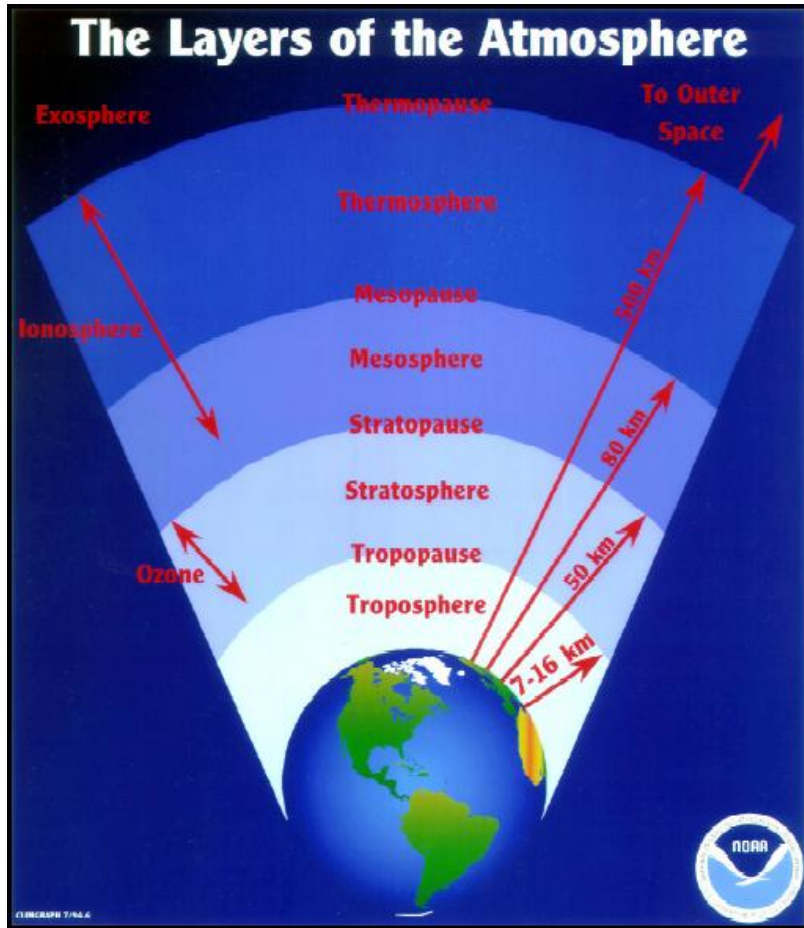


# Atmosphere

## Overview of Earth's Atmosphere

The atmosphere is comprised of gases, consisting mostly of nitrogen and oxygen. It also contains lesser amounts of argon, carbon dioxide, and many other trace gases.



The different layers of the atmosphere have contrasting characteristics, the most fundamental of which is pressure, which decreases with altitude.

Each layer has distinct qualities in terms of temperature.

From bottom to top, the layers are:

- The **troposphere**
- The **stratosphere**
- The **mesosphere**
- The **thermosphere**
- The **exosphere**

## Layer 1: Troposphere

The lowermost of the atmosphere, in contact with the ground is called the troposphere. Temperature decreases with altitude in the troposphere.



We live and breathe in the troposphere, which extends from the ground to about 10 km elevation. What you see from an airplane window is the troposphere.



80% of the mass of the atmosphere is in the troposphere, as the weight of the overlying atmospheric layers compresses the air near the ground.



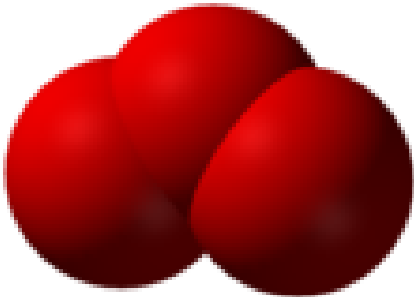
Most weather is confined to the troposphere as well (although some cumulonimbus clouds reach the stratosphere).

