

Name: _____ Date: _____ Period: _____

Determining How Temperature Changes with Altitude

Introduction

The atmosphere is divided into four layers based on temperature: The troposphere, the Stratosphere, the mesosphere, and the thermosphere. The temperature in the lower 12km of the atmosphere decreases with altitude. However, at altitudes from about 12 to 45 km, the temperature increases.

In this investigation, you will explore the temperature changes in Earth's atmosphere as altitude increases and investigate what causes these temperature changes.

The problem:

How does the temperature of Earth's atmosphere change with altitude?

Pre-Lab Questions:

1. Write a question that summarizes the purpose of this investigation.
2. What are the possible sources of heat for the atmosphere?
3. What substance in the upper atmosphere is important to temperature changes in the upper atmospheric layers?

Materials:

Ruler, Colored Pencils, Resource 12 diagram

Procedure:

1. Carefully study the Atmospheric Temperature Curve shown in the diagram.
2. Using a ruler, draw lines to show the Tropopause, Stratopause, and Mesopause. Label each line.
You may use your textbook as a reference.
3. Label the troposphere, mesosphere, stratosphere, and thermosphere. Shade in each section using a DIFFERENT color for each.

Analysis and Conclusions:

1. What is the approximate temperature of the atmosphere at each of the following altitudes?
 - a. 10km: _____°C
 - b. 50km: _____°C
 - c. 80km: _____°C

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2. How does the temperature change with altitude in the troposphere?
3. What causes the temperature change in the troposphere?
4. How does the temperature change with altitude in the stratosphere?
5. What causes the temperature change in the stratosphere?
6. How does the temperature change with altitude in the mesosphere and thermosphere?
7. Explain the temperature change with altitude in the thermosphere.
8. If the average normal temperature decrease with altitude in the troposphere is $6.5^{\circ}\text{C}/\text{km}$, calculate the approximate temperature at 6,000 m if the surface temperature is 16°C . Show your work
(1000m = 1 km)
9. If the average or normal temperature decrease with altitude in the troposphere is $6.5^{\circ}\text{C}/\text{km}$, calculate the approximate altitude in which a pilot would expect to find each of the following atmospheric temperatures, if the surface temperature is 27°C . Show your work. Why is the gas ozone in the stratosphere important? If the ozone gases were to decrease, how would that affect the radiation received at Earth's surface?