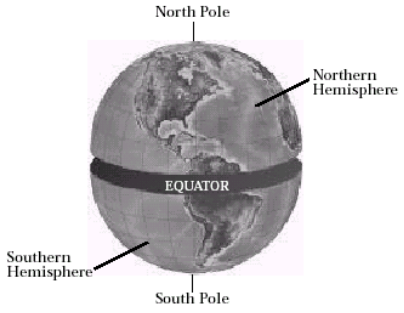
Earth Science – Understanding Mapping

Benchmarks:
Galaxy Explorers will learn about the globe, how to locate points on the earth, what are the major features on our planet, how maps relate to the earth, and the difficulty of projecting flat maps on to the spherical globe.

Standard:
Identify major features on the globe, continents and oceans
Explain the concept of hemispheres
Be able to explain the concept of latitude and longitude
Locate a point on the earth given a latitude and longitude
Given a point on the earth, identify longitude and latitude
Explain the concept of map scales
Explain the difficulty of representing the spherical earth in flat maps

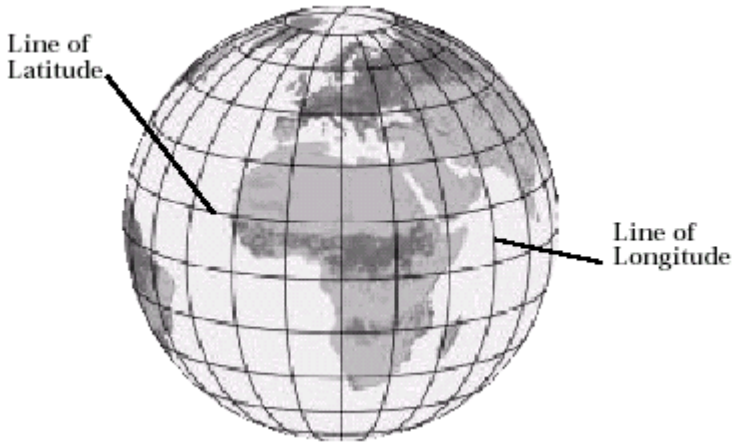
Discussion
Features:
The Surface of Earth Astronauts in the Space Shuttle looking down on Earth see it as a beautiful planet covered with land and water. Only about 30% of Earth's surface is land! The remaining 70% of the surface is covered with water. The land on the surface of Earth is divided into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



Hemispheres:
Hemispheres Earth is approximately spherical with an average radius of 4000 miles. This spherical Earth can be divided into equal halves called hemispheres. If we separate Earth half way 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). Notice that the Northern Hemisphere is 39% land and 61% ocean, while the Southern Hemisphere is 19% land and 81% ocean.

Latitude and Longitude:
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 on the real Earth, 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). The lines circling the globe in a north-south direction are called lines of longitude (or meridians). Lines of latitude and longitude crisscross to form a grid. Two coordinates can describe the location of any point on the surface of Earth: its latitude and its longitude.

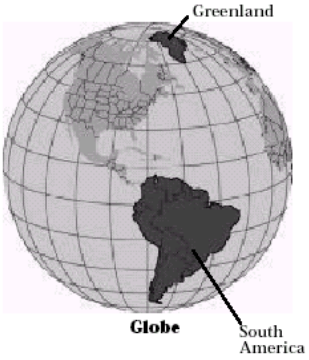
Latitude measures how far north or south a point lies from the equator. The equator is at 0 degrees (0°) latitude, and it divides Earth into its northern and southern hemispheres. It is the starting point for measuring distances in degrees north or south of the equator. Values for latitude range from 0° to 90° North for locations north of the equator, and from 0° to 90° 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.

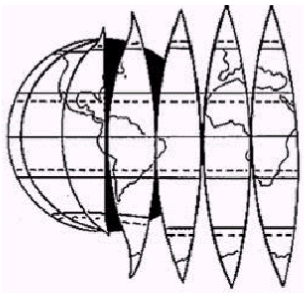


The lines circling the globe in a north-south direction are called lines of longitude (or meridians). Greenwich, England (near London) was selected to be zero degrees longitude in 1884 because it was the home of the most advanced observatory at that time. The "Prime Meridian" runs from the North Pole to the South Pole through Greenwich and is the starting point for measuring East and West longitudes. Locations with 0º longitude lie exactly on the Prime Meridian. Longitude measures how far east or west a point lies from the Prime Meridian. Values for longitude range from 0º to 180º E for locations east of the Prime Meridian and 0º to 180º W for locations west of the Prime Meridian. 180º E and 180º W are the same longitude line.

Globes and Maps:
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 gives true directions, but they exaggerate the size of the land that lies far from the equator.



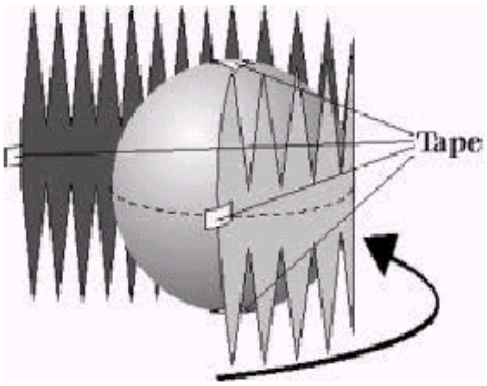


Activity Create a Tennis Ball Globe

Students create a Tennis Ball Globe, seeing how a sphere like the Earth can be shown in one type of flat map.

