

## "LET'S CREATE A LITTLE ATMOSPHERE"



The Task: This activity will help you understand how the atmosphere is divided into layers based on temperature changes at different altitudes. In addition, different characteristics of each layer will be uncovered.

Instructions: The atmosphere can be divided into layers based on temperature variations. This laboratory will help you construct a graphical representation of the temperatures of the atmosphere. In addition, there are several other tasks to complete to help uncover different properties of the atmosphere, so make sure to follow all instructions given. Check off each task as you complete it and use a pencil in case you need to erase any mistakes. **Make sure to read all instructions for each task!!**

### **Task 1: Plotting Temperatures at Different Altitudes**

Table 1 contains the average temperature readings at various altitudes in the Earth's atmosphere.

- \_\_\_ 1. Plot the data on the graph provided and connect the points with solid lines.  
 MAJOR SUGGESTION: Every time you plot a point connect the dots – do not wait until the very end to connect all the dots you plotted – it may confuse you!

Altitude (km)	Temperature (°C)	Altitude (km)	Temperature (°C)
0	15	53	-3
5	-18	56	-10
8	-46	60	-17
11	-55	65	-33
20	-53	70	-54
25	-50	75	-73
30	-46	78	-84
35	-37	81	-90
40	-22	85	-86
45	-8	95	-25
50	0	100	3

## **Task 2: Labeling the Layers of the Atmosphere**

- \_\_\_ 2. Draw dashed horizontal lines at the following altitudes: 11km, 50km, 81km. These lines represent the interfaces (boundaries) between different layers of the atmosphere. (use a darker color like purple)
- \_\_\_ 3. The space between Earth's surface and approximately 11km is known as the troposphere. Label this area "**troposphere**". Use a light color to shade this area in. (light blue, if possible)
- \_\_\_ 4. The dashed line that you drew at 11km is the upper boundary of the troposphere known as the "tropopause". Label this line "**tropopause**".
- \_\_\_ 5. The space between 11km and 50km is known as the stratosphere. Label this area "**stratosphere**". Use a different light color to shade this area in. (pink, if possible)
- \_\_\_ 6. The dashed line that you drew at 50km is the upper boundary of the stratosphere known as the "stratopause". Label this line "**stratopause**".
- \_\_\_ 7. The space between 50km and 81km is known as the mesosphere. Label this area "**mesosphere**". Use another different light color to shade this area in. (orange, if possible)
- \_\_\_ 8. The dashed line that you drew at 81km is the upper boundary of the mesosphere known as the "mesopause". Label this line "**mesopause**".
- \_\_\_ 9. The space above 81km (that extends up to 600km) is known as the thermosphere. Label this area "**thermosphere**". Use another different light color to shade this area in. (yellow, if possible)

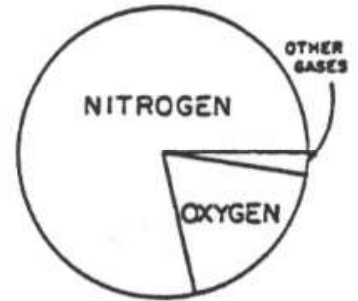
## **Task 3: Indicating Important Characteristics of Each Layer**

In this section of the lab, make a key that will represent the items discussed and then plot the items using the symbols in the appropriate layer.

- \_\_\_ 10. The ozone layer is an important layer of gas that is spread out in the stratosphere. The highest concentration of ozone is located just below the stratopause. Use a highlighter to draw a thick line below the stratopause indicating the location of the ozone layer. Be sure to add this to your key.
- \_\_\_ 11. The thermosphere is directly affected by the Sun's rays that knock electrons (negative particles) off of oxygen atoms. This forms ions (positively charged atoms). These ions are known to reflect radio waves back toward Earth's surface and increase their range of broadcast. Draw ten little "+"s spread out through the thermosphere to indicate these ions. Be sure to add this to your key.
- \_\_\_ 12. 99% of all weather – spread throughout the troposphere. The symbol for weather will be a lightning bolt - be sure to add this symbol to your key. Put 5 lightning bolts spread out in the troposphere to represent the weather.
- \_\_\_ 13. Just about all life exists in the lower areas of the troposphere. Draw 3 little stick people in the troposphere to represent the area that life exists - be sure to add this symbol to your key.

**Task 4: More Characteristics of Each Layer: Summary Questions**

14. The atmosphere contains many different gases, but the majority of the atmosphere is made up of nitrogen and oxygen. The pie graph below shows the relative amounts of the different gases present in the atmosphere.



Even though the pie graph gives you a visual, use the *ESRT* for a more accurate answer ...

- a. What percent of the atmosphere is nitrogen? \_\_\_\_\_
- b. What percent of the atmosphere is oxygen? \_\_\_\_\_
- c. About 1% of the atmosphere is made up of "other gases", name at least one of these "other gases"? \_\_\_\_\_
15. As the altitude in the troposphere increases, the temperature
- (1) increases
  - (2) decreases
  - (3) remains the same
  - (4) increases, then decreases
16. According the graph created, the temperature of the stratosphere ranges from approximately
- |                 |                 |
|-----------------|-----------------|
| (1) -55°F – 0°F | (3) 10°F – 35°F |
| (2) -55°C – 0°C | (4) 10°C – 50°C |
17. Which layer of the atmosphere has the largest distance from the bottom to the top of its zone?  
(Make sure to look back at Task 2 for some help ...)
- |                  |                  |
|------------------|------------------|
| (1) troposphere  | (3) mesosphere   |
| (2) stratosphere | (4) thermosphere |
18. In which layer of the atmosphere is ozone located?
- |                  |                  |
|------------------|------------------|
| (1) troposphere  | (3) mesosphere   |
| (2) stratosphere | (4) thermosphere |
19. Using the graph you created, what is the approximate temperature of the air at an altitude of 3 km?
- |           |           |
|-----------|-----------|
| (1) 3°C   | (3) 0°C   |
| (2) -12°C | (4) -20°C |
20. Which layer of the atmosphere has the smallest distance from the bottom to the top of its zone?
- |                  |                  |
|------------------|------------------|
| (1) troposphere  | (3) mesosphere   |
| (2) stratosphere | (4) thermosphere |

