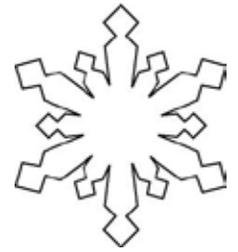


Temperature



Overview:

Air temperature gives one an idea of how hot or cold it is. However, air temperature measurements vary depending upon where they are taken (in shade, in direct sun, etc.). In this activity, students measure the temperature in various places outside and compare their data to National Weather Service weather data.

(Note: This activity will produce the best results when done in the spring or fall, when there is daylight during class time.)

Objectives:

The student will:

- use a thermometer to measure temperature;
- take an average of temperatures;
- investigate why temperature measurements vary; and
- compare student measurements to official measurements.

GLEs Addressed:

Science

- [5-8] SA1.1 The student demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring, and communicating.
- [6] SA1.2 The student demonstrates an understanding of the processes of science by collaborating to design and conduct simple repeatable investigations.
- [7] SA1.2 The student demonstrates an understanding of the processes of science by collaborating to design and conduct simple repeatable investigations, in order to record, analyze (i.e., range, mean, median, mode), interpret data, and present findings.
- [8] SA1.2 The student demonstrates an understanding of the processes of science by collaborating to design and conduct repeatable investigations, in order to record, analyze (i.e., range, mean, media, mode), interpret data and present findings.
- [5] SE2.1 The student demonstrates an understanding that solving problems involves different ways of thinking, perspectives, and curiosity by investigating a problem or project over a specified period of time and identifying the tools and processes used in that project.

Vocabulary:

elevation - the height above sea level

heat - a form of energy produced by the motion of molecules

inversion - a reversal of a normal order

temperature - the degree of heat present in a substance or object

thermometer - an instrument for measuring temperature

topography - an arrangement of features on a landscape (mountains, hills, lakes, etc.)

weather - a description of the state of the atmosphere at a certain time

Whole Picture:

Winter temperatures in Interior Alaska have the greatest variability in the state and one of the greatest in the world, with a possible high of 50° F (10° C) down to a possible low of -65° F (-54° C). This is a range difference of 115° F! In the winter, the sun is at a lower angle in the sky and therefore supplies less warmth to Earth's surface. Temperature inversions (when air temperature increases with elevation) often occur under high pressure systems when clear skies allow more heat to radiate from Earth's surface and there is little or no wind to mix the atmosphere. This layer of warm air acts like a lid across

the valley and traps the cold air beneath. Inversions may be broken when wind and clouds move into the area. Other factors influencing temperature at a given location include exposure to the sun or wind and topography. (Under normal conditions, temperature decreases as elevation increases.)

Temperature variability can be investigated through the scientific process. This process includes repeating an experiment or investigation many times to increase confidence in the results. Many repetitions reduce the chance errors that may affect results.

Materials:

- Thermometer
- STUDENT WORKSHEET: "Temperature"
- SUPPLEMENTARY DIGITAL LECTURE: "Scientific Instruments"
(www.ArcticClimateModeling.org)
- SUPPLEMENTARY DIGITAL LECTURE: "Climate Change in Alaska"
(www.ArcticClimateModeling.org)

Activity Preparation:

Identify 5 locations outside for students to take temperature readings. Pick at least one that is near a building, one that is away from a building, and if possible, one that is in the shade and one that is in the sun.

Activity Procedure:

1. Hand out the STUDENT WORKSHEET: "Thermometer." Ask students to complete the Hypothesis section. Explain the class will go outside and measure the temperature in various places around the school. Direct students to the places previously identified for measuring. Remind students it takes a thermometer several minutes to take an accurate reading. Explain students should not hold the thermometer while taking the temperature, they should set it down on a clipboard or sheet of paper. Holding the thermometer will take the temperature of one's hand, not the air.
2. For each place, instruct students to list the location and the temperature on the data chart.
3. Return to the classroom. Remind students how to take an average and instruct the class to complete the remainder of their worksheets. Discuss results.
4. As a class, compute the average of all the recorded temperatures to get one temperature for the day. Look up National Weather Service Data on the Internet at www.nws.noaa.gov to see what the recorded temperature or forecast is for the day. Is the class temperature the same? Why or why not?
5. Explain to students that the National Weather Service takes temperature measurements several times over the course of the day and averages them together to get a daily average, whereas the class' temperature is based on one time of the day.

In addition, topography can affect temperature. Temperature can change on hills and valleys only a few meters in height. If the students' measurements were recorded at a different elevation than the NWS measurement, then that could account for one difference.

Extension:

Ask students to postulate why temperatures vary at differing elevations.

Answers:

All answers may vary, except:

Conclusion: 3. a. The sun is pointing on some, but not all, of the thermometers.

Name: _____

Temperature

Student Worksheet (page 1 of 2)

Levels



Testable Question:

Will temperatures taken at the same time in various places outside in a small area be the same or different?

Hypothesis:

Temperatures recorded in various places outside in a small area will mostly be _____.
(the same/different)

Experiment:

Materials:

- Thermometer
- Watch or stopwatch (optional)

Procedure:

1. Go outside to the five locations directed by the teacher to take temperatures. For each temperature, place the thermometer on a flat surface and let it sit for at least 2 minutes, so that it may take an accurate reading of air temperature. Use a watch or a stopwatch to keep the time, or just count.
2. Record the measurements on the data chart below.

Data:

1. Record the class temperature readings in the chart below.

Reading #	Location	Temperature
1		
2		
3		
4		
5		

2. What is the average temperature for all 5 readings?

$$\left(\frac{\quad}{\text{Reading \#1}} + \frac{\quad}{\text{Reading \#2}} + \frac{\quad}{\text{Reading \#3}} + \frac{\quad}{\text{Reading \#4}} + \frac{\quad}{\text{Reading \#5}} \right) \div 5 = \underline{\quad}$$

Analysis of Data:

1. The temperatures recorded in the chart above are mostly _____ (the same/different).
2. As a class, look up the National Weather Service data showing today's most recent temperature reading. Today, the National Weather Service says the temperature is _____.
3. The class average temperature (Data Question 2) is _____ (the same/different) than the National Weather Service temperature.

Name: _____

Temperature

Student Worksheet (page 2 of 2)

4. Why might the National Weather Service have a different reading than your class?

Conclusion:

1. Of the temperatures recorded in various places outside the school, they are mostly _____.
(the same/different)
2. Was your hypothesis proved or disproved? _____
3. Why might temperatures measured in different places within a small area be different?
 - a. The sun is shining on some, but not all, of the thermometers.
 - b. The wind is blowing on some, but not all, of the thermometers.
 - c. The air temperature is different in the different locations.
 - d. A and B only.
 - e. All of the above.