

Temperature of the Atmosphere

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Printed: September 6, 2016

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CHAPTER 1

Temperature of the Atmosphere

- Define temperature gradient.
- Explain how air temperature creates the layers of the atmosphere.



Did you know that you can see the layers of the atmosphere?

The layers of the atmosphere appear as different colors in this image from the International Space Station. Imagine looking out the window at a view like that!

Air Temperature

The atmosphere has layers. The layers correspond with how temperature changes with altitude. By understanding the way temperature changes with altitude, we can learn a lot about how the atmosphere works.

Warm Air Rises

This is really important: Warm air rises. Why does warm air rise (**Figure 1.1**)? Gas molecules are able to move freely. Gas molecules move more at higher temperatures. They can take up as much space as is available.

- When gas molecules are cool, they are sluggish. They take up less space. With the same number of molecules in less space, both air density and air pressure are higher.
- When gas molecules are warm, they move vigorously. They take up more space. Air density and air pressure are lower.

Warmer, lighter air is more buoyant than the cooler air above it. So the warm air rises. The cooler air is denser than the air beneath it. So it sinks down. This is convection: warm air rises, and cool air sinks. Warm fluids can undergo convection as well. This is described in the chapter *Plate Tectonics*.

**FIGURE 1.1**

Papers held up by rising air currents above a radiator demonstrate the important principle that warm air rises.

Temperature Gradient

Air temperature changes with altitude. This does not occur in the same way as pressure and density, which decrease with altitude. Changes in air temperature are not regular. A change in temperature with distance is called a **temperature gradient**.

Temperature of the Atmosphere

Air temperature changes as altitude increases. In some layers of the atmosphere, the temperature decreases. In other layers, it increases (**Figure 1.2**). Refer to this figure as you read about the layers in the coming concepts.

Summary

- Warm air rises, cool air sinks. Warm air has lower density.
- Different layers of the atmosphere have different temperature gradients.
- Temperature gradient is the change in temperature with distance.

Review

1. What causes convection in the atmosphere?
2. How are the layers of the atmosphere divided?
3. What is temperature gradient? If you know that, then what is pressure gradient?

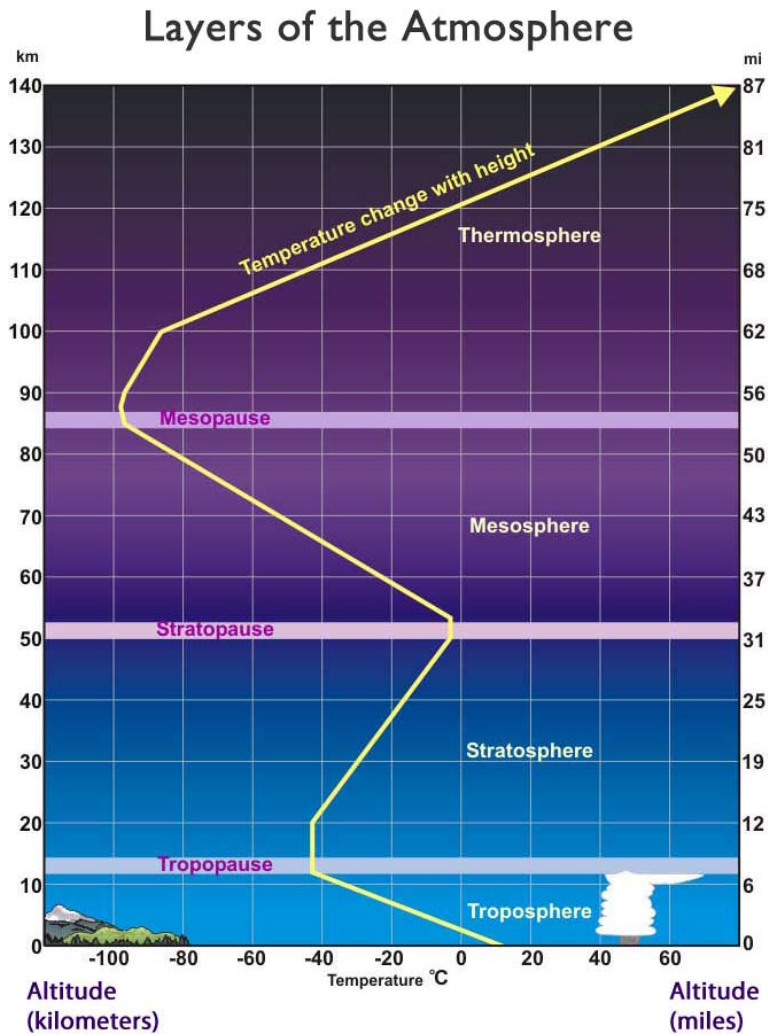


FIGURE 1.2

How does air temperature change in the layer closest to Earth?

References

1. User:SCEhardt/Wikimedia Commons. http://commons.wikimedia.org/wiki/File:Convection_demo_with_radiator_and_papers.jpg . Public Domain
2. Courtesy of National Weather Service, National Oceanic and Atmospheric Administration. <http://www.srh.noaa.gov/jetstream/atmos/atmprofile.htm> . Public Domain