
UNIT 4

Insolation, Latitude, and Temperature

Purpose

The purpose of this lab is to show you how the curvature of the Earth affects the angle at which insolation is striking the planet's surface, therefore affecting its surface temperature. This experiment also reveals the relationship between latitude location on the Earth and surface temperature.

Materials

classroom globe (at least 30 cm in diameter)
three small thermometers
light source
tape
stopwatch
colored pencils
graph paper



SAFETY CONCERN

**THE LIGHT AND THE THERMOMETERS USED IN THIS EXPERIMENT CAN GET VERY HOT!
DO NOT TOUCH THEM UNTIL THEY HAVE HAD TIME TO COOL DOWN!**

Procedure A

1. Using Figure 1 as a guide, carefully tape the bulb of each thermometer so that it is positioned over the prime meridian at the following latitude locations: the equator (0 degrees), 45 degrees north, and the north pole (90 degrees north). Place the tape between the bulb and the current temperature shown on each thermometer, this will enable you to read the temperature during your experiment. Do not cover the bulb of the thermometers with tape.
2. Carefully place your globe so that it is approximately 2 feet from your light source. Have your instructor help you set up the globe so that the prime meridian is in an equinox position (the north pole is not tilted toward or away from the light source). Adjust your light so that the bulb is pointed at the equator on your globe (see Figure 1). **DO NOT TURN ON YOUR LIGHT UNTIL YOUR INSTRUCTOR HAS CHECKED YOUR EXPERIMENT.** After your instructor has checked your setup, record the temperature for time 0 for each thermometer in the correct place in Table 1. After you have

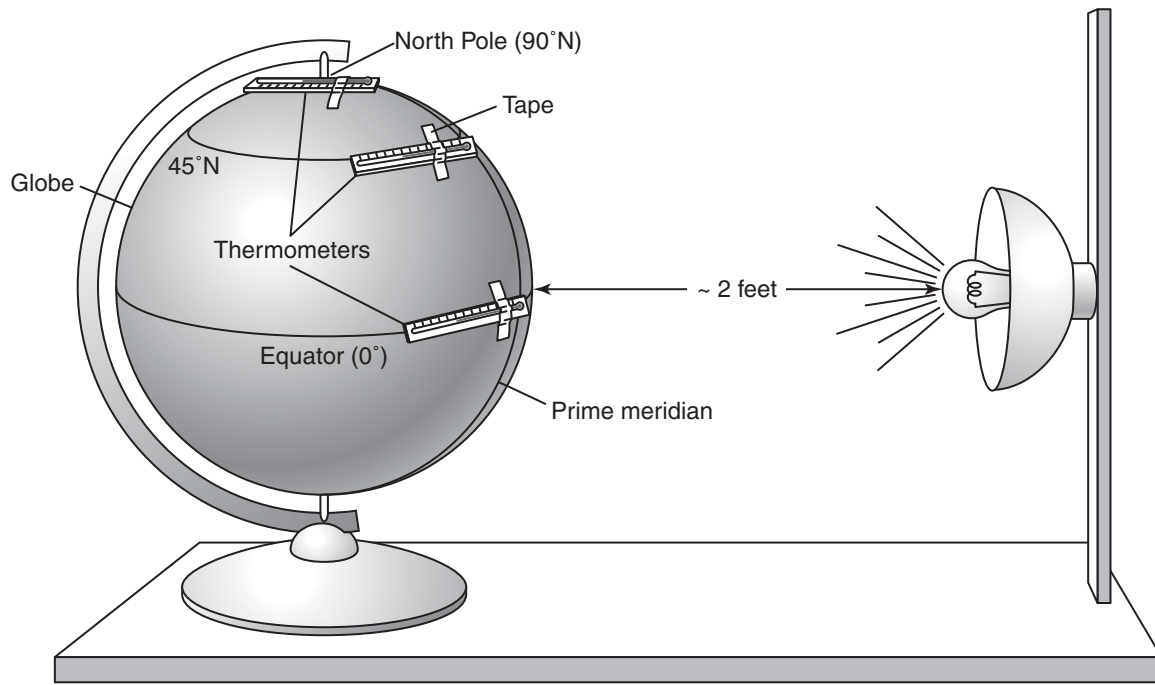


FIGURE 1

Time	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Temperature at the Equator (0°)																
Temperature at 45° North																
Temperature at the North Pole (90°N)																

recorded the start temperatures for each location, you may turn on your light and start your stopwatch. You will then record the temperature for each thermometer once every minute for a total of 15 minutes. During your experiment make sure to not touch either the thermometers or the light because they can get very hot!

3. After your experiment is complete, carefully turn off your light. Do not touch either the light or the thermometers until they have had time to cool down.

Procedure B

1. Use the data from Table 1 to construct a multiple line graph that shows the relationship between latitude location and temperature on your globe. The *x*-axis should be labeled

“Time,” and the *y*-axis should be labeled “Temperature.” Use a different colored pencil for each latitude location, and make a key for your graph.

Conclusions

1. Define the term *insolation*.
2. What was the approximate angle of insolation for the thermometer on the equator during this experiment?
3. What was the approximate angle of insolation for the thermometer on the north pole during this experiment?
4. Explain what happens to the angle of insolation as you travel from the equator to the north pole on the Earth during an equinox.
5. What causes the angle of insolation to change as you travel from the equator to the poles on the Earth?
6. Why was it important to tape the bulbs of the thermometers along the prime meridian?
7. Which latitude location in your experiment experienced the highest temperature. Why?
8. Which latitude location in your experiment experienced the lowest temperature? Why?
9. Calculate the rate of temperature change for each latitude location for the first 10 minutes of the experiment (show your work!).
10. Describe the relationship between latitude location and surface temperature on the Earth.
11. Explain how this experiment helped to prove why it is usually cooler in the higher latitudes and warmer near the equator.