## Layer 2: Stratosphere

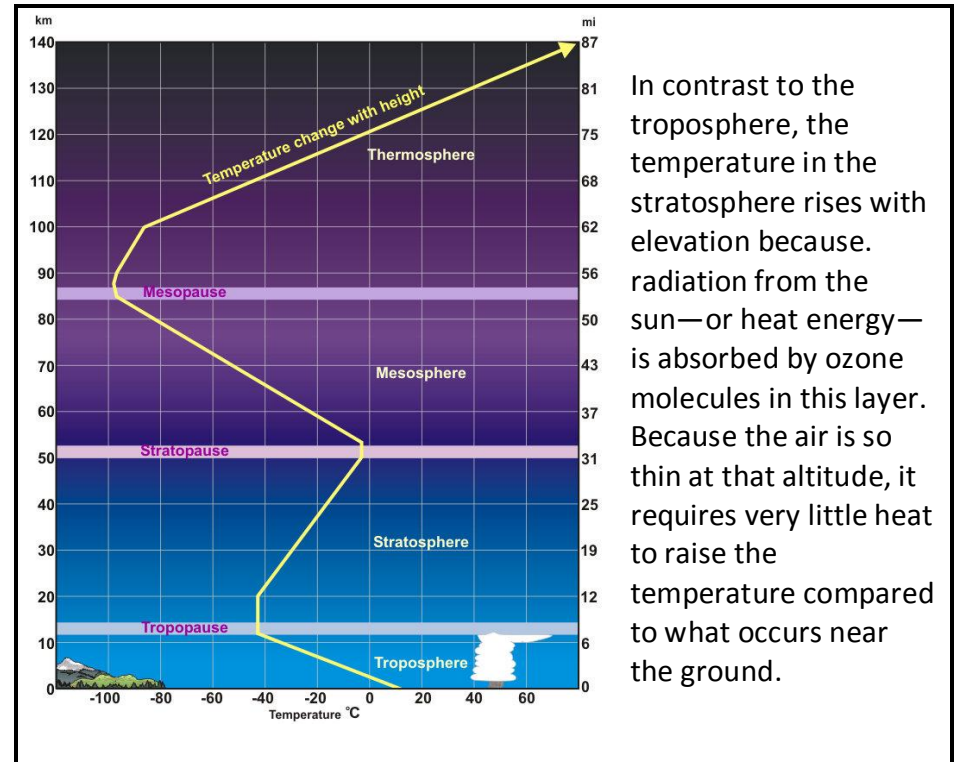
The second layer of the atmosphere is called the stratosphere. This layer is between approximately 10 km and 50 km above the surface.



Compared to the troposphere, the stratosphere has very little water vapor. This layer contains most (19.9% of the remaining 20%) of the remaining of the mass of the atmosphere. This picture was taken from a weather balloon at about 30km above the Earth's surface.



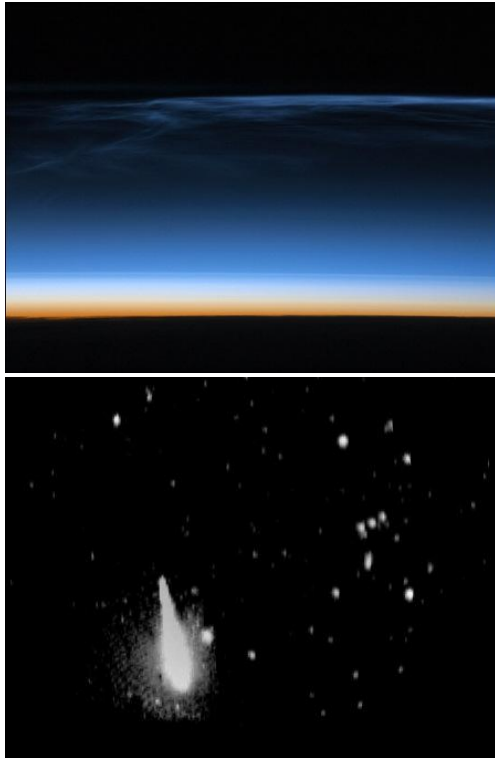
An important aspect of the stratosphere is that there is a key layer of high concentrations of ozone, a molecule consisting of 3 oxygen atoms.



