

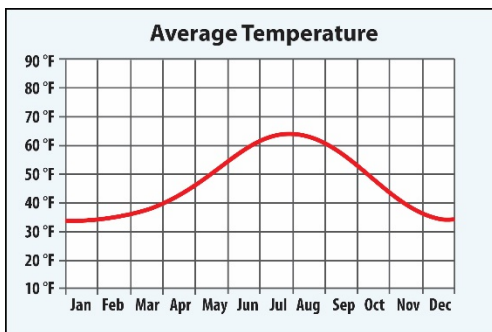
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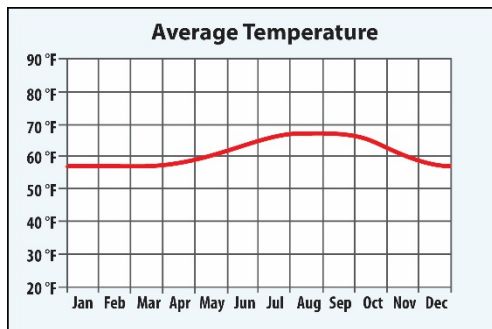
Team Challenges: Why Are Some Places on Earth Hotter Than Others at Different Times of the Year?

Challenge 1

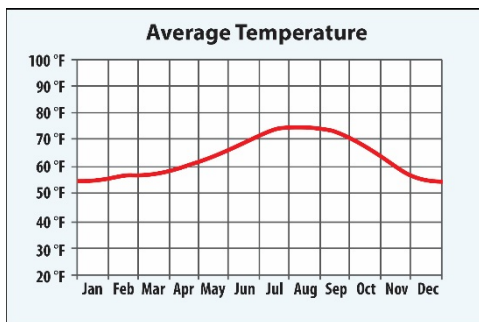
Below are three temperature graphs for places within 100 miles of Los Angeles, California, with average high temperatures in July and January each year (in degrees Fahrenheit). Explain why these places, which are located close to one another, have different temperatures throughout the year.



Location: Big Bear Lake, CA
Average January Temperature: 47 °F
Average July Temperature: 81 °F



Location: Santa Monica, CA
Average January Temperature: 64 °F
Average July Temperature: 71 °F



Location: Pomona, CA
Average January Temperature: 68 °F
Average July Temperature: 90 °F

Challenge 2

The city of Belém, Brazil, is located at latitude 1° S, which is almost at the equator. Below are Belém's average monthly temperatures for one year.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
78 °F	78 °F	78 °F	78 °F	79 °F	79 °F	78 °F	79 °F	79 °F	79 °F	79 °F	79 °F

How might you explain the temperature pattern in Belém, Brazil?

Challenge 3

The city of Santa Rosa, Argentina, is located at latitude 37° S. The city of Richmond, Virginia, in the United States is located at latitude 37° N. Below are the average monthly temperatures in those two cities for one year.

	Jan	Mar	May	July	Sept	Nov
Santa Rosa 37° S latitude	74 °F	67 °F	52 °F	45 °F	54 °F	67 °F
Richmond 37° N latitude	38 °F	48 °F	66 °F	78 °F	70 °F	49 °F

Why is it warm in Santa Rosa, Argentina, when it's cold in Richmond, Virginia? Why is it cold in Santa Rosa, Argentina, when it's warm in Richmond, Virginia? (Think about the four positions of Earth as it orbits the Sun.)

Challenge 4*

Four friends were sharing their ideas about why it's warmer in the summer than in the winter. This is what they said:

Ava: "It's because the Sun gives off more heat in the summer than in the winter."

Raul: "It's because Earth's tilt changes the angle of sunlight hitting the surface."

John: "It's because Earth orbits closer to the Sun in the summer than in the winter."

Shakira: "It's because one side of Earth faces the Sun, and the other side faces away from the Sun."

Which friend do you most agree with and why?

Describe your thinking about why it's warmer in the summer than in the winter.

*Challenge 4 adapted from Keeley, P., Eberle, F., & Dorsey, C. (2008). *Uncovering student ideas in science: Another 25 formative assessment probes* (pp. 177–184). Arlington, VA: NSTA Press.