CHAPTER 26

LAB ACTIVITY

Temperature Inversion

In Denver, Colorado, weather reports occasionally inform people that they are experiencing a high pollution day. On these days, people are asked not to drive unless it is absolutely necessary and are told not to light any fires or barbecues. In this investigation, you will determine how temperature inversions in the atmosphere can affect air quality near the ground. Under normal conditions, rising air cools at a rate of 1°C every 160 meters. In a temperature inversion, however, warm air is above cold air, therefore, the temperature increases with altitude. You will graph a normal temperature pattern and a temperature inversion and then analyze how a temperature inversion can trap pollution close to the ground.

Lab Skills and Objectives

- To **graph data** associated with a temperature inversion and with normal conditions, and to **compare** these two graphs.
- To **predict** the effects of a temperature inversion on the levels of air pollution near the ground
- To **predict** changes in temperature conditions in the early morning.

Materials

- 2 sheets graph paper
- ruler

Procedure

1. On a sheet of graph paper, plot Temperature (°C) versus Elevation (m) for the data shown in Data Table A. Plot temperature on the horizontal axis and elevation on the vertical axis, as shown in Figure 26.16. Label this graph Graph 1, leaving space for a graph title.
2. Connect the data points on Graph 1, using a ruler to draw a straight line. On a second sheet of graph paper, plot the data shown in Data Table B. Plot temperature on the horizontal axis and elevation on the vertical axis, as you did in Step 1. Label this graph Graph 2. Leave space for a graph title.
3. Connect the data points on Graph 2. Use a ruler to draw a series of straight line segments.
4. Answer the questions in *Analysis and Conclusions.*

Analysis and Conclusions

1. In Graph 1, does the temperature increase or decrease as altitude increases?
2. In Graph 1, how many meters of elevation does it take for the temperature to change by 1°C? Does the rate at which the temperature decreases change as altitude increases?
3. How does the rate of temperature change from 0–300 meters shown in Graph 1 compare with the rate of temperature change from 0–200 meters shown in Graph 2?
4. Describe the changes in temperature above 300 meters in Graph 2.

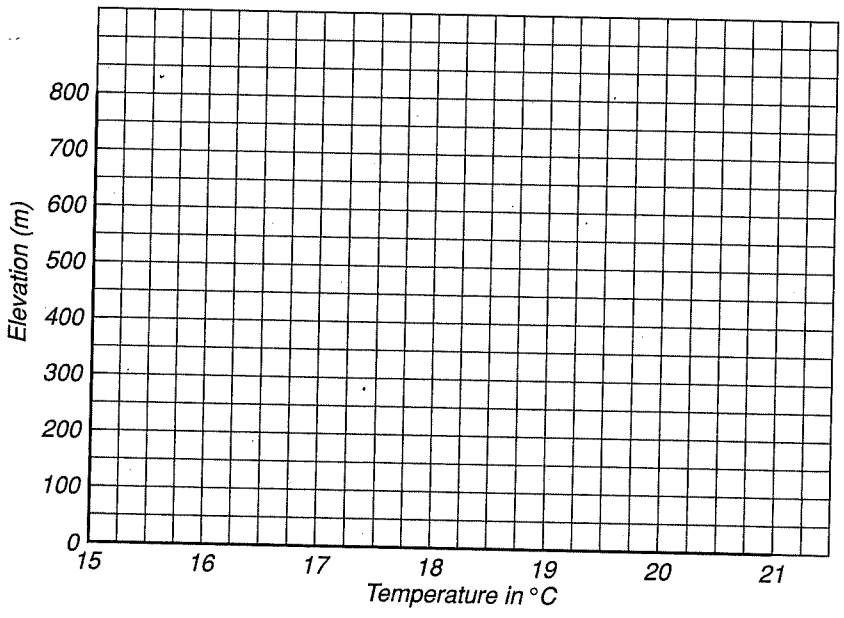
5. Determine which of your graphs represents normal conditions and which represents a temperature inversion. Write these terms as titles on the appropriate graphs. Based on your graphs, explain what a temperature inversion is.
6. Since the addition of heat increases the distance between particles, volume also changes. Any slight changes in volume affect density because density is the mass of a substance divided by its volume. In Graph 2, how would the density of air from 300–500 meters compare with the density of air above 500 meters?
7. How would the density difference implied in Graph 2 affect the movement of air pollutants that are released at the surface? Why is it important to be aware of this effect?
8. Strong winds can destroy or prevent temperature inversions from forming. Which city, Des Moines, Iowa or Denver, Colorado is more likely to experience frequent temperature inversions? Explain your answer.

Data Table A

Elevation (m)	Temperature (°C)
(0)	20.0
100	19.5
200	18.7
300	18.0
400	17.5
500	16.9
600	16.0
700	15.5

Data Table B

Elevation (m)	Temperature (°C)
(0)	20.0
100	19.3
200	18.8
300	18.0
400	19.0
500	19.5
600	19.4
700	18.8



26.16 Setup for Graph 1 and Graph 2