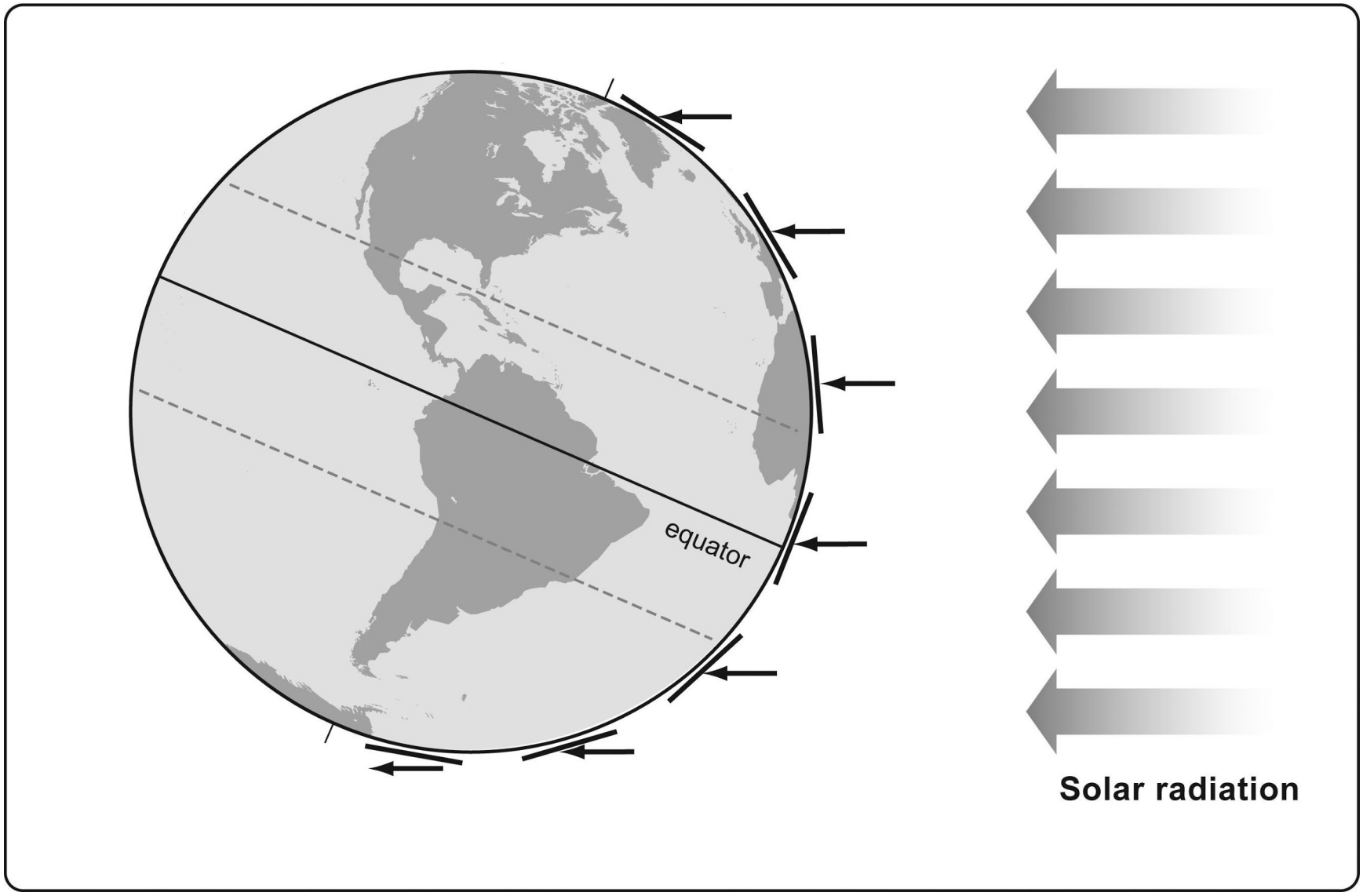
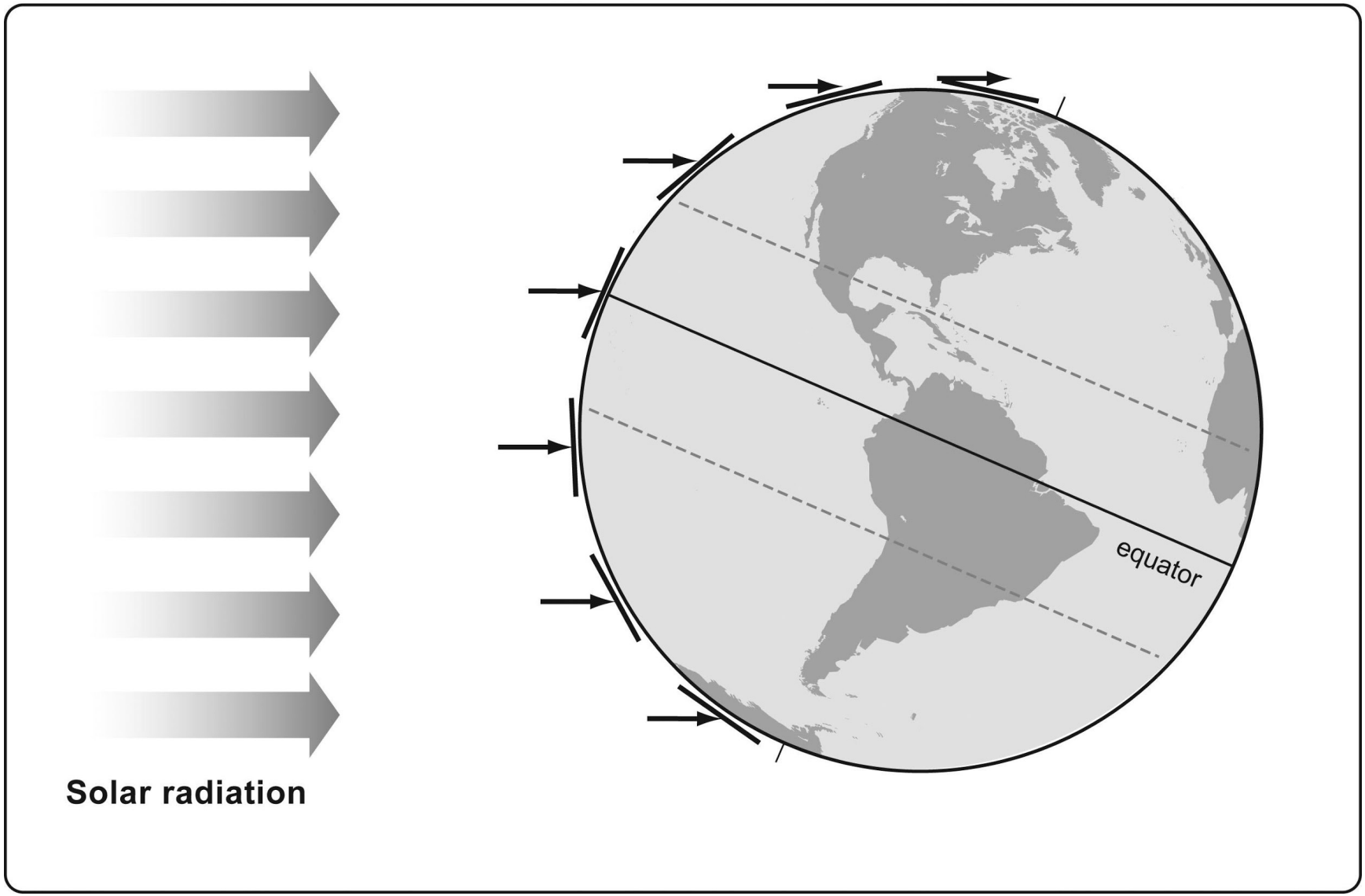
The Sun’s Incoming Energy - Angle Related to Latitude at Position 1



