Name: _____ Laboratory Section: _____

Date: _____ Score/Grade: _____

Video
Exercise 1
Pre-Lab Video

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LAB EXERCISE

# 1 Latitude and Longitude

To know specifically where something is located on Earth's surface, a coordinated grid system is needed, one that is agreed to by all peoples. The terms *latitude* and *longitude* were in use on maps as early as the first century A.D., with the concepts themselves dating back to Eratosthenes and others.

As you complete your *Geography I.D.* in the Preface, you will eventually determine the latitude and longitude for your campus. We examine great circles, latitude, and longitude in this exercise. Lab Exercise 1 features three sections.

## Key Terms and Concepts

great circle
latitude
longitude
meridian
parallel
prime meridian
small circle

## KEY LEARNING concepts

*After completion of this lab you should be able to:*

1. *Define* great circle and small circle and *describe* the relationship between a great circle and travel.
2. *Define* latitude and parallel, longitude and meridian, and *use* them in simple sketches to *demonstrate* how Earth's reference grid is established.

## Materials/Sources Needed

globe
string
ruler
protractor
world atlas

# Lab Exercise and Activities

## SECTION 1

### Great and Small Circles

Great circles and small circles are important concepts relating to latitude and longitude—concepts that we will refer to in later activities. A **great circle** is any circle of Earth's circumference whose center coincides with the center of Earth. An infinite number of great circles can be drawn on Earth. On most flat maps, airline and shipping routes appear to arch their way across oceans and landmasses following great circles. Despite their curved appearance on flat maps, great circle routes are the shortest distance between two points on Earth.

Using a globe and a piece of string, place one end on San Francisco and stretch the string tautly to London. This direct route is a portion of a great circle. **Small circles** are circles whose centers do not coincide with Earth's center. In Figure 1.1 properly draw and label a great circle and a small circle, other than those noted by the latitude and longitude grid.

▲ Figure 1.1 **Label great circles and small circles**

Again using the globe and piece of string, show the great circle routes linking the following cities, listing at least four or five prominent geographical features (e.g., mountains, seas, rivers, nations, cities, etc.) that you would cross as you traveled along those routes:

1. London, England, and Colombo, Sri Lanka (English Channel, Germany, Carpathian Mtns.)

2. Vancouver, British Columbia, and Sydney, Australia

3. Your hometown and Beijing, China

## SECTION 2

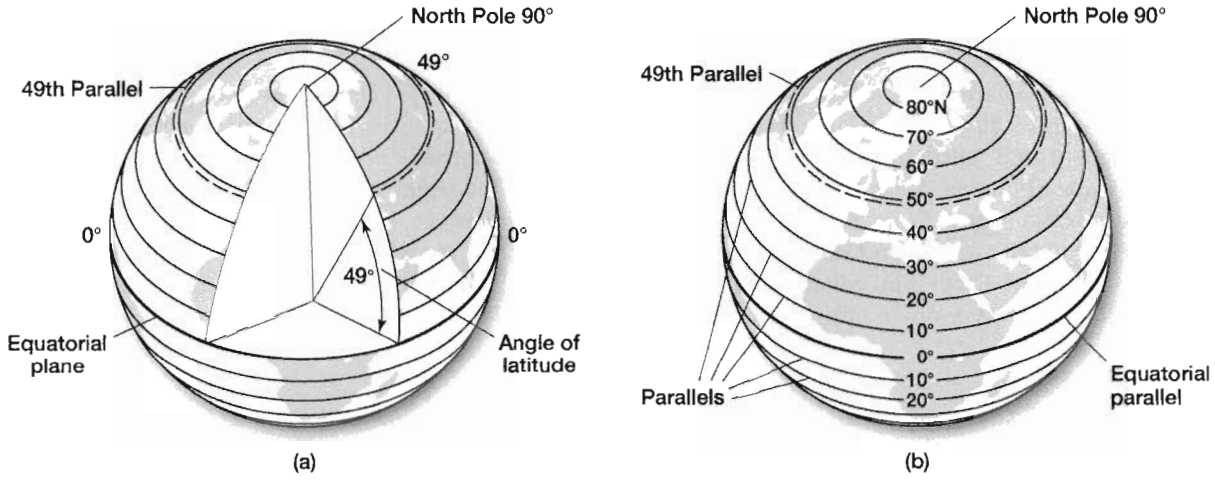
## Latitude and Parallels

Adapting from the Babylonians, Ptolemy divided the circle into 360 *degrees* (360°), with each degree subdivided into 60 *minutes* (60′), and each minute further subdivided into 60 *seconds* (60″). This method of dividing degrees into minutes and seconds is often referred to as DMS coordinates. Geographic Information Systems, GPS, and other computer-based systems often use decimal degrees or DD coordinates. In this method, each degree is divided into a more familiar base ten system. We'll now examine each of these grid coordinate elements.

