

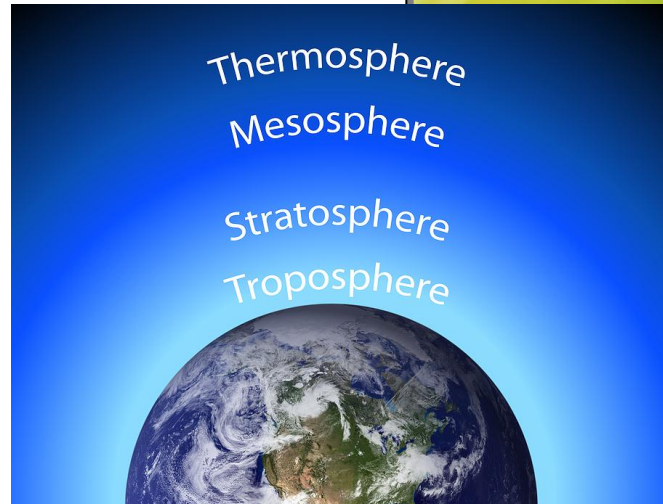
# Problems in the Atmosphere

Earth's atmosphere protects the planet in many ways. It holds in the gases necessary for life and keeps moisture from escaping into space. It also shields the planet from the strong rays of the Sun and burns up meteorites as they head down to the surface. The atmosphere is made up of several layers. The troposphere is the layer closest to Earth's surface. This is followed by the stratosphere, the mesosphere, and the thermosphere. Each layer has a different temperature range and contains different mixtures of gases and moisture. Human

activities on Earth's surface can create changes in the atmosphere. Pollution, acid rain, and holes in the ozone disrupt how the atmosphere normally functions. These disruptions can be tested and observed from the surface of the planet.

## Pollution

Air in the atmosphere is made up of several gases. It is 78% nitrogen (N) and 21% oxygen (O<sub>2</sub>). The last 1% includes carbon dioxide and small amounts of several other gases. Pollution from cars, industry, and other sources add different chemicals to the gases in the atmosphere. These chemicals can get trapped down near the surface of the planet in the troposphere. The troposphere contains the many of Earth's living species. These organisms depend on the gases in the troposphere to stay alive. Pollutants in this layer sometimes react with atmospheric gases to create a molecule called ozone. Ozone is made of three atoms of oxygen bonded



Earth's atmosphere consists of four main layers. Some scientists identify additional layers, including an exosphere, located between the thermosphere and the boundary of space.



Smog is caused by pollutants from cars and industry. These chemicals react to form ozone in the lowest layer of the atmosphere, which can cause health problems for humans.

together ( $O_3$ ). Ozone naturally occurs higher up in the stratosphere, where it protects the planet from the Sun's dangerous radiation. When ozone is present in the troposphere, however, it can cause respiratory problems in humans. Children are more sensitive to ozone and may develop asthma from being exposed to it. Ozone can also damage farmer's crops and trees and other plants in cities and forests. Ozone is also one of the main ingredients of smog that forms over urban areas.

## Acid Rain

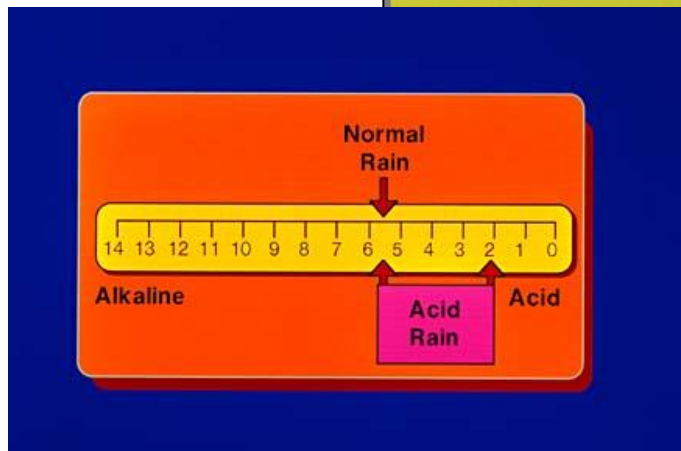
Pollutants from human activities can also cause acid rain.

Acid rain is rain that has a lower-than-normal pH. The pH scale ranges from 0 to 14. It is a way of measuring how acidic or alkaline a substance is.

Substances with a pH under 7 are acidic, and substances with a pH over 7 are alkaline. For example, lemon juice is acidic because it has a pH of 3. Pure water has a pH of 7, right in the middle of the scale. (For this reason, pure water is considered a neutral substance.) However, rainwater and

water on Earth's surface typically have a slightly acidic pH. The chemicals present in pollutants can lower the pH of rain even further. When the pH of rain falls below 5.6, it is considered acid rain.

Many organisms on Earth need water with a pH close to 7 in order to survive. When plants absorb acidic water from the soil, it can cause damage to plant tissue. Acid rain can lower the pH of lakes and rivers to levels that cause problems for fish and other aquatic animals. Acidic water can burn the sensitive skin of these organisms and even cause death. Acid rain also causes decay on buildings and statues in urban areas.



Pollutants can cause the pH of rain to become acidic. Acid rain causes problems for organisms on Earth's surface.

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## Ozone Holes

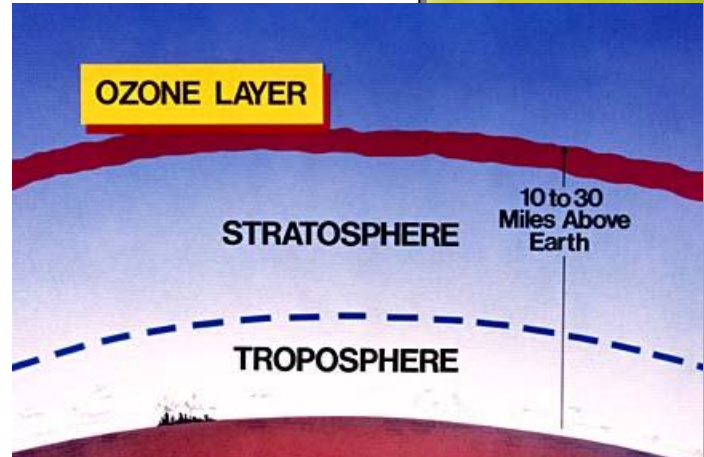
At the top of the stratosphere, there is a layer of naturally-occurring ozone (O<sub>3</sub>). This ozone layer plays an important part in protecting the planet from the ultraviolet (UV) radiation of the Sun. The ozone molecules let some UV radiation through to Earth's surface, but they absorb a large amount.

Chemicals called CFCs cause problems in the ozone layer. CFCs

get released into the atmosphere from chemicals that humans use as coolants and propellants (for example, in aerosol spray cans). CFCs react with ozone molecules in the stratosphere, breaking them

apart. This forms "holes" in the ozone layer where there is a reduced amount of ozone molecules. These areas of reduced ozone molecules cannot protect the planet from the strong UV radiation of the Sun. Too much UV radiation can cause damage to tissue in organisms, including humans.

Human activities release chemicals into the air that can change how the atmosphere functions. As the protective layers of the atmosphere change, it will cause increasing health problems in humans, as well as other organisms on Earth.



The ozone layer protects the surface of the planet from strong UV radiation from the Sun. Chemicals called CFCs react with ozone molecules in this layer at the top of the stratosphere. This reaction causes ozone molecules to break apart.