

Graphing the Atmosphere

Name: _____ Date: _____ Period: _____

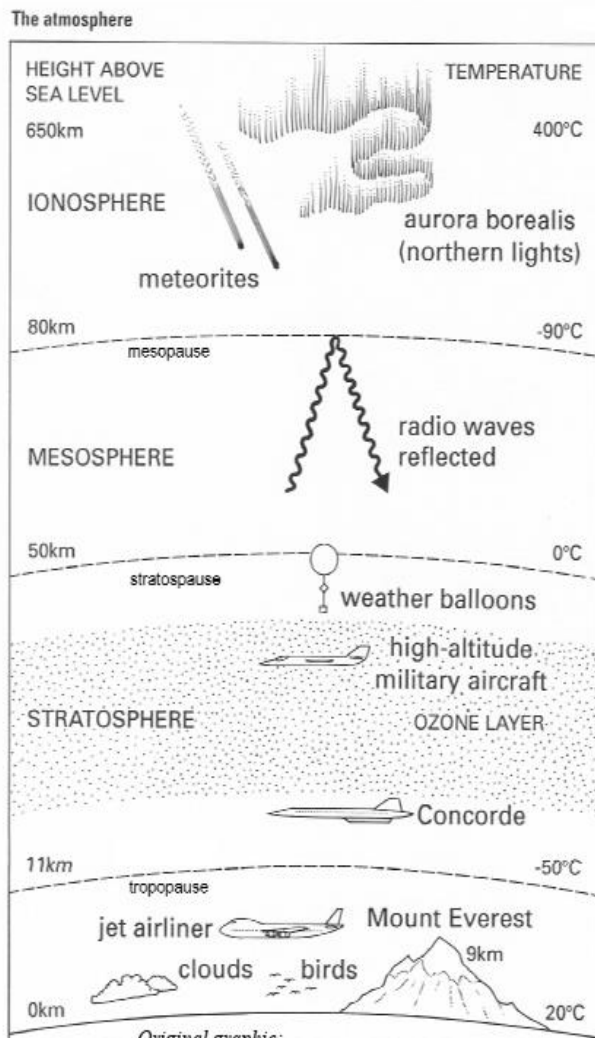
LT: I can develop a logical argument for dividing the atmosphere into layers by graphing temperature data for different altitudes.

Source: Poarch, M. "Graphing the Atmosphere." *Science-Class.net*, 2006, science-class.net/archive/science-class/Lessons/Atmosphere/graphing_the_atmosphere.pdf.

Background Information:

The atmosphere can be divided into four layers based on temperature differences. The layer closest to the Earth is called the troposphere. Above this layer is the stratosphere, followed by the mesosphere, then the thermosphere. The upper boundaries between these layers are known as the tropopause, the stratopause, and the mesopause in that order.

Temperature differences in the four layers are caused by the way solar energy (energy from the sun) is absorbed as it moves downward through the atmosphere. The Earth's surface absorbs most of the sun's energy. Some of this energy is bounced back out by the Earth as heat, which warms the troposphere.



At the mesopause, the temperature begins to increase with altitude, and this trend continues in the thermosphere. Solar energy hits the Earth's atmosphere and heats it.

The mesosphere does not absorb solar heat, so the temperature decreases with altitude.

The temperature begins to increase with altitude in the stratosphere. This warming is caused by a form of oxygen called ozone (O_3) absorbing ultraviolet radiation from the sun.