In contrast to the troposphere, the temperature in the stratosphere rises with elevation because radiation from the sun—or heat energy—is absorbed by ozone molecules in this layer. Because the air is so thin at that altitude, it requires very little heat to raise the temperature compared to what occurs near the ground.

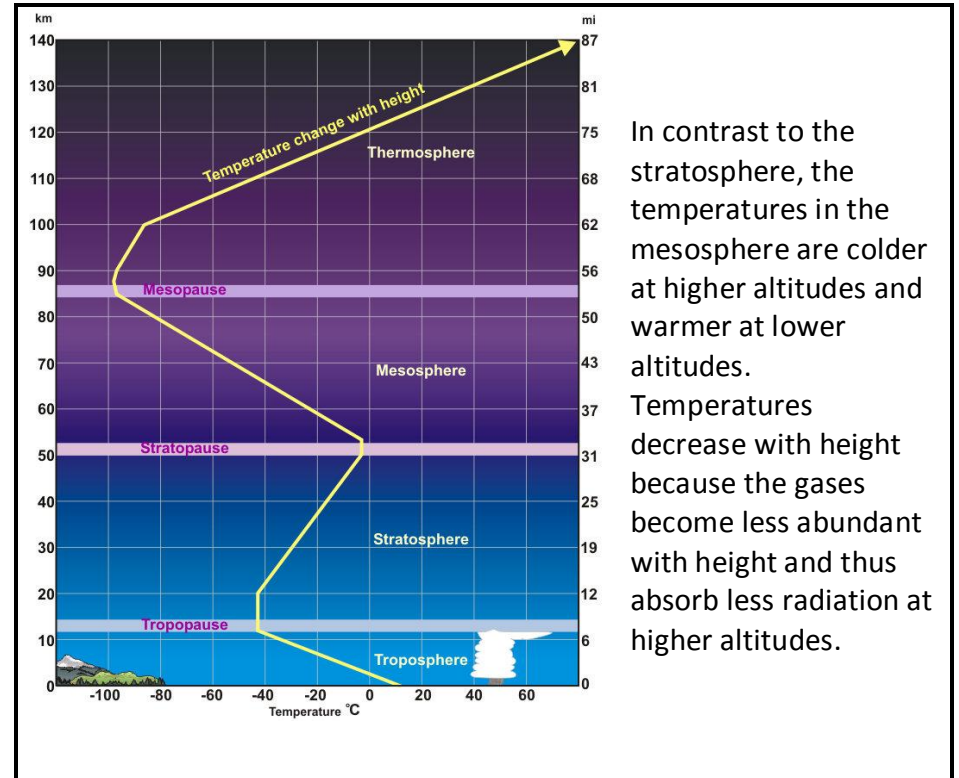
### Layer 3: Mesosphere

The third layer, or middle layer, of the atmosphere is called the mesosphere. This layer is between approximately 50 km and 80-85 km above the surface.



This layer contains gases including oxygen molecules but they become less abundant as the distance from Earth increases. This picture shows mesospheric clouds; it was taken by an astronaut.

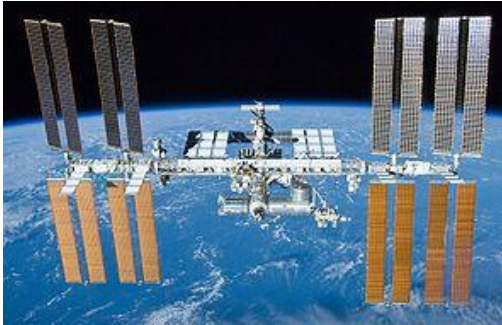
An interesting aspect of the mesosphere is that the gases are thick enough to slow down meteorites. As the meteorite slows down it burns up leaving a fiery trail.



