

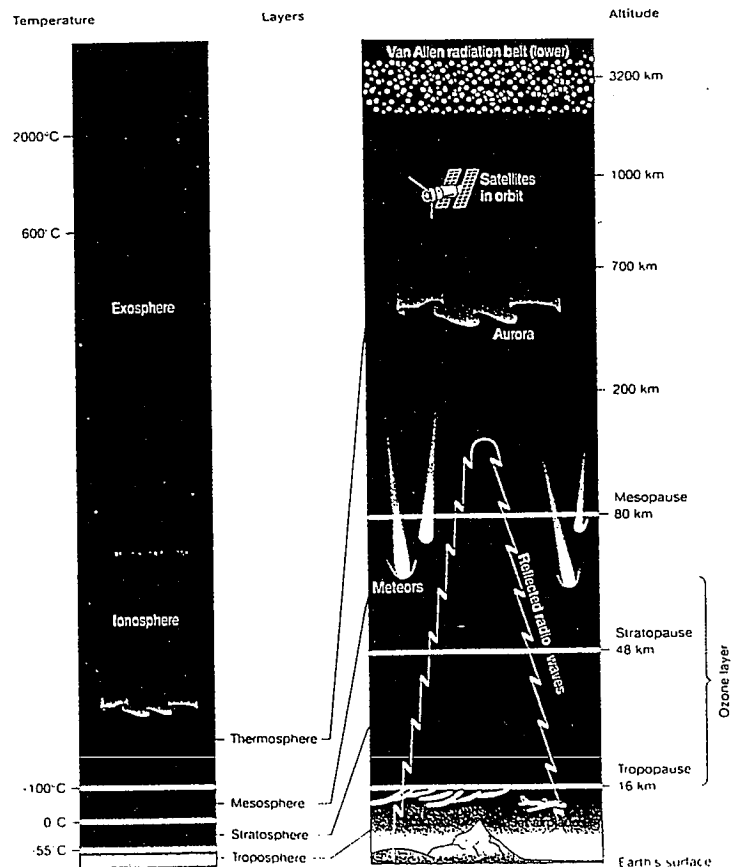
Teaching Activity: Characteristics of the Earth's Atmosphere

Introduction: For centuries people have marveled at and wondered about the envelope of gases that surrounds our planet. Earth's atmosphere is the product of 4 billion years of evolution. Observation and interpretation from the time of Aristotle to the present reveal a complex and ever-changing mix of gases.

The atmosphere exists as a series of distinct layers, each layer having its own characteristics and sometimes special phenomena. The *troposphere*, the bottom-most layer, is a region where air temperature decreases steadily with increasing altitude. In the *stratosphere*, ozone, a form of oxygen, absorbs ultraviolet (UV) radiation from the Sun and warms this layer, especially between 19 and 30 km above sea level. The stratosphere plays a protective role since both ultraviolet and cosmic rays are absorbed or broken up there, decreasing their harmful effects at lower levels in the atmosphere. Moving up to the next layer, the *mesosphere*, temperatures as low as -130 degrees C may be recorded. Still farther up, in the *thermosphere*, very high temperatures, often in excess of 1650 degrees C, are the result of a steady influx of solar energy.

The high intensity of solar energy in the upper mesosphere and thermosphere strips atmospheric atoms of their electrons, producing an electrically conductive region known as the *ionosphere*. It is in this region that long-distance radio broadcasts may be affected and auroral displays are produced. Auroras are usually observed in polar regions.

At 480 km above sea level, the top layer, or *exosphere*, merges into the realm of Earth's magnetic field, radiation belt and eventually outer space. The drawing below illustrates the spatial relationships and characteristics of these atmospheric layers and interfaces.



Important Terms: Troposphere, stratosphere, mesosphere, thermosphere, exosphere, ionosphere, ultraviolet radiation, infrared radiation, auroras;

Materials: Atmosphere charts and models (optional), resource materials;

Objectives:

- To identify the characteristics of the layers of the Earth's atmosphere;
- To analyze the spatial relationships of the atmospheric layers and interfaces;

