

What Happens to the Sun's Energy When It Reaches Earth?

Sunlight must pass through the atmosphere before it reaches Earth's surface. The path of the sun's rays is shown in **Figure 2**.  Some sunlight is absorbed or reflected by the atmosphere before it can reach the surface. The rest passes through the atmosphere to the surface.

Upper Atmosphere Different wavelengths of radiation are absorbed by different layers in the atmosphere. For example, some ultraviolet radiation is absorbed by the ozone layer in the stratosphere. Infrared radiation penetrates farther into the atmosphere before some of it is absorbed by water vapor and carbon dioxide.

Troposphere Clouds act as mirrors, reflecting sunlight back into space. Dust-size particles and gases in the atmosphere disperse light in all directions, a process called **scattering**. When you look at the sky, the light you see has been scattered by gas molecules in the atmosphere. Gas molecules scatter short wavelengths of visible light (blue and violet) more than long wavelengths (red and orange). Scattered light looks bluer than ordinary sunlight. That's why the clear daytime sky looks blue.

Earth's Surface It may seem like a lot of the sun's energy is absorbed by gases in the atmosphere or reflected by clouds and particles. However, about 50 percent of the energy that reaches Earth's surface is absorbed by land and water and changed into heat. Look at **Figure 3** to see what happens to incoming sunlight at Earth's surface.

FIGURE 3

Energy at Earth's Surface

Identify What's happening to energy in the lower atmosphere and at Earth's surface? Find out by using the words in the word bank below to complete each sentence.

Word Bank

reflected absorbed radiated

Words may be used more than once.

Draw Conclusions Using the diagram below, draw a conclusion about energy at Earth's surface.

About 25 percent of incoming sunlight is _____ by clouds, dust, and gases in the atmosphere.

About 50 percent is _____ by Earth's surface. This heats the land and the water.

About 20 percent is _____ by gases and particles in the atmosphere.

Some absorbed energy is _____ back into the atmosphere.

About 5 percent is _____ by the surface back into the atmosphere.

Earth's Energy Budget

What happens to the energy that heats the land and water?  Earth's surface radiates some energy back into the atmosphere as infrared radiation.

Much of this infrared radiation doesn't immediately travel all the way back into space. Instead, it's absorbed by water vapor, carbon dioxide, methane, and other gases in the air. The energy from the absorbed radiation heats the gases in the air. These gases in turn hold heat in Earth's atmosphere in a process called the greenhouse effect.

The greenhouse effect, shown in Figure 4, is a natural process. It keeps Earth's atmosphere at a temperature that is comfortable for most living things. Over time, the amount of energy absorbed by the atmosphere and Earth's surface is in balance with the amount of energy radiated into space. In this way, Earth's average temperatures remain fairly constant. But scientists have evidence that human activities may be altering this process.

FIGURE 4

Greenhouse Effect

The greenhouse effect is a natural heat-trapping process.

 **Sequence** Number each step in the diagram to show how the greenhouse effect takes place. Discuss the diagram with a partner.

