



## Teacher Guide

### Understanding Maps of Earth

#### The surface of Earth

Astronauts in the *International Space Station* looking down on Earth see it as a beautiful planet covered with land and water. Only about 30 percent of Earth's surface is land. The remaining 70 percent of the surface is covered with water. The land on the surface of Earth is divided into seven major pieces called continents: Asia, Europe, Antarctica, Australia, Africa, North America, and South America. The largest bodies of water are the oceans. The five major oceans, from largest to smallest, are the Pacific Ocean, Atlantic Ocean, Indian Ocean, Southern Ocean, and Arctic Ocean. There are many bodies of water smaller than oceans called seas.

#### Hemispheres

Earth is approximately spherical with an average radius of 6,400 kilometers (4,000 miles). This spherical Earth can be divided into equal halves called hemispheres. If we separate Earth halfway between the North and South poles (at the equator), we get the Northern Hemisphere (centered around the North Pole), and the Southern Hemisphere (centered around the South Pole).

The Northern Hemisphere is 39 percent land and 61 percent ocean, while the Southern Hemisphere is 19 percent land and 81 percent ocean.

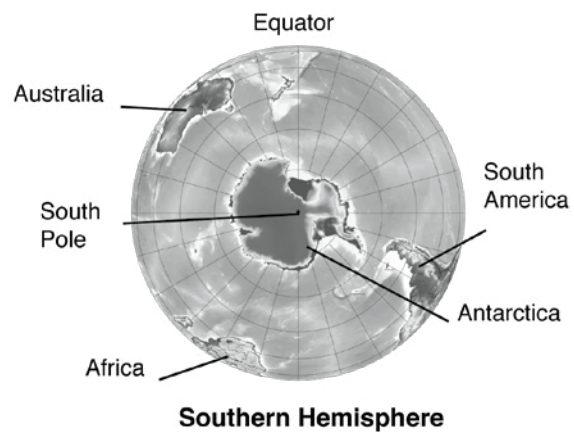
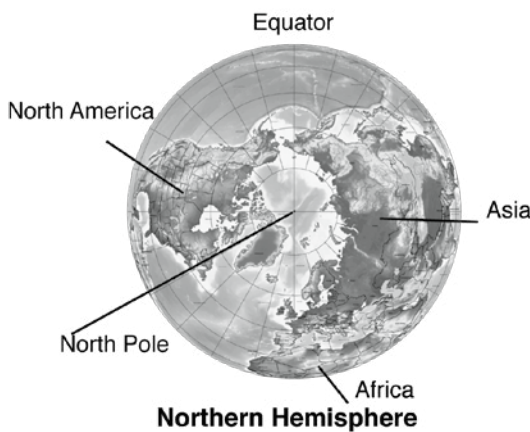
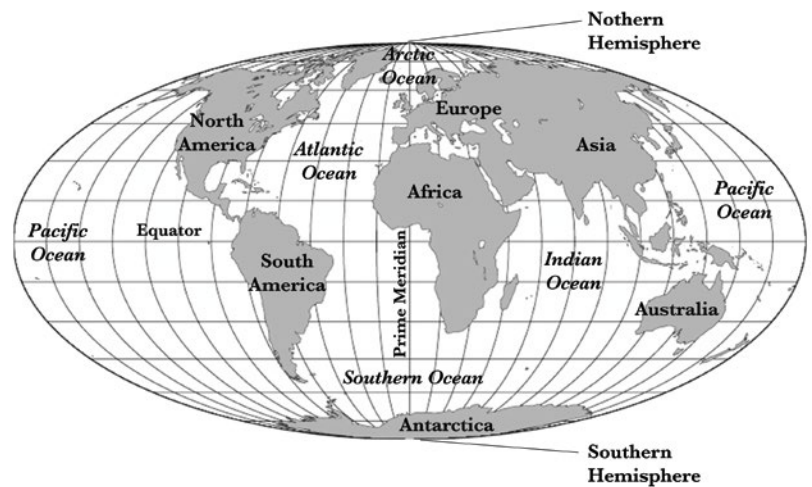
#### STANDARDS ALIGNMENT

##### Geography

- I.1:** The World in Spatial Terms: How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective.
- II.4:** Places and Regions: The physical and human characteristics of places.
- III.8:** Physical Systems: The characteristics and spatial distribution of ecosystems on Earth's surface.

