before each degree of latitude and longitude in the correct place on the graph. The first one is done for you.

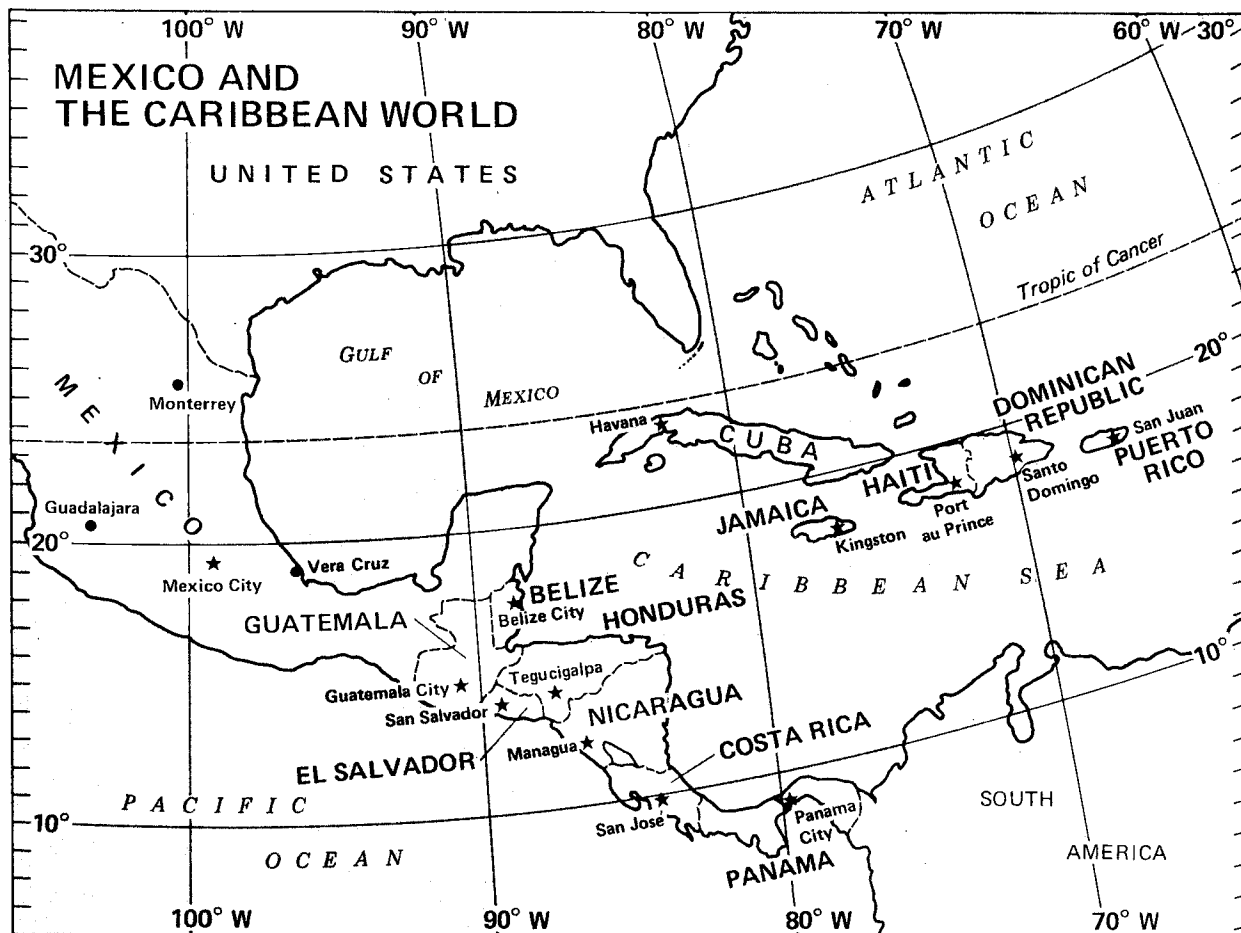|		
1. 45°N 20°E	6. 30°N 80°E	11. 50°N 40°E
2. 60°N 60°E	7. 60°S 100°E	12. 50°S 50°E
3. 45°S 40°E	8. 75°N 0°	13. 70°N 110°W
4. 75°S 75°W	9. 0° 0°	14. 80°S 0°
5. 0° 20°W	10. 15°N 80°W	15. 25°N 75°E

E. Study the following map of Mexico and the Caribbean World.

Place a check mark next to the correct answers to questions 1 to 10.