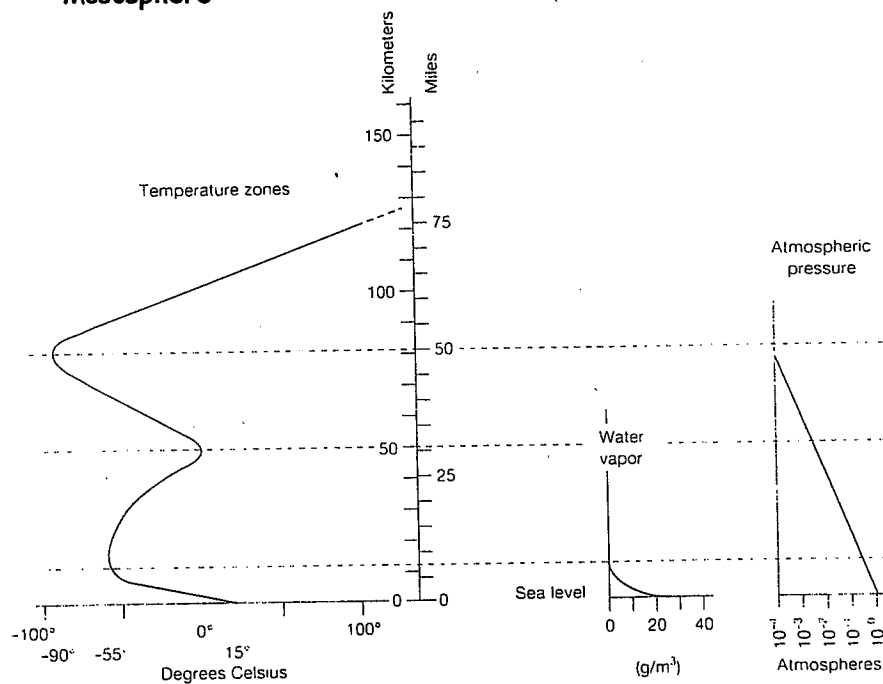
Procedure:

1. Using the information in the Introduction and the illustration of the Earth's atmosphere, students should label the following layers and features of the Earth's atmosphere in the diagram provided:

Troposphere
Stratosphere
Mesosphere

Thermosphere
Exosphere

Ozone layer
Aurora region



2. Students should then complete the **Analysis and Conclusions** section.

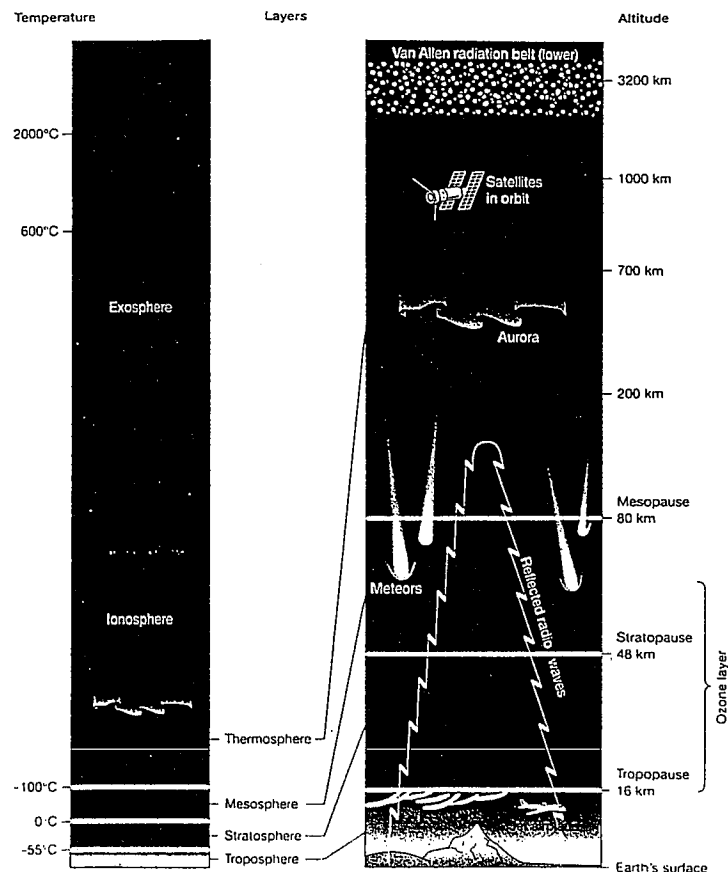
Students Activity Sheet: Characteristics of the Earth's Atmosphere

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Objectives:

- To identify the characteristics of the layers of the Earth's atmosphere;
- To analyze the spatial relationships of the atmospheric layers and interfaces;

Procedure:

1. Using the information in the **Introduction** and the illustration of the Earth's atmosphere, label the following layers and features of the Earth's atmosphere:

