

EXPLORING OUR FLUID EARTH *Teaching Science as Inquiry (TSI)*

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Locating Points on a Globe

NGSS Performance Expectations: MS-ESS1-3 Analyze and interpret data to determine scale properties of objects in the solar system.

The content and activities in this topic will work towards building an understanding of navigational distance scales on earth's surface.

When describing location, it is common to mention the city, state, or country as a location descriptor. It is also common to talk about landmarks that may be nearby. Another way to describe location is to use reference lines to describe coordinates, or absolute position, on the globe.

Two types of imaginary reference lines are used to locate positions or points and to make accurate globes and maps. These lines are called parallels of latitude and meridians of longitude. Two of these imaginary reference lines, the equator and the prime meridian, are called *primary reference lines* because they are where we start the numbering system.

Equator, Hemispheres, Axis, and Directions

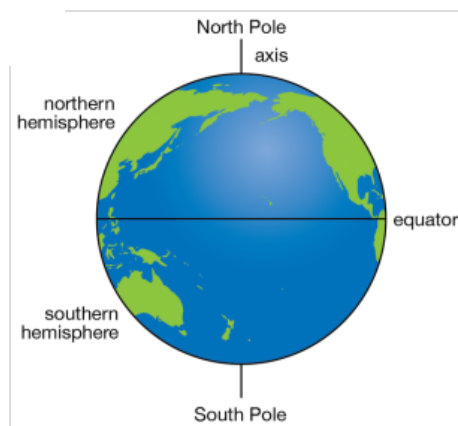


Fig. 1.9. The earth is divided into hemispheres by the equator.

Image by Byron Inouye

The earth rotates daily about its axis. The north and south poles are the two imaginary points where the axis would enter and exit from the earth if the axis were a pole or a line (see Fig. 1.9). The equator is the imaginary primary reference line drawn around the earth halfway between the north and south poles. The half of the earth to the north of the equator is the northern hemisphere; the half to the south is the southern hemisphere (Fig. 1.9). (The prefix *hemi-* means "half"; thus, *hemisphere* means "half-sphere.") The poles determine north and south directions. Movement toward the North Pole is northerly in direction. Movement toward the South Pole is southerly in direction.

Parallels of Latitude

Latitude is measured in degrees ($^{\circ}$)—from 0° to 90° —north or south of the equator. Degrees of latitude are measured from an imaginary point at the center of the earth. If the earth was cut in half, this imaginary point would be intersected by a line drawn from the North Pole to the South Pole and by a line drawn from the equator on one side of the earth to the equator on the other (Fig. 1.10 A). A radius is a line drawn from the edge of a circle to its center. The angle between the radius lines drawn from the equator and from the north pole (or south pole) forms a right angle, which is 90° .

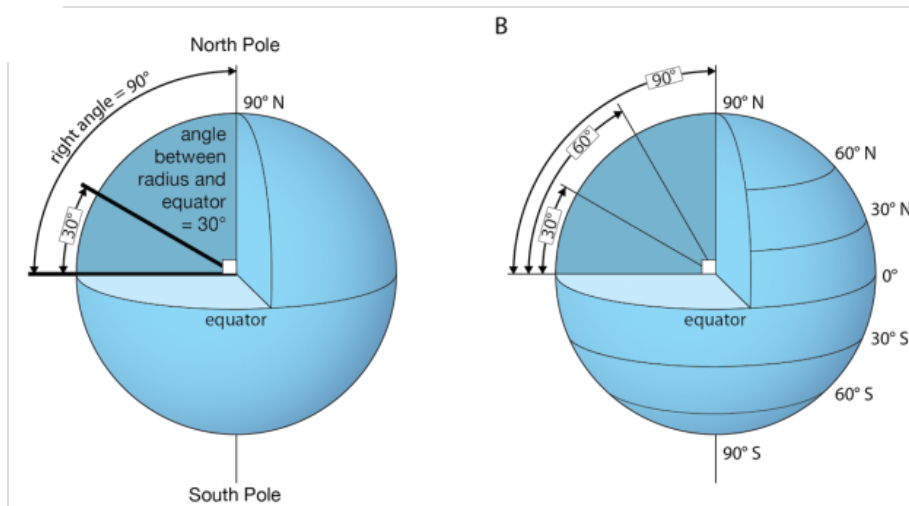


Fig. 1.10. (A) Latitude is determined by the angle between a point on the earth's surface and the equator. Latitude angles are between 0° and 90° . (B) Connecting all the points on earth's surface that are at 30° and 60° angles from the equator in each hemisphere creates these imaginary parallels of latitude.

Images by Byron Inouye

The equator is at 0° , and both of the earth's poles are at 90° from the equator. Latitude is determined by the angle between a point on the earth's surface and the equator. To calculate the angle, draw a line from the point to the center of the earth and a line from the equator to the center of the earth (Fig. 1.10 A).

Parallels of latitude are imaginary reference lines that form complete circles around the earth parallel to the equator and parallel to each other. Every point on a parallel of latitude is the same distance from the equator, and thus the angle formed between the equator and the latitude line is constant. This is shown in Fig. 1.10 B for the latitude lines 30° and 60° north.

Parallels of latitude are circles of different sizes (see Fig. 1.11). The largest parallel is at the equator, and the parallels decrease in size towards the poles. Except for positions located right on the equator (0°), parallels of latitude are described by the number of degrees that they are north (N) or south (S) of the equator. The greater the distance from the equator, either north or south, the higher the latitude. Honolulu, Hawai'i, for example, is on the 21° N parallel. Sydney, Australia, is on the

34° S parallel.

