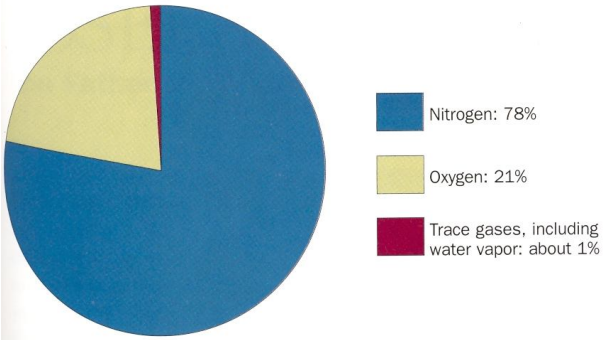
The Atmosphere: A Blanket of Air

What makes the earth different from all other planets in the solar system? Its atmosphere does! The atmosphere acts like a blanket of air around the earth. That means that the atmosphere holds in the amount of heat needed to keep the earth livable. It also affects that amount of solar energy that reaches the earth and protects it from the sun's more harmful radiation.

Just Passing Through

Earth's atmosphere absorbs and reflects solar energy. As a result, the sun does not heat the poles and the equator evenly. Why not? At the poles, sunlight has to pass through more atmosphere than it does at the equator. More atmosphere results in more reflecting and absorbing of the sun's rays. (See the illustration.) This causes less solar energy to reach the earth's surfaces at the poles. And when the sun's energy does reach the poles, ice and snow reflect a portion of it away from the earth. Therefore, even though the North Pole experiences 24 hours of continuous daylight on June 21, it is still colder than cities farther south.

The composition of the atmosphere also affects the amount of solar energy that reaches the earth. Most of the atmosphere is made up of nitrogen. But oxygen, carbon dioxide, variable amounts of water vapor (water that has changed to a gas), and traces of other gases are also part of the mix. Although most of these gases neither absorb nor reflect solar energy, water vapor and carbon dioxide do absorb solar energy and energy given off from the earth. They are the main "greenhouse gases" that keep the planet's atmosphere warm and livable. Without this property of the atmosphere, all of the solar energy would escape back into space. Earth's surface would be so cold that any water would be permanently frozen.



Nitrogen and oxygen make up the majority of the atmospheric gases.

Multilayered Atmosphere

The force of gravity holds the earth's atmosphere in place. The moon has no atmosphere. This is because its gravitational force is much smaller than that of the earth.

Think of the earth's atmosphere as layers of a cake. (See the illustration on page 36.) The bottom layer, the troposphere, is where most of the earth's weather takes place. The troposphere contains most of the water vapor in the atmosphere. Air moves in all directions in the troposphere—up and down and sideways. This is due to the uneven heating created by radiation from the sun above and from the land and oceans below. (In Lessons 5 and 6, you will investigate what happens to air when it is heated by the surface below it.)

The temperature in the troposphere usually gets colder as one goes higher. So the temperature of the air at the top of the tallest mountain is always colder than the air at the base of the mountain.

Above the troposphere is the stratosphere. The stratosphere protects the earth from the sun's harmful radiation. Here the temperature is nearly constant. Very little water vapor or other gases are present; water vapor clouds are rare. Somewhere in the middle is a protective ozone layer. Ozone is a special form of oxygen, O_3. It is an almost colorless gas with an odor similar to weak chlorine. The ozone layer traps the sun's harmful ultraviolet radiation and keeps it from reaching the troposphere.

The third layer of the atmosphere is the mesosphere. At the top of this layer, the temperature decreases to about minus 90 °C before reaching the final layers: the thermosphere and exosphere. There, the air is thin and the least dense. Satellites and other spacecraft can travel in the thermosphere and exosphere with very little resistance. In the exosphere, the earth's atmosphere fades into the vacuum of outer space. □