

## TEAM CHALLENGES

Why are some places on Earth hotter than others at different times of the year?

### **Challenge #1**

Barrow, Alaska, is located at latitude  $71^{\circ}$  N. In July, during the summer, people who live in Barrow get 24 hours of sunlight every day. That means that the Sun shines all the time and it never gets dark.

In July, the average high temperature in Barrow, Alaska, is  $45^{\circ}\text{F}$ .

Lagos, Nigeria, is located at latitude  $6^{\circ}$  N. In July, during the summer, people who live in Lagos experience 12 hours of daylight and 12 hours of darkness each day.

In July, the average high temperature in Lagos, Nigeria, is  $82^{\circ}\text{F}$ .

Explain why the average summer temperature in Barrow, Alaska, is  $45^{\circ}\text{F}$  even though there are 24 hours of sunlight while Lagos, Nigeria, with only 12 hours of sunlight a day, reaches a temperature of  $82^{\circ}\text{F}$ .

### **Challenge #2**

The city of Belem, Brazil, is located at latitude  $1^{\circ}$  S, which is almost at the equator.

In the table below are the average high temperatures in Belem, Brazil, during one year.

| Jan                  | Feb                  | Mar                  | Apr                  | May                  | Jun                  | Jul                  | Aug                  | Sep                  | Oct                  | Nov                  | Dec                  |
|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| $78^{\circ}\text{F}$ | $78^{\circ}\text{F}$ | $78^{\circ}\text{F}$ | $78^{\circ}\text{F}$ | $79^{\circ}\text{F}$ | $79^{\circ}\text{F}$ | $78^{\circ}\text{F}$ | $79^{\circ}\text{F}$ | $79^{\circ}\text{F}$ | $79^{\circ}\text{F}$ | $79^{\circ}\text{F}$ | $79^{\circ}\text{F}$ |

What do you notice about the temperatures in Belem, Brazil?

Why do you think Belem, Brazil, does not have summer and winter like we do in the United States?

**Challenge #3**

The city of Santa Rosa, Argentina, is located at latitude 37° S.

The city of Richmond, Virginia, USA, is located at latitude 37° N.

In the table below are the average high temperatures in those two cities during one year.

|                            | January | March | May  | July | September | November |
|----------------------------|---------|-------|------|------|-----------|----------|
| 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 the average temperature higher in Santa Rosa, Argentina, when the average temperature in Richmond, Virginia is lower?

Why is the average temperature lower in Santa Rosa, Argentina, when the average temperature in Richmond, Virginia is higher?

**Challenge #4**

*Think about positions 1, 2, 3, and 4 as Earth orbits the Sun.*

Four friends were sharing their ideas about why it is 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 Earth."

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."

Which friend do you most agree with? \_\_\_\_\_

Describe your thinking about why it is warmer in the summer than in the winter.\*

*\*Challenge #4 is adapted from Keeley, P., Eberle, F., Dorsey, C. (2008). "Summer Talk" in Uncovering Student Ideas in Science: Another 25 Formative Assessment Probes. Arlington, VA: NSTA Press.*