1. The equator (0°) divides the earth into the Northern Hemisphere and the Southern Hemisphere. Therefore, the area on the map is in the

_____ (a) Northern Hemisphere.

_____ (b) Southern Hemisphere.

_____ (c) Northern Hemisphere and the Southern Hemisphere.

2. The Tropic of Cancer runs through

_____ (a) Cuba.

_____ (b) Jamaica.

_____ (c) Mexico.

3. Monterrey, Mexico, is located in

_____ (a) the Low Latitudes.

_____ (b) the Middle Latitudes.

_____ (c) the High Latitudes.

4. San Juan, Puerto Rico, is located in

_____ (a) the Low Latitudes.

_____ (b) the Middle Latitudes.

_____ (c) the High Latitudes.

5. Mexico City is located at

_____ (a) 19°N 99°W.

_____ (b) 99°N 19°W.

_____ (c) 19°N 19°W.

6. Havana, Cuba, is located at

_____ (a) 83°N 22°W.

_____ (b) 23°N 83°W.

_____ (c) 22°N 22°W.

7. Which city on the map is located at 10°N 84°W?

_____ (a) Panama City, Panama

_____ (b) San Jose, Costa Rica

_____ (c) Belize City, Belize

8. Which city on the map is located at 18°N 70°W?

_____ (a) Kingston, Jamaica

_____ (b) San Salvador, El Salvador

_____ (c) Santo Domingo, Dominican Republic

9. Each degree of latitude on a map stands for 69 miles on the earth. Therefore, the distance between Monterrey, Mexico, and Mexico City is about

_____ (a) 210 miles.

_____ (b) 480 miles.

_____ (c) 690 miles.

10. Each degree of latitude stands for 69 miles on the earth. The distance between Havana, Cuba, and San Jose, Costa Rica, is about

