

Stratosphere

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CHAPTER

1

Stratosphere

- Describe the stratosphere and the ozone layer within it.
- Explain the ozone layer's importance to life on Earth.



The pilot says, "We are now at our cruising altitude of 30,000 feet." Why do planes fly so high?

That altitude gets them out of the troposphere and into the stratosphere. Although the arc that they must travel is greater the further from the surface they get, fuel costs are lower because there is less friction due to the lower air density. Also, there is little air turbulence, which makes the passengers happier.

Stratosphere

There is little mixing between the **stratosphere**, the layer above the troposphere, and the troposphere below it. The two layers are quite separate. Sometimes ash and gas from a large volcanic eruption may burst into the stratosphere. Once in the stratosphere, it remains suspended there for many years because there is so little mixing between the two layers.

Temperature Gradient

In the stratosphere, temperature increases with altitude. What is the heat source for the stratosphere? The direct heat source for the stratosphere is the Sun. The ozone layer in the stratosphere absorbs high energy ultraviolet radiation, which breaks the ozone molecule (3-oxygens) apart into an oxygen molecule (2-oxygens) and an oxygen atom (1-oxygen). In the mid-stratosphere there is less UV light and so the oxygen atom and molecule recombine to form ozone. The creation of the ozone molecule releases heat.

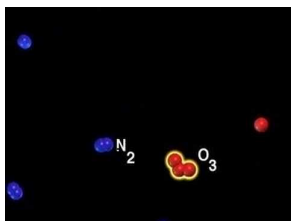
Because warmer, less dense air sits over cooler, denser air, air in the stratosphere is stable. As a result, there is little mixing of air within the layer. There is also little interaction between the troposphere and stratosphere for this reason.

The Ozone Layer

The **ozone layer** is found within the stratosphere between 15 to 30 km (9 to 19 miles) altitude. The ozone layer has a low concentration of ozone; it's just higher than the concentration elsewhere. The thickness of the ozone layer varies by the season and also by latitude.

Ozone is created in the stratosphere by solar energy. Ultraviolet radiation splits an oxygen molecule into two oxygen atoms. One oxygen atom combines with another oxygen molecule to create an ozone molecule, O_3 . The ozone is unstable and is later split into an oxygen molecule and an oxygen atom. This is a natural cycle that leaves some ozone in the stratosphere.

The ozone layer is extremely important because ozone gas in the stratosphere absorbs most of the Sun's harmful ultraviolet (UV) radiation. Because of this, the ozone layer protects life on Earth. High-energy UV light penetrates cells and damages DNA, leading to cell death (which we know as a bad sunburn). Organisms on Earth are not adapted to heavy UV exposure, which kills or damages them. Without the ozone layer to absorb UVC and UVB radiation, most complex life on Earth would not survive long.



MEDIA

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MEDIA

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Summary

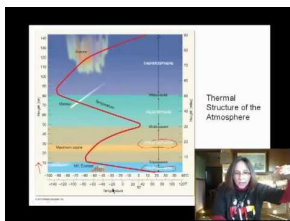
- There is little mixing between the troposphere, where all the turbulence is, and the stratosphere.
- Ozone gas protects life on Earth from harmful UV light, which damages cells.
- The ozone layer, in the stratosphere, has a higher concentration of ozone than other spots in the atmosphere.

Review

1. Why doesn't air mix between the troposphere and stratosphere?
2. Why does one part of the stratosphere earn the name ozone layer?
3. What is the natural cycle that creates and destroys ozone molecules?

Explore More

Use this resource (watch up to 5:24) to answer the questions that follow.



MEDIA

Click image to the left or use the URL below.

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1. What does the figure tell you about what happens to air temperature when you climb a mountain?
2. What happens to temperature with altitude in the stratosphere?
3. Why does the stratosphere have that temperature gradient?
4. What tops the stratosphere?
5. What is the most important feature of the stratosphere and why?