**ROMANO**

21. What is the approximate thickness of the mesosphere?  
(1) 11km (3) 50km  
(2) 31km (4) 81km
22. Near which boundary would a temperature of -90°C most likely occur?  
(1) tropopause (3) mesopause  
(2) stratopause (4) thermopause
23. Looking back at the graph, where does it look like planes fly to avoid the weather?  
(1) troposphere (3) mesosphere  
(2) stratosphere (4) thermosphere
24. Which layer would have the most air pollution and therefore most affect people on Earth?  
(1) troposphere (3) mesosphere  
(2) stratosphere (4) thermosphere
25. What is the approximate elevation of the mountain shown in the graph?  
(1) -70km (3) 5.5km  
(2) 4km (4) 6.2km
26. Base your answer to the following question on the article below and previous knowledge you may have concerning the importance of the ozone layer.

**Legislation Protects Ozone**

The governor of New York signed environmental legislation that restricts the use of ozone-depleting chemicals employed in refrigeration systems, air-conditioners, and fire extinguishers. The law restricts, and in some cases bans, the sale of chlorofluorocarbons and halons. Both have been found to contribute to the destruction of the Earth's ozone layer, which protects the Earth from dangerous ultraviolet rays of the Sun.

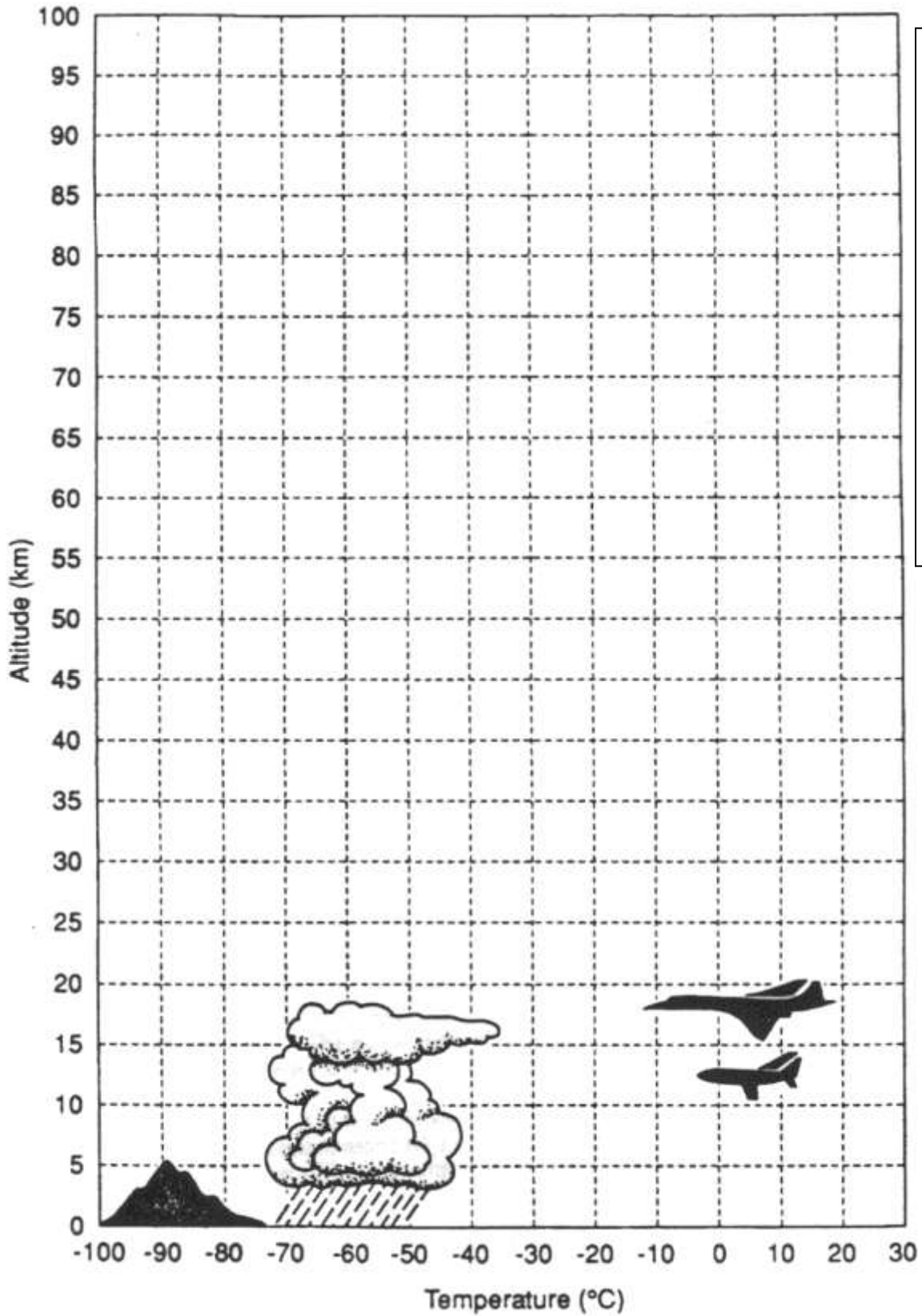
Using one or more complete sentences, state one reason that ultraviolet rays are dangerous.

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**Aim:**



KEY