CH 17: EARTH'S ATMOSPHERE

The Earth's atmosphere is more than just the air we breathe. It's also a buffer that keeps us from being peppered by meteorites, a screen against deadly radiation, and the reason radio waves can be bounced for long distances around the planet. The air that accomplishes all of this is composed of four major layers and is thickest near the surface and thins out with height until it eventually merges with space.

Troposphere

The lowest is the troposphere and temperature decreases with altitude. This layer provides most of our weather and is where living organisms exist. It contains about four-fifths of the Earth's air, but extends only to a height of about 11 miles (17 kilometers) at the Equator and somewhat less at the Poles.

The air is heated from the ground up because the surface of the Earth absorbs energy and heats up faster than the air.The name comes from a Greek word that refers to mixing. And mixing is exactly what happens within the troposphere, as warm air rises to form clouds, rain falls, and winds stir the lands below. Typically, the higher you go in the troposphere, the colder it gets. The air in troposphere consists volume of about 78% N_2, 21% O_2, 1% argon (Ar), and 0.03% CO_2.

Stratosphere

Above the troposphere is the stratosphere. It extends to a height of about 30 miles (50 kilometers) and includes the ozone layer (O_3, Three oxygens), which blocks much of the sun's harmful ultraviolet rays.

This layer is characterized by increasing temperature with height (temperature inversion). Near the top of this layer is the region where the harmful ultraviolet solar radiation is absorbed by ozone. This region is known as Ozonosphere. Ozone effectively absorbs the most energetic ultraviolet light, known as UV---C and UV---B, which causes biological damage. The protective role of the ozone layer in the upper atmosphere is so vital that scientists believe life on land probably would not have evolved --- and could not exist today --- without it. Recently, there have been many studies on how humans caused a hole to develop in the ozone layer near the poles. There is compelling scientific evidence that ozone is destroyed in the stratosphere and that some human---released chemicals such as CFC's are speeding up the breakdown of ozone in the atmosphere. Although the global elimination of ozone---depleting chemicals from the atmosphere will take decades yet, we have made a strong and positive beginning. For the first time in our species' history, we have tackled a global environmental issue on a global scale.

Mesopshere

Next comes the mesosphere. In this layer, the air temperature drops again, down to nearly -180 degrees Fahrenheit (-120 degrees Celsius), the coldest atmosphere temperature, at the top. Meteors generally burn up in the mesosphere, which extends to a height of about 52 miles (85 kilometers). This is why the Earth's surface isn't pocked with meteor craters, like the moon's.

Thermosphere

Above the mesosphere is the thermosphere. It is characterized by increase in temperature from the mesosphere. The air is so thin that a small increase in energy can cause a large increase in temperature.

The temperature in the thermosphere is very dependent on solar activity. When the Sun is active, temperatures can reach up to 1,500°C or higher! Because of the thin air in the thermosphere, scientists can't measure the temperature directly. They measure the density of the air by how much drag it puts on satellites and then use the density to find the temperature. It extends to about 430 miles (690 kilometers) and is so thin it's generally considered part of outer space. The International Space Station and many satellites orbit within this layer.

The upper part of the thermosphere is called the ionosphere, it is named for the ions created within this layer by energetic particles from sunlight and outer space. These ions create an electrical layer that reflects radio waves, allowing radio messages to be sent across oceans in the days before communication satellites. Electrical displays in the ionosphere also create the auroras called the Northern and Southern Lights.

LAYERS OF THE ATMOSPHERE STUDENT WORKSHEET

After reading the background information complete the first data table.

Atmospheric Layer	List at least two important characteristics of each layer.
Troposphere	
Stratosphere	
Mesosphere	
Thermosphere	

Analysis Questions:

1. Describe the relationship between the density of air and height (altitude) in Earth's atmosphere?

2. Explain why the troposphere is thicker at the equator than at the poles.

3. List the two most abundant gases in Earth's Atmosphere. _____
    a. Draw a pie chart that shows these two gases.

4. What is needed for clouds to form? _____

5. What important layer exists within the stratosphere? _____
    a. What is the importance of this layer within the stratosphere?

6. Explain a temperature inversion. _____
    a. Which layers have a temperature inversion?

7. Which layer has the coldest temperatures? _____

8. After reviewing the effects of ozone, how do you think our lives would be different if the ozone were destroyed?

9. What chemical is helping destroy ozone? _____

10. What latitude are the ozone holes located at? _____

11. What important layer exists within the thermosphere? _____
    a. What is the importance of this layer within the thermosphere?

12. Sketch a graph that shows how temperature (x axis) changes with each layer, or height (y-axis).