Procedure

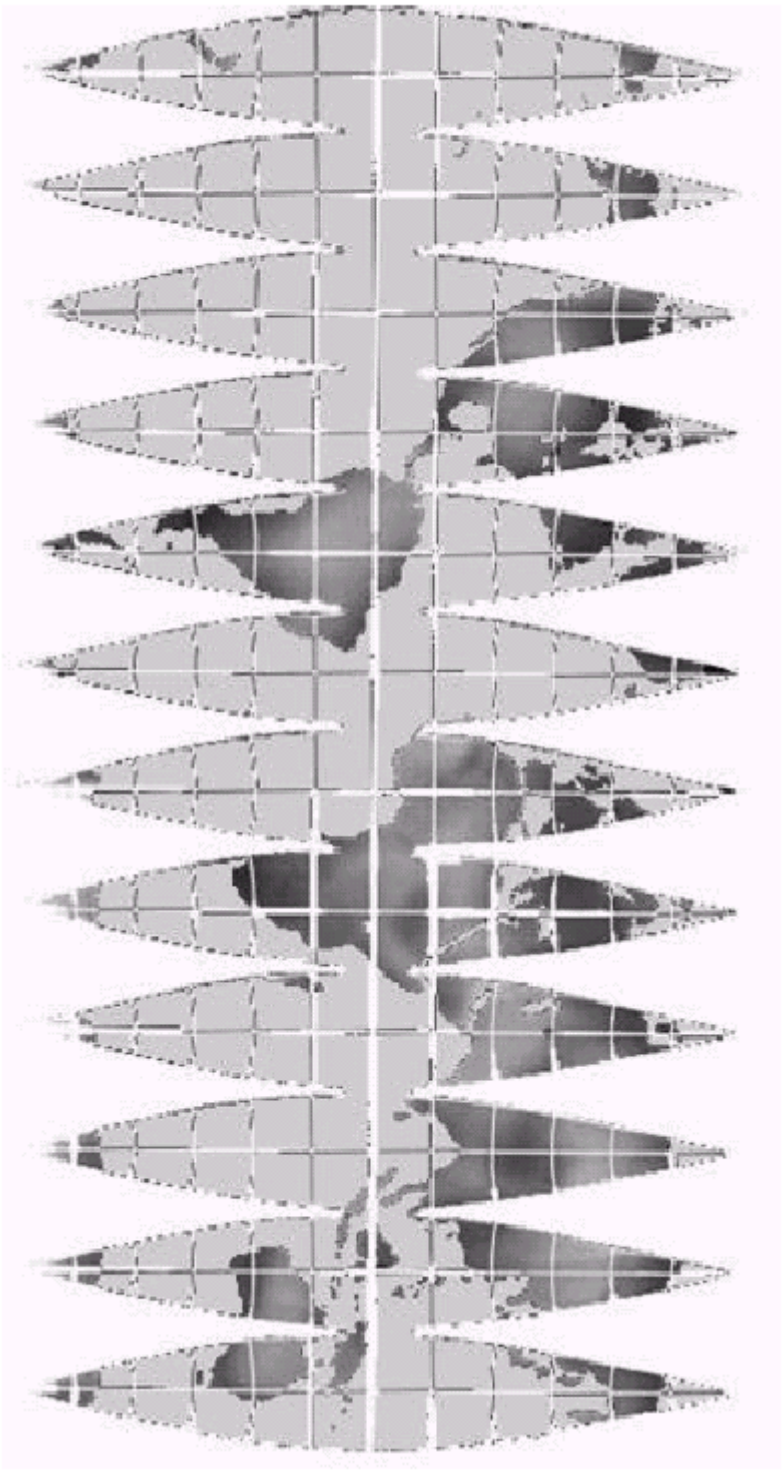
a. Carefully cut out the Map Cut-out.
b. Wrap the cut-out around the tennis ball so the equator goes around the middle of the ball.
c. Tape the map together at the equator.
d. Put a piece of two-sided or folded-over scotch tape at each of the poles—the top and bottom of the ball.
e. Bring the points of the map together, section by section, at each of the poles by pressing them onto the tape.
f. Put a piece of tape on top of the poles to hold all the points in place.



Mission Team Leaders Notes
Each team now has a model of Earth. Have students measure the circumference (in inches) of the tennis ball globe. Then have them determine the scale of their globe, using the fact that the actual circumference of Earth is approximately 25,000 miles. How many miles equal one inch? (If the

tennis ball had a circumference of 10 inches, then 1 inch on the tennis ball would be equal to 2500 miles on Earth's surface.)

MATERIALS
Map Cut-out (1 per team)
Scissors
Tape
Two-sided tape (if available)
Tennis balls (1 per team)
Tape measures
Atlas (optional)

Material Warning:
The Map Cut-out is appropriately sized for wrapping around a tennis ball; however, photocopy machines sometimes cause changes in scale. Check that your photocopies are of the appropriate size before making enough for your Mission Team.

Map Cut-out