##### CCSS

**MS-RI.6-12.7:** Integrate information presented in different media and formats (e.g., visually and quantitatively) as well as in words to develop a coherent understanding of a topic or issue.



## Latitude and longitude

Maps and globes usually have lines on them to help locate places on Earth. These lines are called latitude and longitude lines. These lines are not actually on the planet, but are imaginary lines used to help us find our way around the curved surface of Earth. The imaginary lines circling the globe in an east-west direction are called the lines of latitude (or parallels, as they are parallel to the equator). They are used to measure distances north and south of the equator. The lines circling the globe in a north-south direction are called lines of longitude (or meridians). They are used to measure distances east and west. Lines of latitude and longitude crisscross to form a grid. The location of any point on the surface of Earth can be described by two coordinates: its latitude and its longitude.



## Latitude

Latitude measures how far north or south a point lies from the equator. The equator is at 0 degrees ( $0^\circ$ ) latitude, and it divides Earth into its northern and southern hemispheres. It is the starting point for measuring distances in degrees north or south of the equator. Values for latitude range from  $0^\circ$  to  $90^\circ$  North for locations north of the equator, and from  $0^\circ$  to  $90^\circ$  South for locations south of the equator. Notice on the figure that the lines of latitude run in the east-west direction and are parallel to the equator. Any other location directly east or west of you lies at the same latitude that you do.

## EarthKAM coordinates

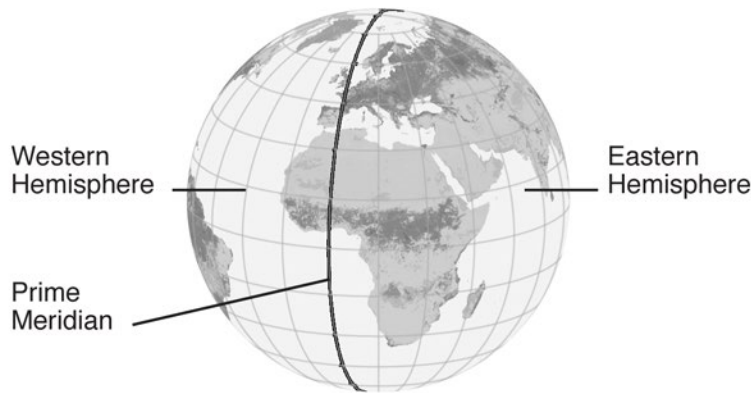
ISS EarthKAM measures latitude and longitude using decimal degrees and N, S, E, W notation—for example,  $39.2^\circ$  N and  $120.7^\circ$  W. Other formats for reporting latitude and longitude that you may see include:  $39^\circ 12' 00''$  and  $120^\circ 42' 00''$  (degrees, minutes, and seconds), or  $39.2^\circ$  and  $-120.7^\circ$  (south and west are negative)

## One degree of latitude

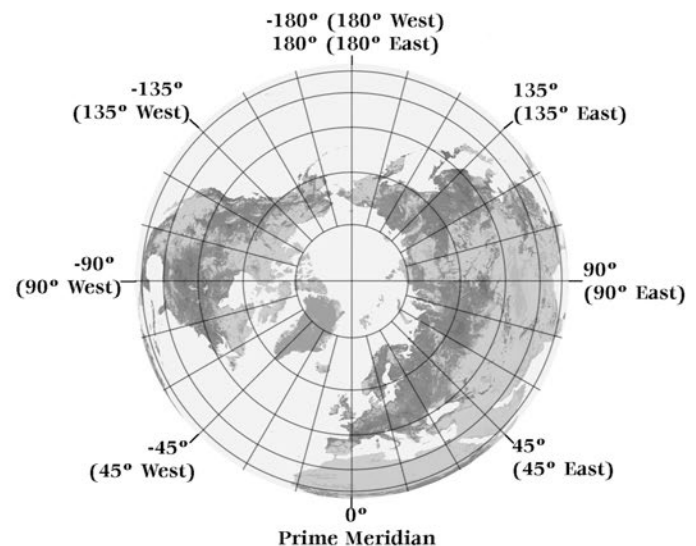
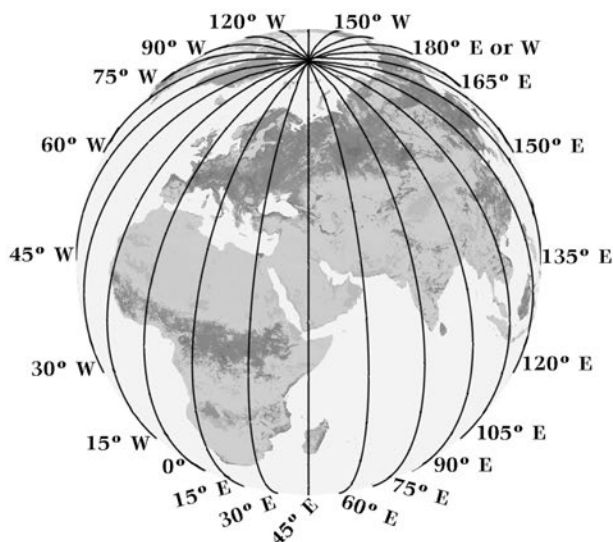
One degree of latitude is equal to about 111 kilometers at any place on the globe. If you know that two cities, at the same longitude, are 10 degrees of latitude apart, then you know they lie about 1,110 kilometers (10 degrees  $\times$  111 km/degree) from each other.