The Sun’s Incoming Energy - Angle Related to Latitude at Position 3



Angle of Sunlight and Seasons on Earth

Purpose

This activity will help us collect evidence to answer our Lesson Focus Questions:

What causes winter in the United States to occur in December–February and summer to occur in the United States in June–August? What is happening in Brazil, and why?

Team Task

As Earth orbits the Sun, describe what happens to the *angle of sunlight* hitting Earth at different times of the year. Focus your attention on the effect of Earth's *orbit* and *axis tilt*. Be prepared to share your ideas.

Materials

Your team will need these items:

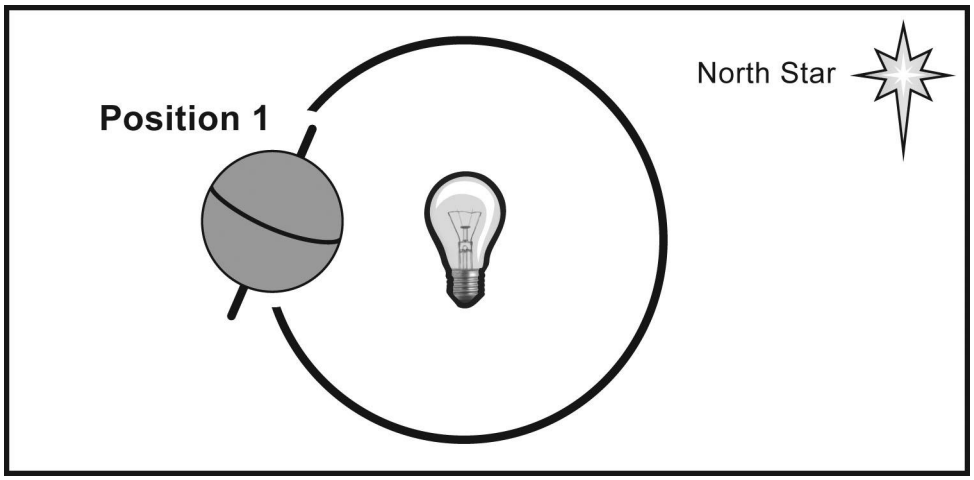
- 1 light setup (lightbulb, socket, plug)
- 1 hoop (to represent Earth's orbit)
- 1 Styrofoam ball on a stick (to represent Earth on its axis)
- 1 rubber band (representing the equator)
- 2 push pins (locating where we are on the globe and where Brazil is on globe)

Each of you will need these things:

- handout: *Sun's Incoming Energy with Tilt—Position 1*
- handout: *Sun's Incoming Energy with Tilt—Position 3*
- handout: *Data Table: Number of Sun's Incoming Rays by Season at Different Latitudes*
- your science journal

Directions

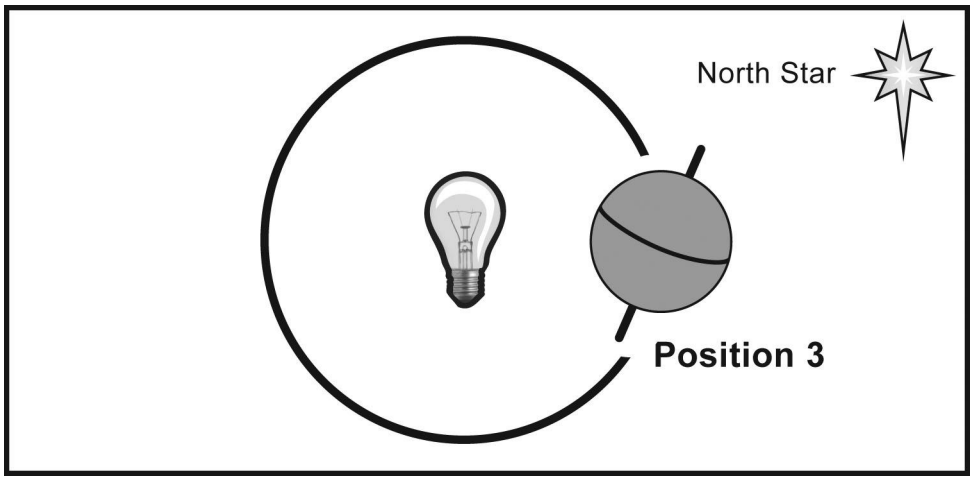
1. Position your Styrofoam ball "Earth" in position 1 in its orbit around the Sun so that the North Pole points *toward* both the Sun and the North Star with a 23.5° tilt.



a. Place the handout *Sun's Incoming Energy with Tilt—Position 1* on the table next to your Styrofoam "Earth." Notice that the Earth image on your handout is tilted at 23.5°, just like the Styrofoam "Earth," so that the North Pole points *toward* the Sun and the North Star.
b. Count the number of lines of solar radiation hitting Earth in the following locations on Earth's surface and record the numbers in your data table:

Latitude 60° N–75° N
Latitude 30° N–45° N
Latitude 0°–15° N
Latitude 0°–15° S
Latitude 30° S–45° S
Latitude 60° S–75° S

2. Now, place your Styrofoam "Earth" at position 3 in its orbit. The North Pole is still pointing toward the North Star, but now it's pointing at a 23.5° angle *away* from the Sun and the South Pole is pointing *toward* the Sun.



a. Place the handout *Sun's Incoming Energy with Tilt—Position 3* on the table next to your Styrofoam "Earth." Notice that the Earth image on your handout is tilted at 23.5°, just like the Styrofoam "Earth," so that the North Pole points *away* from the Sun but still toward the North Star. (Where is the South Pole pointing?)

b. Count the number of lines of solar radiation hitting Earth in the following segments on Earth's surface and record the numbers in your data table:

Latitude 60° N–75° N
Latitude 30° N–45° N
Latitude 0°–15° N
Latitude 0°–15° S
Latitude 30° S–45° S
Latitude 60° S–75° S

Discuss with your team.

1. Where is the Sun's light "straight on" when Earth is in position 1? (Think: Is it at the equator?)
    a. Which hemisphere experiences summer in position 1?
    b. Which hemisphere experiences winter in position 1?
    c. Use your data to explain why it is summer in one hemisphere and not the other.