**Latitude** is an angular or arc distance north or south of the *equator* (the line running east to west halfway between the poles), measured from the center of Earth (Figure 1.2a). On a map or globe, the lines designating these angles of latitude run east and west, parallel to the equator, whose latitude is 00.00°.

The North Pole is 90.00° north latitude, and the South Pole is 90.00° south latitude. "Lower latitudes" are those nearer the equator, whereas "higher latitudes" refer to those nearer the poles.

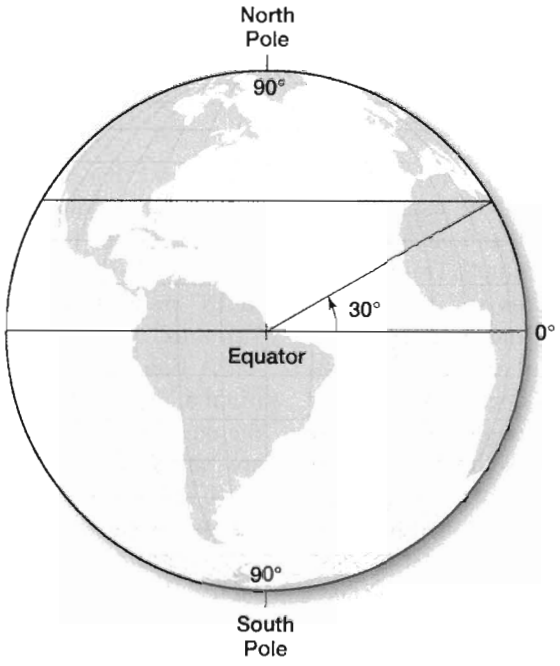
A line connecting all points at the same latitudinal angle is called a **parallel**. Only one parallel—the equatorial parallel—is a great circle; all others are small circles, diminishing in circumference north and south toward the poles, which are merely points. As shown in Figures 1.2a and 1.2b, *latitude is the name of the angle* (49° north latitude), *parallel names the line* (49th parallel), and both indicate arc distance north of the equator.




▲ Figure 1.2 a and b **Latitude and parallels**

1. Parallels have often been used to demarcate political boundaries. The 49th parallel north forms a portion of the border between which two countries?

2. Parallels made famous by wars in the last century include the parallel dividing the two Koreas and the parallel that divided Vietnam until 1975. (The border was approximately 80 km [50 mi] north of the city of Hue). What are these two parallels?




▲ Figure 1.3 **Measuring latitudes on Earth**

3. Figure 1.3 is a half-Earth section through the poles. An angle of 30° has been measured north of the equator, with the 30th parallel drawn on the globe. Following this example, use your protractor to measure an angle of 23.5° north of the equator and draw and label the corresponding parallel, which is known as the Tropic of Cancer. Measure another angle 66.5° north of the equator and draw and label the parallel known as the Arctic Circle. Repeat this in the Southern Hemisphere, drawing and labeling the Tropic of Capricorn (23.5° south) and the Antarctic Circle (66.5° south). We will be working with these parallels while studying Earth–Sun relationships in Lab Exercise 5. Finally, measure, draw, and label one last parallel to show your own latitudinal location.

4. Using a globe and your atlas or other world map, locate three cities that are located at approximately the 23rd parallel in the Northern Hemisphere; note their location in degrees (and minutes, if your map is detailed enough to estimate minutes). Use the globe first, then refer to the atlas maps to better determine specific latitudes. Be sure and list their country names as well.

| | **City and Country Name** | **Longitude (degrees and minutes, if possible)** |
|---|---|---|
| **a)** | _____ | _____ |
| **b)** | _____ | _____ |
| **c)** | _____ | _____ |

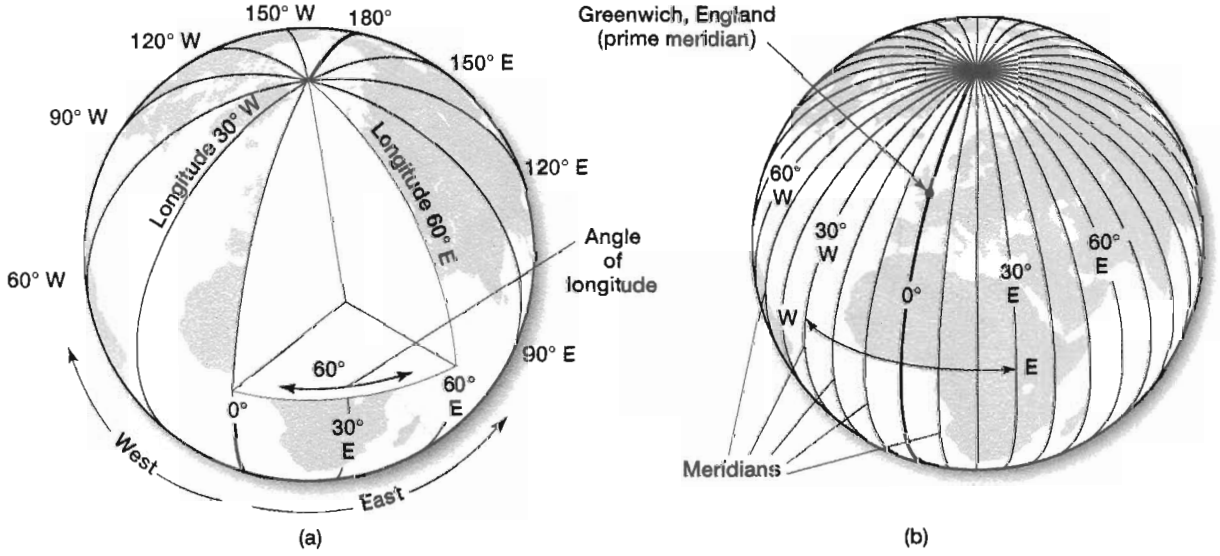
5. List the names and longitudes of three cities that are located at approximately your latitude.

