Investigating Factors That Control Temperature

Introduction
One summer day, the official temperature in Columbus, Ohio, was reported as 88°F. However, the electronic sign at a local drugstore reported a temperature of 97°F. Was the temperature on the sign wrong? Actually, both measurements were correct, but they were measured under different conditions.

Official temperatures are measured in the shade, over a grassy surface, and five feet above the ground. The store’s temperature was measured by a sensor in full sun, located close to a dark, paved surface. This difference in measuring the temperature accounted for almost a 10-degree increase in temperature—on the same day and at the same time.

In this investigation, you will explore the differences in temperature across North America and investigate the factors that influence temperature.

Problem
How does temperature vary and what causes these variations?

Pre-Lab Discussion
Read the entire investigation. Then work with a partner to answer the following questions.

1. Posing Questions Write a question that summarizes the purpose of this investigation.

2. Inferring What factors can influence temperature?

3. Predicting Which heats up faster, land or water?
Materials (per group of students)
ruler or straight edge
graph paper
Resources 14 and 15 in the DataBank

Procedure
1. Study Resource 14. The top map shows surface temperature across the United States, and it has been contoured to show areas that have the same temperature range. The contour lines are similar to the contour lines shown on a topographic map. However, these contour lines represent temperature rather than elevation.
2. Locate your state on Resource 14. Use the scale below the map to determine the temperature range or ranges that occurred in your state on August 9, 2004.

3. Make a temperature profile, or cross section, from the southwest corner of New Mexico through the Four Corners to the northeast corner of Colorado. The Four Corners is the location where the borders of New Mexico, Arizona, Utah, and Colorado intersect. First place a piece of paper on the United States map on Resource 14, extending from the SW corner of New Mexico to the NE corner of Colorado. Mark the ends of the cross section.

4. Then make marks on the paper where contour lines cross the profile line. Label the areas in between the marks with the corresponding temperature ranges from the map scale.

5. Use the marks to construct a temperature profile across this area on graph paper. Make the horizontal scale of the graph double the horizontal scale of the map.

6. Use the contour plots on Resources 14 and 15 in the DataBank (United States Surface Temperature, North American Surface Temperature, 24-Hour Temperature Change, and Surface Heat Index) to answer the questions in Analysis and Conclusions.

Analysis and Conclusions
1. Using Graphs How does the temperature profile you made across New Mexico and Colorado change?
2. **Observing** What are the lowest temperatures shown on the North American Surface Temperature Contour Plot on Resource 14? What are the highest temperatures?

3. **Inferring** Which coast of North America is the leeward coast and which is the windward coast?

4. **Inferring** Which coast, leeward or windward, usually has cooler temperatures? Explain. Does the data shown on both maps on Resource 14 support this inference?

5. **Analyzing Data** What is the general trend of temperature shown on the North American Surface Temperature Contour Plot?
6. **Analyzing Data** On the maps on Resources 14, there is a band of cooler temperatures that extends from northern New Mexico through Colorado, and up into Wyoming, Montana, and Idaho. What do you think could be influencing this area of cooler temperatures?


7. **Analyzing Data** Use the 24-hour temperature change contour plot on Resource 15 to determine where in the United States the temperature change over the 24-hour period was the greatest. Was the temperature change positive or negative?


8. **Analyzing Concepts** Study the heat index contour plot on Resource 15. The heat index is used to warn people when temperatures are high enough to pose a health hazard. The heat index combines the air temperature with relative humidity to determine the apparent temperature—what the air temperature “feels like” to the average person. A heat index of 90°F–105°F with prolonged exposure or physical activity can cause sunstroke or heat exhaustion, which can be dangerous to health. Where in the United States should people be warned about the possible danger of prolonged outdoor physical activity?


**Go Further**

Investigate the current temperatures, heat index, or wind chill in your area by accessing temperature plots available on the Internet. Your teacher will provide you with the Web site information or with copies of the current data. Which features in your area have a strong influence on local temperature?