_____ (a) 300 miles.

_____ (b) 600 miles.

_____ (c) 900 miles.

CHAPTER 27
Longitude and Time

If you were to visit a television news station, you might see clocks on the wall like the ones in the drawing. They show different times in different cities in the world. The clocks show that when it is 4 A.M. in San Francisco, it is 7 A.M. in New York, 1 P.M. in Rome, 2 P.M. in Cairo, and 8 P.M. in Peking. These time differences can be shown on a map with the help of lines of longitude.
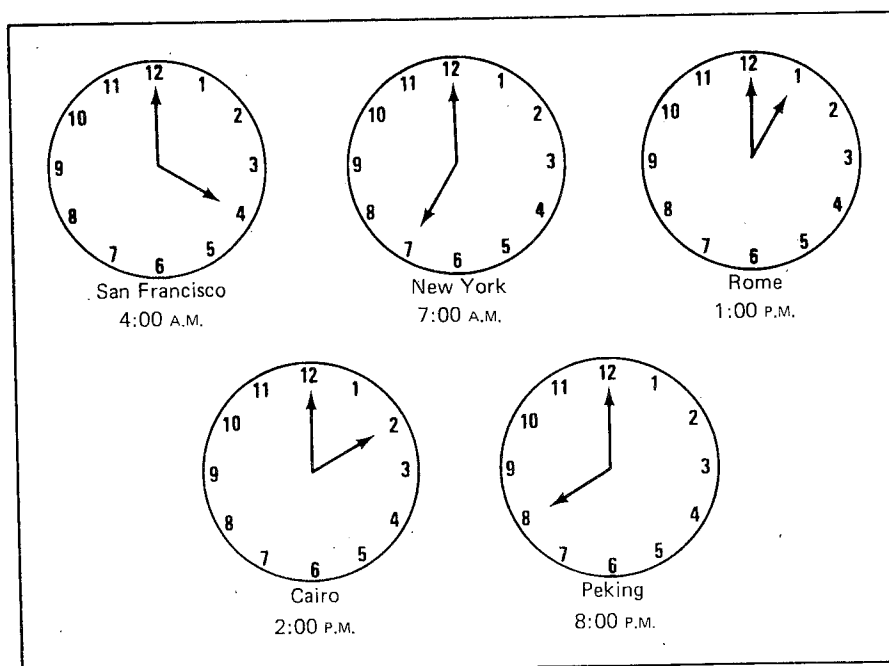
In the last chapter, you learned that lines of longitude are used to measure distance east or west of the Prime Meridian. Besides measuring distance, lines of longitude are used to help you find what time it is in different parts of the world. Map A shows how lines of longitude are used to show time.
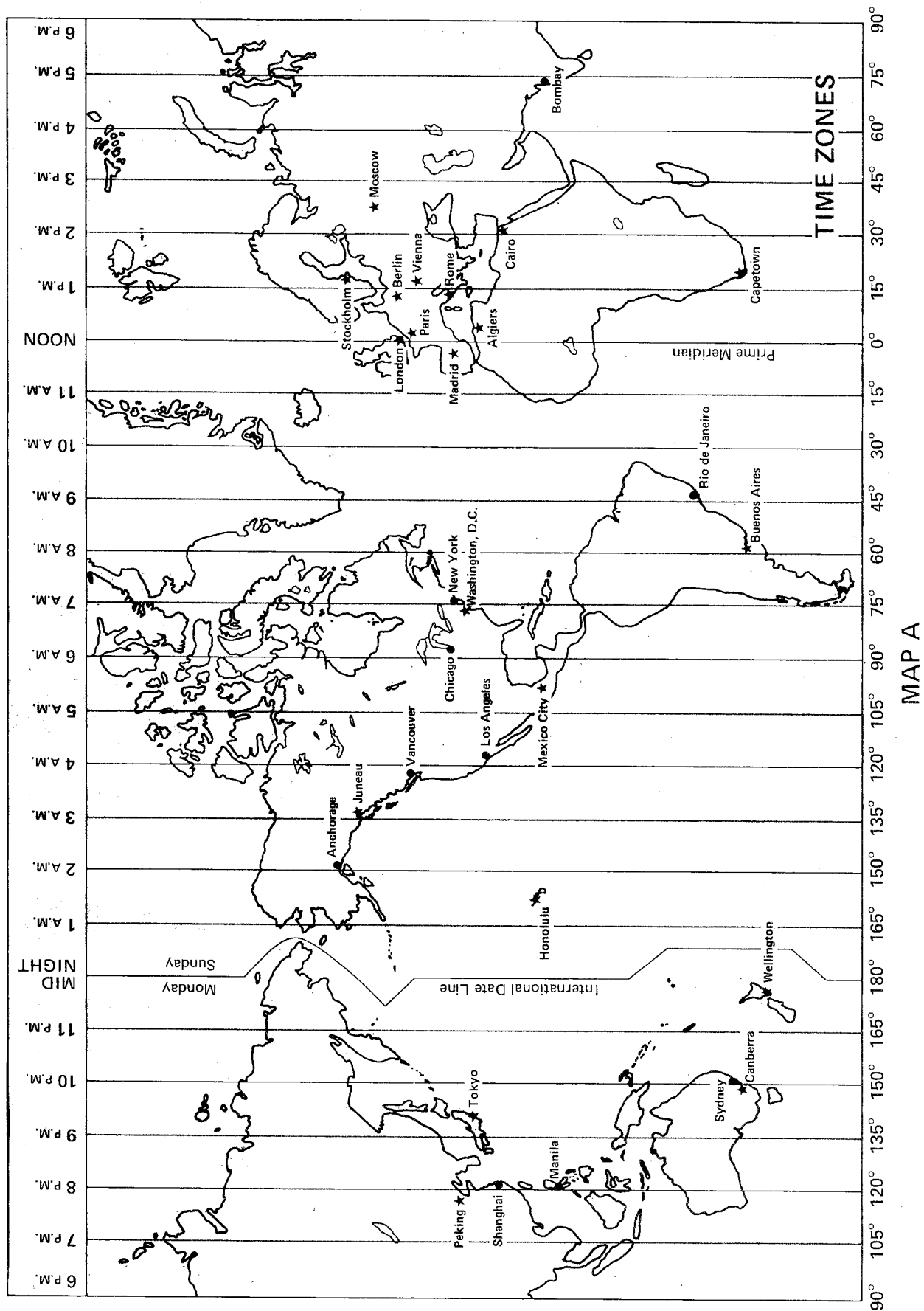
The lines of longitude on Map A are 15° apart. They run 15°, 30°, 45°, and so on. Each of these lines of longitude has a dif-

ferent time. For example, the line of longitude marked 0° is 12 noon. The line marked 30°W is 10 A.M. The line 45°E is 3 P.M.