| | **City and Country Name** | **Longitude** |
|---|---|---|
| **a)** | _____ | _____ |
| **b)** | _____ | _____ |
| **c)** | _____ | _____ |

## SECTION 3

## Longitude and Meridians

**Longitude** is an angular or **arc distance** east or west of a point on Earth's surface, measured from the center of Earth (Figure 1.4a). On a map or globe, the lines designating these angles of longitude run north and south at right angles (90°) to the equator and to all parallels. A line connecting all points at the same longitude is a **meridian** (Figure 1.4b). Every meridian is one-half of a great circle that passes through the poles. As shown in Figures 1.4a and 1.4b, longitude is the name of the angle, meridian names the line, and both indicate arc distance east or west of the prime meridian.




▲ Figure 1.4 a and b **Longitude and meridians**

1. On a political globe or world map follow the International Date Line across the Pacific Ocean. Why do you think the International Date Line is not straight but zigs and zags?

2. Examine an atlas or a political globe and in the spaces marked a through h list the provinces and states through which the 100th meridian in the Western Hemisphere passes—north to south. The first answer is provided for you in bracketed italics.

a) _____ [*Nunavut, Canada*] _____ e) _____

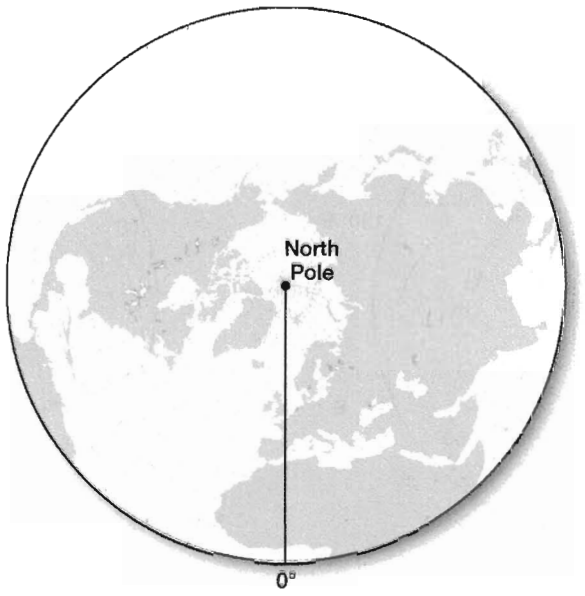
b) _____ f) _____

c) _____ g) _____

d) _____ h) _____

3. Figure 1.5 is a view of Earth from directly above the North Pole; the equator is the full circumference around the edge. A line has been drawn from the North Pole to the equator and labeled 0°, representing the prime meridian. Earth's prime meridian through Greenwich, England, was not generally agreed to by most nations until 1884. To the right of 0° on the diagram is the *Eastern Hemisphere*—label this—and to the left of 0° is the *Western Hemisphere*—label this.

Extend another line from the North Pole to the other side of Earth, opposite the prime meridian, and label it 180°. You now have marked the line that is the International Date Line, which extends from North to South Poles on the opposite side of Earth from the prime meridian. Using your protractor, measure, draw, and label the meridians that are 100° east and 60° west of the Greenwich meridian. Finally, locate, draw, and label the meridian that marks your present longitude.




▲ Figure 1.5 **Measuring longitudes on Earth**

The 98th meridian is roughly the location of the 51 cm (20 in) isohyet (a line connecting points of equal precipitation), with wetter conditions to the east and drier conditions to the west. In North America, tallgrass prairies once rose to heights of 2 m (6.5 ft) and extended westward across the Great Plains to about the 98th meridian, with short-grass prairies farther west. The deep sod formed beneath these tall grasslands posed problems for the first settlers, as did the climate. The self-scouring steel plow, introduced in 1837 by John Deere, allowed the interlaced grass sod to be broken apart, freeing the soils for agriculture. Keep this information about the region around the 100th meridian, and close to the 98th, in mind as a "location reference" later on when studying precipitation and vegetation.