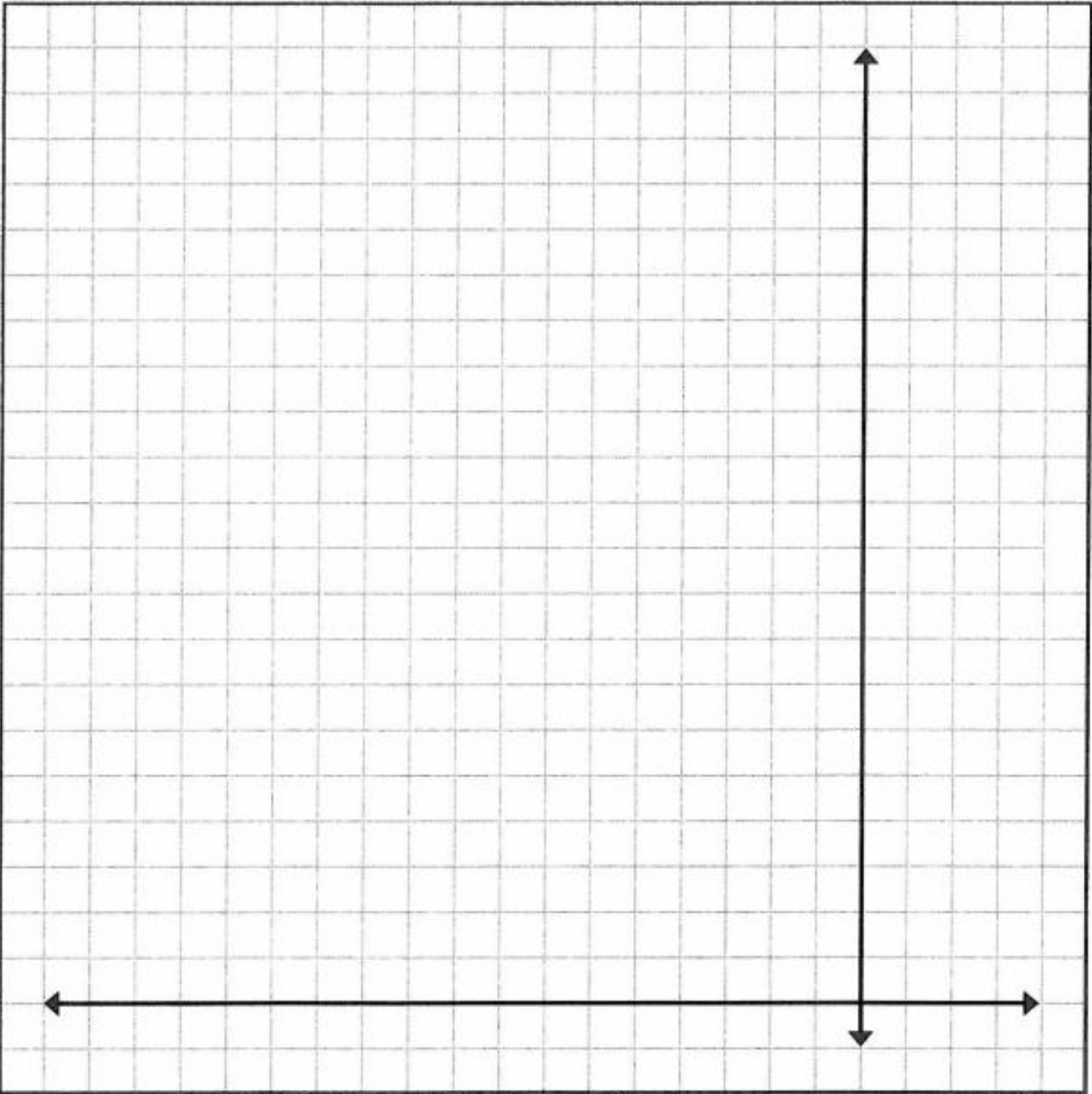
The average temperature in the troposphere rapidly decreases with altitude – it colder the higher you go.

Procedure:

1. Graph the data
 - a. Using the data table below make a line graph of the data. You will use a line graph even though the data does not seem to fit the rules that we have laid out for a line graph. Both variables are numbers, but one of them is not time. It would seem that we should use a scatter plot. Since the altitude is a continuum (i.e. a continuous sequence), you will use a line graph. Line graphs are used to plot continuous data.
 - b. Temperature is plotted on the x-axis and altitude on the y-axis
 - c. Be careful to plot the negative temperatures correctly.
 - d. Remember TAILS

Temperature (°C)	Altitude (km)
15	0
-18	5
-49	10
-56	12
-56	20
-51	25
-46	30
-37	35
-22	40
-8	45
-2	48
-2	52
-7	55
-17	60
-33	65
-54	70
-65	75
-79	80
-86	84
-86	92
-81	95
-72	100

2. After you have graphed your data label the different layers (spheres) of the atmosphere and the separating boundaries (pauses) between each layer. Use the figure on page one to help you choose the correct altitude for each label.
 - Troposphere
 - Tropopause
 - Stratosphere
 - Stratopause
 - Mesosphere
 - Mesopause
 - Thermosphere
3. Label the general location of the ozone layer.



Questions and Conclusions:

1. Does the temperature increase or decrease with altitude in the:
 - a. troposphere? _____
 - b. stratosphere? _____
 - c. mesosphere? _____
 - d. thermosphere? _____

2. What is the approximate height and temperature of the:

	Height (km)	Temperature (°C)
tropopause?	_____	_____
stratopause?	_____	_____
Mesopause?	_____	_____

3. What do you think causes the temperature to increase with altitude through the stratosphere?

4. What do you think causes the temperature to decrease with altitude through the mesosphere?

5. What do you think causes the temperature to decrease with altitude in the troposphere?

6. Why do you think scientists divide the atmosphere into four layers?

7. Where do you think that the “pauses” got their names?