In contrast to the stratosphere, the temperatures in the mesosphere are colder at higher altitudes and warmer at lower altitudes. Temperatures decrease with height because the gases become less abundant with height and thus absorb less radiation at higher altitudes.

## Layer 4: Thermosphere

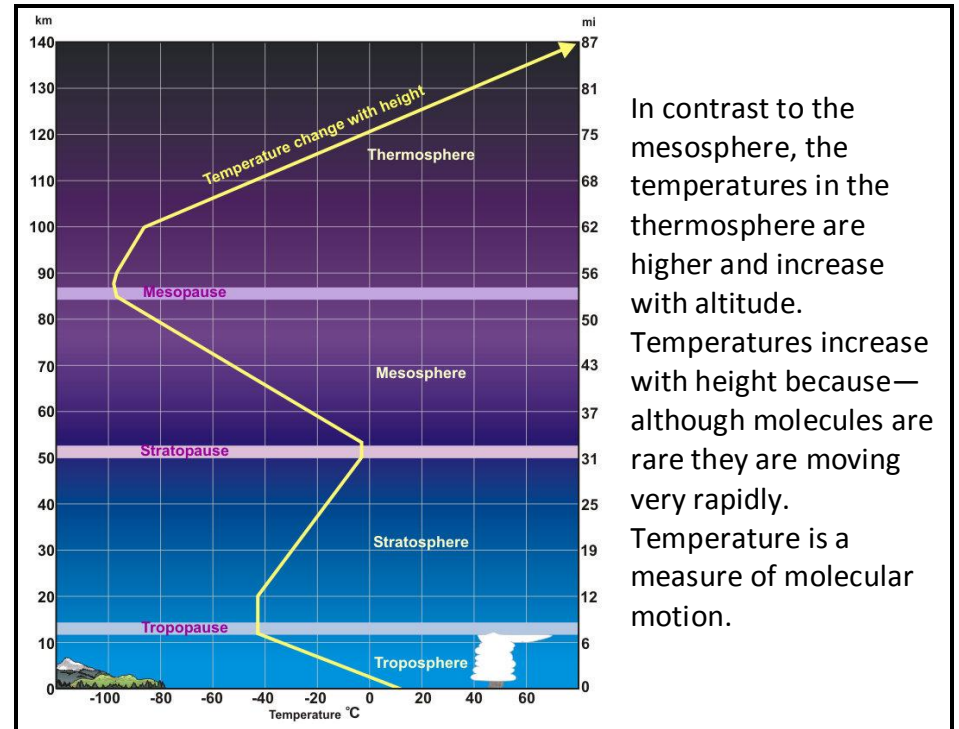
The fourth layer of the atmosphere, or upper atmosphere, is called the thermosphere. This layer is between approximately 80 km and 500 km above the surface.



Like the mesosphere, this layer also contains gases including oxygen molecules but here they become even rarer as the distance from Earth increases. The International Space Station orbits in the thermosphere.



An interesting aspect of the thermosphere is that radiation cause particles to become electrically charged, or ionized. The thermosphere is where auroras occur.



In contrast to the mesosphere, the temperatures in the thermosphere are higher and increase with altitude. Temperatures increase with height because—although molecules are rare they are moving very rapidly. Temperature is a measure of molecular motion.

## Layer 5: Exosphere

The fifth layer of the atmosphere, or outmost layer, is called the exosphere. This layer is between approximately 600 km to 10,000km above the surface.



This layer contains the fewest molecules within the Earth's atmosphere. From the exosphere, molecules can escape into outer space. NASA's Mercury MESSENGER spacecraft took this photo on a mission to observe the Earth's exosphere.