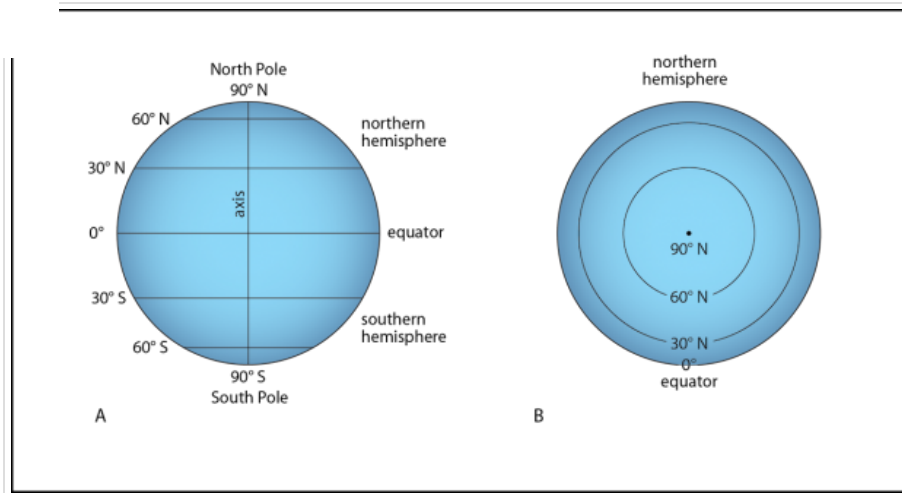


Fig. 1.11. The equator and the parallels of latitude (A) are equally spaced as see in an equatorial view of the world and (B) can be seen to form complete circles when viewed from the north or south pole.

Images by Byron Inouye

WEIRD SCIENCE

► **Weird Science: Polar Circles and Tropical Circles**

Meridians of Longitude

Meridians of longitude are imaginary half-circles running from the North Pole to the South Pole. They are sometimes called lines of longitude. Unlike parallels of latitude that are different sizes, all lines of longitude are the same length. Since every meridian must cross the equator, and since the equator is a circle, the equatorial circle can be divided into 360°. These divisions of the equatorial circle are used to label the meridians.

By international agreement, the 0° meridian (also called the prime meridian) is drawn through Greenwich, England. Meridians are numbered east and west from the prime meridian (Fig. 1.12 A).

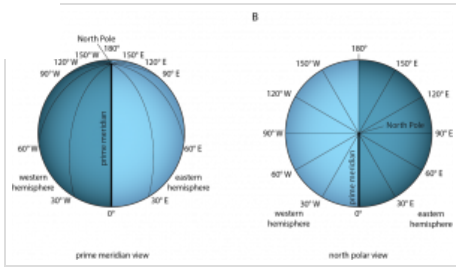


Fig. 1.12. Longitude lines are drawn between the North Pole and the South Pole. (A) The prime meridian (0°) divides earth into two halves of 180°. (B) Longitude is measured in degrees from 0° to 180° east or west of the prime meridian.

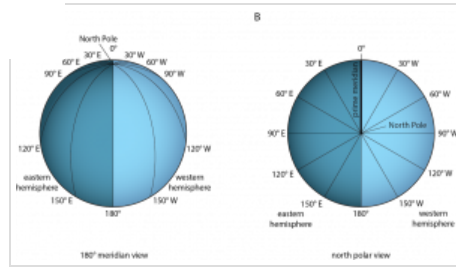


Fig. 1.13. (A) East and west longitude meeting at 180° meridian. (B) The 180° meridian is on the opposite side of the globe from the prime meridian.

Images by Byron Inouye

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Longitude is the distance east or west of the prime meridian, and longitude is measured in degrees from 0° to 180° (Fig. 1.12 B). Places to the east of the prime meridian have east longitude. Rome, Italy, for example, is located on the 12° E meridian, whereas Washington DC, USA, is located on the 77° W meridian.

East and west longitude meet at the 180° meridian, which runs through the Pacific ocean basin (Fig. 1.13). Therefore, most of the United States (including Hawai'i) lies in the western hemisphere. Only a small portion of Alaska (part of the Aleutian Islands) crosses the 180° meridian into the eastern hemisphere. The complete circle around the earth made by the prime meridian (0°) and the 180° meridian divide the earth into eastern and western hemispheres (see Figs. 1.12 and 1.13).

International Date Line

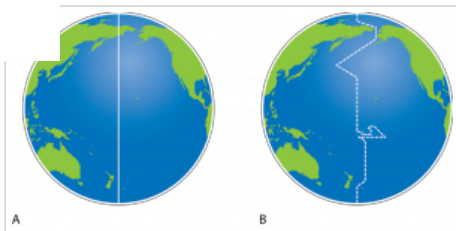


Fig. 1.14. (A) The 180° meridian (B) The international date line

The international date line is an imaginary line running mostly along the 180° meridian (see Fig. 1.14). The international date line determines where on earth the date changes. For example, at the same moment the time is 6:00 am on July 1st in Bangladesh, the time is 6:00 pm on June 30th in Mexico and midnight on June 30th in England (see Fig. 1.15 A).

Images by Byron Inouye

Places located immediately to the right and left of the date line are 24 hours apart. This means that on the left side of the international date line in Tonga, when the time is noon on Monday, July 1st, on the right side of the date line in Sāmoa, the time is noon on Sunday, June 30th (see Fig. 1.15 B).