Layers of the atmosphere

The atmosphere is divided into layers

You probably know that temperature at the top of a high mountain is usually colder than at the base. But the temperature doesn't just keep decreasing as you go farther and farther up in the atmosphere. The temperature first decreases, then increases, then decreases, and then increases again. Scientists divide Earth's atmosphere into layers based on these zigzags in temperature (Figure 11.7).

The troposphere

We live in the **troposphere** (defined on page 251), the layer that extends from 0 kilometers to approximately 11 kilometers above Earth's surface. About 75 percent of the atmosphere's mass is found in the troposphere. Almost all of Earth's water vapor, carbon dioxide, dust, airborne pollutants, and terrestrial life forms exist here. The Sun warms Earth's surface. Heat radiates from the surface and warms the troposphere. As a result, the troposphere is warmest at Earth's surface. The temperature drops about 6.5°C for every 1 kilometer you go up in the troposphere. The temperature at the top of the troposphere is about –60°C.

Weather in the troposphere

The name *troposphere* contains the Greek root *tropo*, meaning "to turn or change." The troposphere is the region where clouds form and where all weather happens. When you hear about airplanes "flying above the weather," this means that they are flying above the troposphere.

The stratosphere

Above the troposphere lies the **stratosphere** (defined on page 251), extending from about 11 to 50 kilometers above Earth's surface. The temperature *increases* as you go up in the stratosphere because of a thin layer of ozone. The *ozone layer* absorbs the Sun's high-energy ultraviolet (UV) radiation. As a result, the stratosphere increases in temperature with altitude, and we are protected from UV radiation.

The mesosphere

Above the stratosphere, the temperature begins to drop again. This marks the beginning of the **mesosphere** (defined on page 251), which extends from 50 to 85 kilometers above Earth. The mesosphere is the coldest layer of the atmosphere. At its outer reaches, the temperature can be as low as –90°C. Most meteors, or "shooting stars," burn up in the mesosphere.

VOCABULARY

Vocabulary terms are defined on the next page.

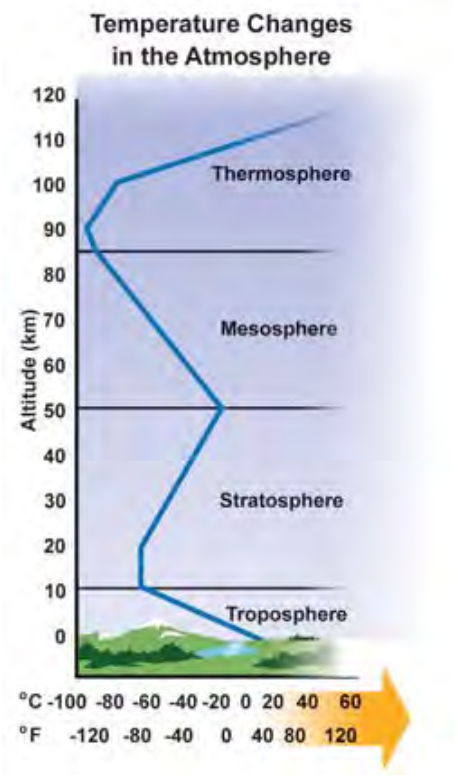

Figure 11.7: *Earth's atmosphere is divided into layers based on temperature.*

The thermosphere

The **thermosphere** layer begins at about 85 kilometers above Earth's surface. This layer has a low density of air molecules—there are 100,000 times more air molecules in a cubic meter of air at Earth's surface than in the thermosphere. These molecules have a lot of kinetic energy, because the energy from the Sun hits them first. Temperatures in this layer can reach 1,800°C.

The ionosphere

The **ionosphere** is part of the thermosphere and is where the Sun's ultraviolet light creates charged atoms and molecules called *ions*. The energy released in this process causes the high temperatures in the thermosphere. Ions easily transmit electricity and electromagnetic waves. The ionosphere makes it possible for you to tune into short wave radio stations that originate a thousand or more miles away. The radio signals are rebroadcast by the ions in the ionosphere back to Earth.

The exosphere

The **exosphere** begins at about 500 kilometers above Earth's surface and does not have a specific outer limit. Lightweight atoms and molecules escape into space from this region. Satellites orbit Earth in the exosphere. Most satellites that we rely on orbit 36,000 kilometers above the equator and travel at the same speed that Earth rotates (called geostationary orbit). This orbital path is called the Clarke Belt.

VOCABULARY

troposphere - a layer of atmosphere that occurs from 0 kilometers to about 11 kilometers above Earth's surface; where all weather occurs.

stratosphere - a layer of atmosphere that occurs from about 11 kilometers to 50 kilometers above Earth's surface; the location of the ozone layer.

mesosphere - a layer of atmosphere that occurs from about 50 kilometers to 85 kilometers above Earth's surface; the coldest layer.

thermosphere - a layer of atmosphere that occurs from about 85 kilometers to about 500 kilometers above Earth's surface; this layer has a low density of air molecules and a very high temperature.

ionosphere - portions of the atmosphere in the region of the thermosphere where electricity can be transmitted.

exosphere - the region of the atmosphere that begins at about 500 kilometers above Earth's surface and extends into space; the location of the orbits of satellites.