You may wonder why there is a line every 15° on a map showing time. The earth turns, or rotates, on its axis from west to east. Every 24 hours the earth makes a complete 360° turn. By dividing 24 into 360, you get 15. This means that for every 15° of longitude, there is a difference in time of one hour.

Each 15° line of longitude is at the center of a *time zone*, which spreads 7½° west and 7½° east of the center line. For example: the center line of longitude, or standard meridian, for the Mountain Time Zone in the United States is 105°W. The area covered by the Mountain Time Zone is between 97½°W and 112½°W. All of the places in the Mountain Time Zone have the same time.

San Francisco
4:00 A.M.

New York
7:00 A.M.

Rome
1:00 P.M.

Cairo
2:00 P.M.

Peking
8:00 P.M.

TIME ZONES

MAP A

Actually, none of the 24 time zones on the earth has a straight north-south boundary. Zone lines zig-zag to meet the needs of the people living in the areas affected by the time changes.

When it is noon in a time zone, the 12 time zones to the left (the west) of it are in *ante meridiem* time, or A.M. This is any time between midnight and noon. Times that are A.M. are said to be in the morning. The 12 time zones to the right (the east) of the noon time zone are in *post meridiem* time, or P.M. This is any time between noon and midnight. Times that are P.M. are said to be in the afternoon, evening, or night.

You can see on Map A that when you travel east, or to the right, the time continues to become one hour later as you move into each time zone. For example, when it is 12 noon in London, it is 1:00 P.M. in Vienna. When you travel west, or to the left, the time continues to become one hour earlier as you move from zone to zone. For example, when it is 9:00 A.M. in Rio de Janeiro, it is 8:00 A.M. in Buenos Aires.

On Map A, look at the line of longitude marked 180°. This line is called the *International Date Line*. When you travel from east to west across the International Date Line, you jump ahead to the same time the next day. If it is 2 P.M. on Sunday east of the International Date Line, it is 2 P.M. on Monday west of the International Date Line. Likewise, if you travel west to east across the International Date Line, you go back a day. If it is 9 A.M. on Friday west of the International Date Line, it is 9 A.M. on Thursday east of the International Date Line.

Use Map A to answer the following questions on longitude and time.

_____ 1. True or False: There is a one-hour difference in time for every 30° of longitude.

What was your answer? If you divide 24 hours into 360°, you get 15° for each hour. You can also see on Map A that each one-hour time zone covers 15° and not 30°. Therefore, the answer to question 1 is False.

2. On Map A, it is 3:00 P.M. on the line of longitude marked

_____ (a) 15°.

_____ (b) 45°.

_____ (c) 135°.

Which answer did you choose? Find the line of longitude marked 3:00 P.M. on Map A. Remember that you are looking for 3:00 P.M., not 3:00 A.M. The 3:00 P.M. line of longitude is east of the Prime Meridian. When you find the 3:00 P.M. line, follow the line all the way down with your finger. At the bottom of the line, you will see 45°. Therefore, the answer to question 2 is (b).

3. What time is it in New York on the map?

_____ (a) 2:00 A.M.

_____ (b) 7:00 A.M.

_____ (c) 1:00 P.M.

Which answer did you choose? First find New York on the map. The standard meridian that determines the time for New York is 75°. It is marked 7:00 A.M. Therefore, the answer to question 3 is (b).

Map A shows that it is 12 noon in London. But you know that it does not stay 12 noon in London all day long. As the earth rotates on its axis, the time in a place changes. This is because the position of a place on earth in relation to the sun changes. The rotation turns a place toward or away from the sun.

Study Pictures A and B on page 219 to see how time changes.

You see that Pictures A and B show the same degrees of longitude. Each line of longitude is 15° apart. But the times are different in each picture. On Picture A, 0° (the Prime Meridian) shows 12 noon. This means that the sun is shining directly over the time zone of 0°. Each hour the earth rotates 15° to the east. This makes the sun appear to be moving to the west. Picture B shows you where it is 12 noon one hour later. The direct sun is now over 15°W. So it is 12 noon at 15°W in Picture B and 1:00 P.M. at 0°. One hour later, it will be 12 noon at 30°W, 1:00 P.M. at 15°W, and 2:00 P.M. at 0°. This hour-by-hour change happens 24 times a day until the earth makes one complete rotation.