## Longitude

Maps and globes usually have lines on them to help locate places on Earth. These lines are called latitude and longitude lines. These lines are not actually on the planet, but are imaginary lines used to help us find our way around the curved surface of Earth. The imaginary lines circling the globe in an east-west direction are called the lines of latitude (or parallels, as they are parallel to the equator). They are used to measure distances north and south of the equator. The lines circling the globe in a north-south direction are called lines of longitude (or meridians). They are used to measure distances east and west. Lines of latitude and longitude crisscross to form a grid. The location of any point on the surface of Earth can be described by two coordinates: its latitude and its longitude.



Longitude measures how far east or west a point lies from the prime meridian. Values for longitude range from  $0^{\circ}$  to  $180^{\circ}$  E for locations east of the prime meridian and  $0^{\circ}$  to  $180^{\circ}$  W for locations west of the prime meridian.  $180^{\circ}$  E and  $180^{\circ}$  W are the same longitude line.



### One degree of longitude

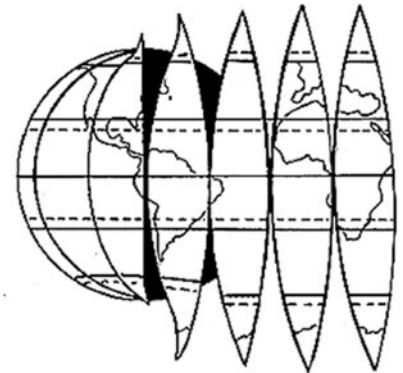
As you go further north or south of the equator, the distance between the two lines of longitude becomes smaller, because all longitude lines intersect at the poles. At the equator ( $0^{\circ}$  latitude),  $1^{\circ}$  of longitude corresponds to approximately 110 kilometers. At  $30^{\circ}$  N or S,  $1^{\circ}$  of longitude corresponds to approximately 96.5 km, and at  $60^{\circ}$  N or S,  $1^{\circ}$  of longitude corresponds to approximately 56 km.

## Globes

The best representation of Earth is a globe. Globes do not distort the geometry of Earth (except, of course, its size!). Since globes are hard to carry around and you can't see the entire surface of Earth all at once, mapmakers produce flat maps of Earth. This is not an easy thing, since the surface of Earth is curved.

## Flat maps of Earth

One way to get a flat map of the curved Earth is to cut the outer layer of the globe from top to bottom in equal sections. These long sections (called gores) are pointed on both ends.



## Mercator maps

There are numerous mathematical methods—called projections—used to transfer information about Earth's curved surface to a flat, rectangular map. One method—the Mercator projection—is the type used for the EarthKAM Slider Map.

Mercator maps give true directions, but they exaggerate the size of the land that is located far from the equator. Compare the two figures: the globe and the Mercator map. They show the same regions of Earth, but the details of the regions look different.

Greenland is much smaller than South America on the globe, but it appears to be larger than South America on the Mercator projection map. Also notice how the longitude and latitude lines are curved on the globe but straight on the Mercator projection map.