Troposphere

Thermosphere

Ozone layer

Stratosphere

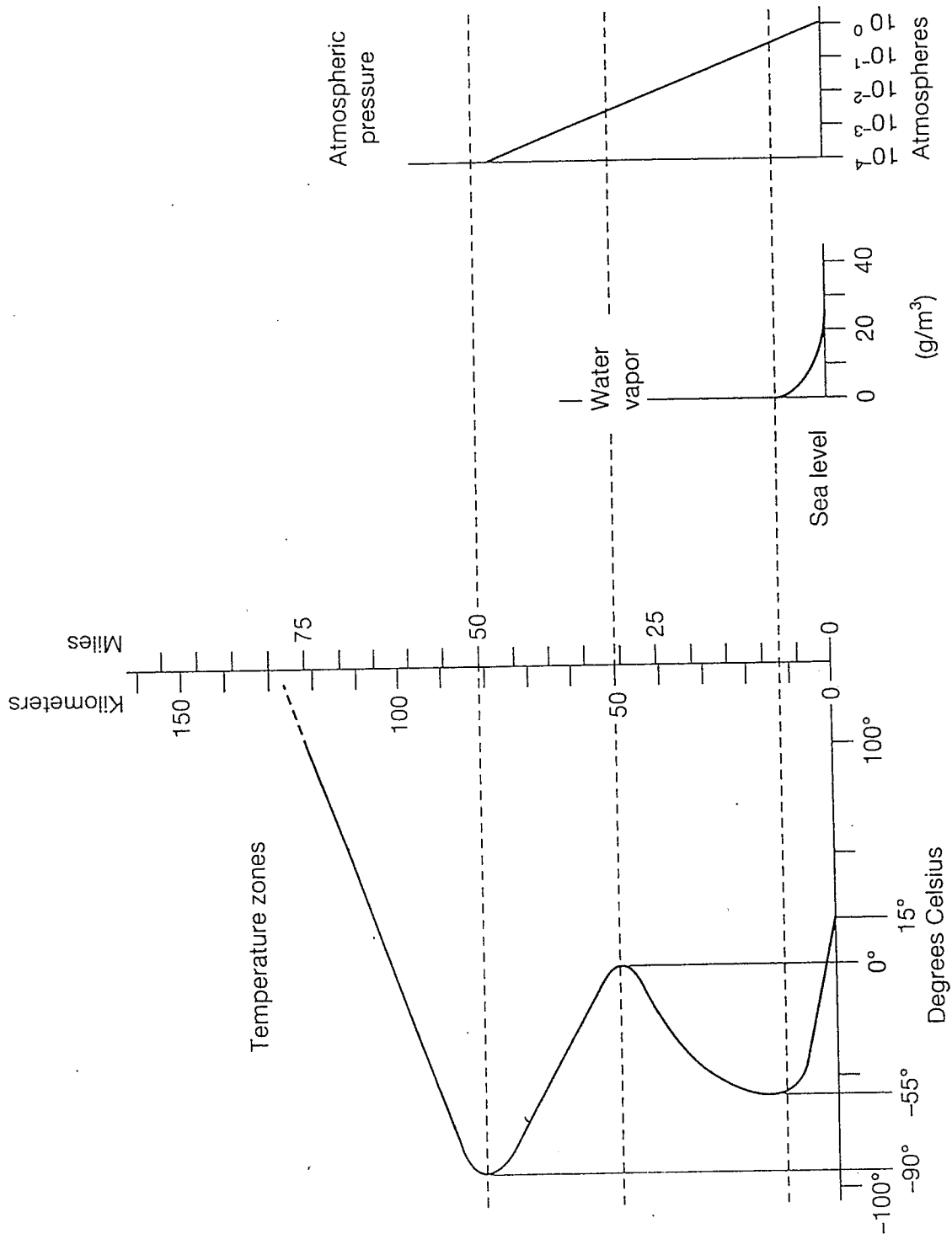
Exosphere

Aurora region

Mesosphere

2. Complete the **Analysis and Conclusions** section.

Diagram: Atmospheric Layers and Interfaces



ANALYSIS AND CONCLUSIONS:

1. Compare temperature changes and patterns in the troposphere and stratosphere.

2. In which layer of the atmosphere is most of the water vapor located?

3. In which layer is the atmospheric pressure the highest? The lowest?

4. In which layer would the Earth's water cycle be the most active? Why?

5. In which layer would weather systems have the greatest impact on living things? Why?

5. What are the two main sources of heat in the troposphere?

6. Ions are electrically charged particles. What does this tell you about the ionosphere?

7. The average sea level air pressure is equal to about 1000 millibars (mb) or 10^0 atmospheres. What is the pressure of the atmosphere at the following heights:

- a. 16 km _____ c. 48 km _____
b. 80 km _____ d. 40 km _____

8. With an increase in altitude, pressure decreases at a(n) (constant, increasing, decreasing) rate. Write the correct answer.

9. Why does the temperature increase in the stratosphere?

10. Although the ionosphere does not appear to have any effect on daily weather, a person still might have some indirect contact with this electrically charged zone. Briefly explain.

11. What is the main cause of auroral displays?

12. List the layers of the atmosphere and the approximate ranges in altitude.