Answer the following questions using Pictures A and B.
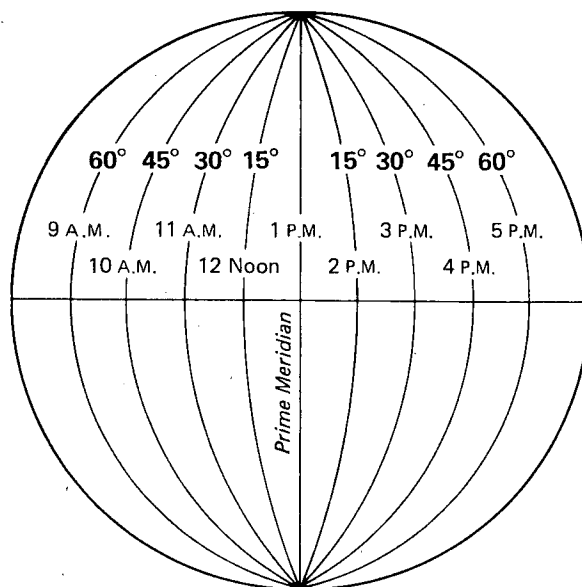
1. When it is 10:00 A.M. at 30°W, it is _____ at 30°E.

What time did you fill in? Which picture shows 10:00 A.M. at 30°W? It is Picture A. Now on Picture A look for the 30°E line of longitude. Since 30°E has a time of 2:00 P.M., the answer to question 1 is 2:00 P.M.

You could also find the answer to question 1 in another way. When you travel from
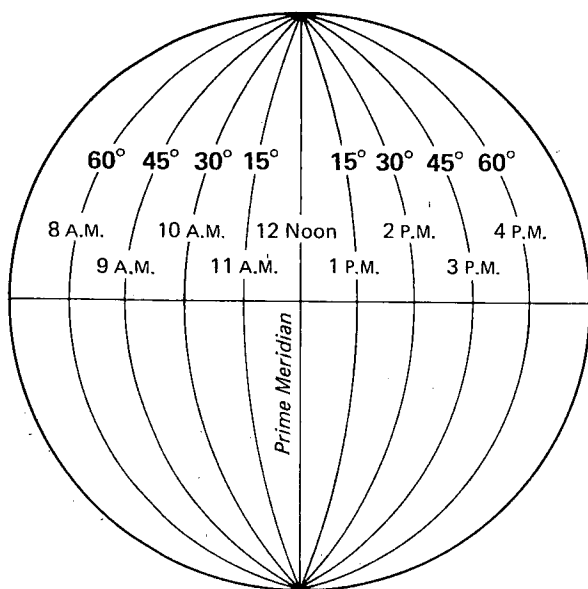
PICTURE A

PICTURE B ONE HOUR LATER

30°W to 30°E, you pass through four lines of longitude. These four lines are 15°W, 0°, 15°E, and 30°E. Each of these lines represents one hour. By adding these four hours to the 10:00 A.M. at 30°W, you come to 2:00 P.M. at 30°E.

Suppose it is 2:00 P.M. at 30°E, and you are asked what time it is at 30°W. To find out, you subtract four hours from 2:00 P.M. You would then know it is 10:00 A.M. at 30°W.

2. When it is 2:00 P.M. at 45°W, it is _____ _____ at 45°E.

What time did you fill in? Neither Picture A nor Picture B shows 2:00 P.M. at 45°W. Picture B shows that it is 10:00 A.M. at 45°W and 4:00 P.M. at 45°E. How many hours dif-

ference is there between 10:00 A.M. and 2:00 P.M.? There is a difference of four hours. So the time you want to find out is four hours after the time shown in Picture B. You must add four hours to the 4:00 P.M. found at 45°E. This gives you 8:00 P.M. Therefore, when it is 2:00 P.M. at 45°W, it is 8:00 P.M. at 45°E.

You could also have found the answer to question 2 in another way. You could have counted the time zones between 45°W and 45°E. There are six of them. Then you could have added that number to 2:00 P.M.

The following exercises will give you more practice in understanding longitude and time zones.

USING WHAT YOU HAVE LEARNED

A. True or False: If every part of the statement is true, write **T**.
If any part of the statement is false, write **F**.

_____ 1. The earth makes one complete rotation every 24 hours.

_____ 2. For every 15° of longitude, there is a difference of one hour in time.

_____ 3. Time zones always have straight boundaries.

_____ 4. It is 12 noon everywhere on the earth at the same time.

_____ 5. The letters A.M. stand for the 12 hours before 12 noon.

_____ 6. Post meridiem means the 12 hours after 12 noon.

_____ 7. The line of longitude at 180° is called the Prime Meridian.

_____ 8. When you travel across the International Date Line, you stay in the same day.

_____ 9. When you cross the Prime Meridian, you stay in the same day.

_____ 10. It takes one hour for the earth to rotate 15°.

B. Longitude and Time Change.

120°	105°	90°	75°	60°	45°	30°	15°	0°	15°	30°	45°	60°	75°	90°	105°	120°

4 A.M.　　6 A.M.　　8 A.M.　　10 A.M.　　12 Noon　　2 P.M.　　4 P.M.　　6 P.M.　　8 P.M.

5 A.M.　　7 A.M.　　9 A.M.　　11 A.M.　　1 P.M.　　3 P.M.　　5 P.M.　　7 P.M.

120°	105°	90°	75°	60°	45°	30°	15°	0°	15°	30°	45°	60°	75°	90°	105°	120°
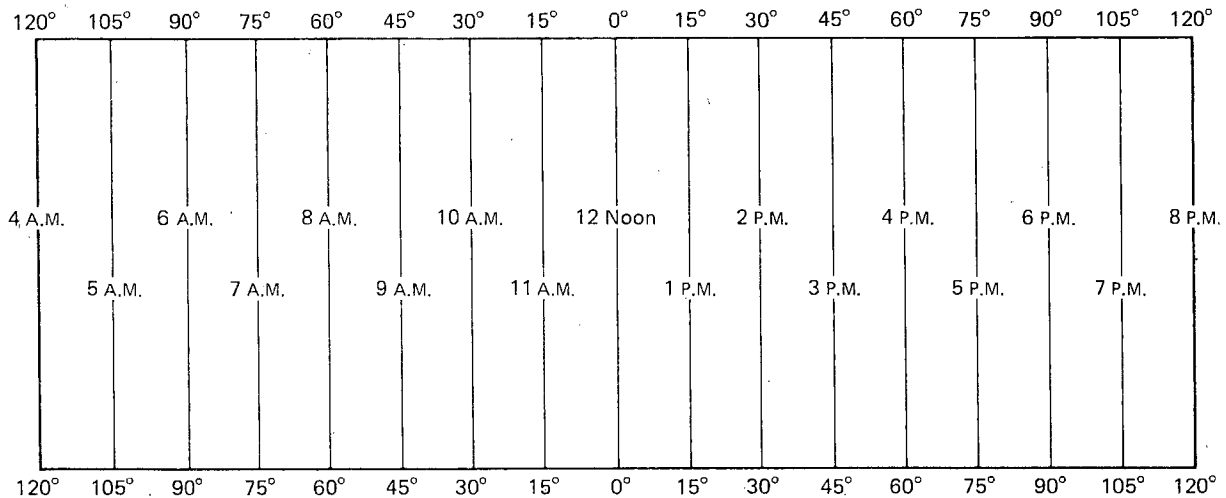
Use the graph to help you answer the following questions. Write the correct answer in the space provided.

1. On the graph, it is 12 noon at _____ degrees.

2. The sun is directly overhead at _____ degrees.

3. When it is 9 A.M. at 45°W, it is _____ at 45°E.

4. When it is 10 A.M. at 30°W, it is _____ at 60°E.

5. When it is 5 P.M. at 75°E, it is _____ at 75°W.

6. When it is 10 A.M. at 45°W, it is _____ at 45°E.

7. When it is 10 A.M. at 60°W, it is _____ at 75°E.

8. When it is 7 P.M. at 45°E, it is _____ at 0°.

9. When it is 4 P.M. at 15°W, it is _____ at 15°E.

10. When it is 7 P.M. at 60°W, it is _____ at 60°E.

C. Time Zones in the United States.

C-1. Place a check mark next to the correct answers to questions 1 to 10. Use the map on page 221 to help you answer the questions.

1. From the map, you can see that the 48 states of the United States that border each other have

_____ (a) one time zone.

_____ (b) four time zones.

_____ (c) ten time zones.
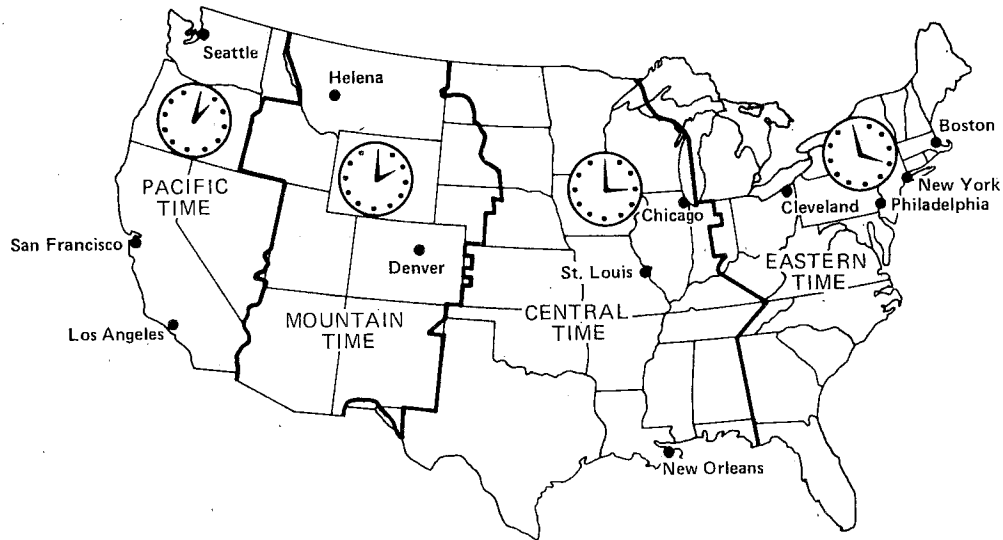
2. New York is in the

      _____ (a) Eastern Time Zone.

      _____ (b) Central Time Zone.

      _____ (c) Pacific Time Zone.

3. Chicago is in the

      _____ (a) Eastern Time Zone.

      _____ (b) Central Time Zone.

      _____ (c) Mountain Time Zone.

4. Denver is in the

      _____ (a) Eastern Time Zone.

      _____ (b) Mountain Time Zone.

      _____ (c) Pacific Time Zone.

5. San Francisco is in the

      _____ (a) Central Time Zone.

      _____ (b) Mountain Time Zone.

      _____ (c) Pacific Time Zone.

6. Which one of the following statements is true?

      _____ (a) It is the same time everywhere in the United States.

      _____ (b) Chicago and Denver always have the same time.

      _____ (c) There is a time difference of one hour between neighboring time zones in the United States.

7. The map shows that it is

      _____ (a) 2 o'clock in Boston.

      _____ (b) 3 o'clock in Boston.

      _____ (c) 4 o'clock in Boston.

8. What is the time difference between New York and San Francisco?

_____ (a) Two hours

_____ (b) Three hours

_____ (c) Four hours

9. Mountain Time means

_____ (a) the time it is at the top of a mountain.

_____ (b) the time it is where there are mountains.

_____ (c) the time it is in a particular time zone in the United States.

10. If it is 11 A.M. in Cleveland, in New Orleans it is

_____ (a) one hour earlier.

_____ (b) one hour later.

_____ (c) the same time.

C-2. Fill in the correct times based on the Time Zone map.

1. When it is 1 o'clock in Los Angeles, it is _____ o'clock in Chicago.

2. When it is 5 o'clock in Philadelphia, it is _____ o'clock in New Orleans.

3. When it is 2 o'clock in San Francisco, it is _____ o'clock in Denver.

4. When it is 5 o'clock in Denver, it is _____ o'clock in New York.

5. When it is 4 o'clock in St. Louis, it is _____ o'clock in Seattle.

D. In your own words, explain why different places in the United States show different hours on the clock at the same time. In other words, why is it 9 A.M. in Seattle and 11 A.M. in St. Louis when it is noon in Philadelphia? (Answer in three or four sentences.)

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____