2. Where is the Sun's light "straight on" when Earth is in position 3?
    a. Which hemisphere experiences summer in position 3?
    b. Which hemisphere experiences winter in position 3?
    c. Use your data to explain why it is summer in one hemisphere and not the other.

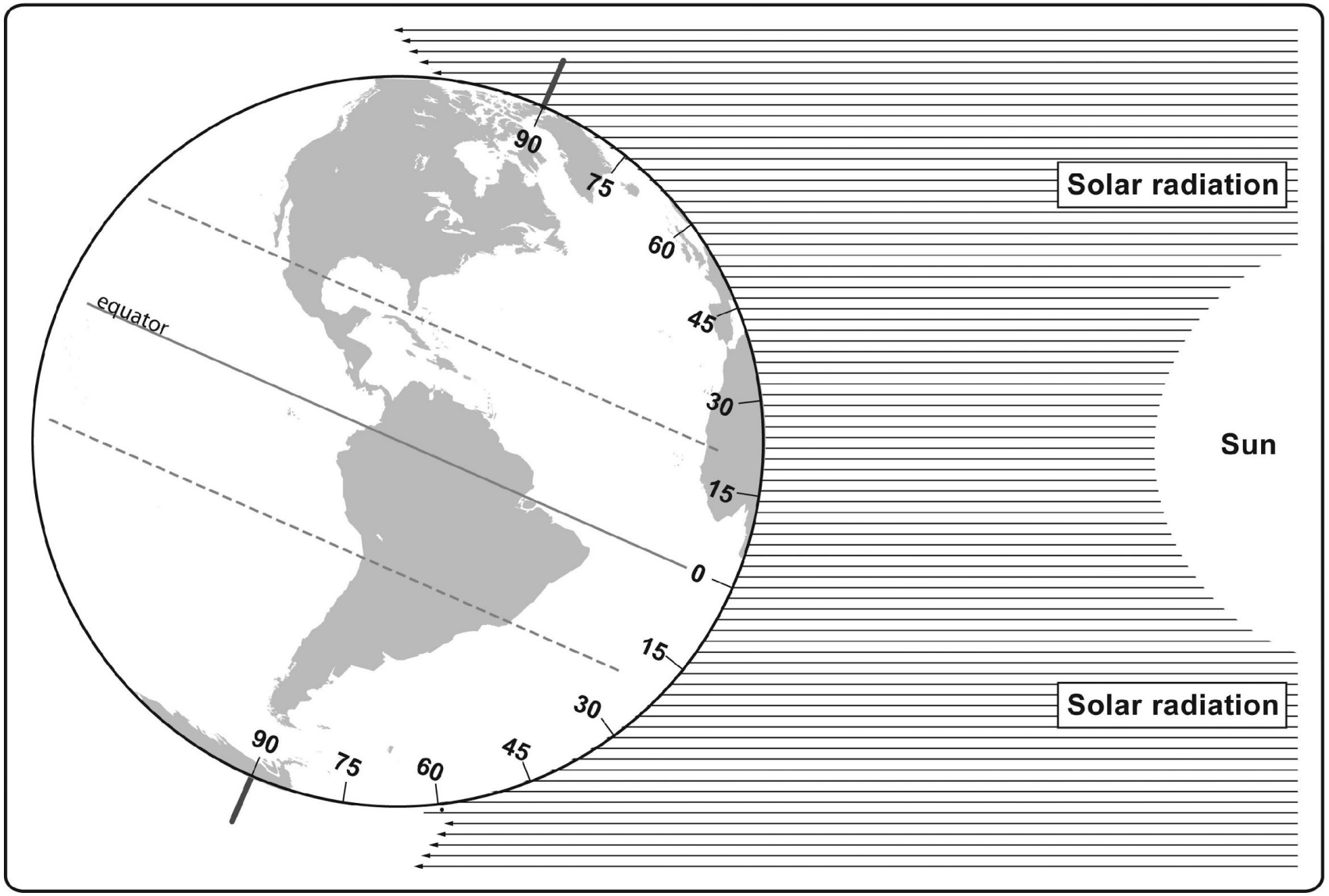
3. Compare the data in your data table to the data you collected in Lesson 2 on your *Sun's Incoming Energy* handout in your notebook. Is the Sun's energy the same intensity at the same latitudes now as in Lesson 2? Where do you find differences?

4. What is the reason for the differences in your data? (Think about what is different in the diagram from Lesson 2 and these diagrams.)

5. Summarize your learning from this activity *using specific data from your table* and the following sentence stems.

    Winter and summer occur in each hemisphere during ...
    When comparing the hemispheres, I notice …
    The data that support this are …
    This happens because ...

Sun's Incoming Energy with Tilt - Position 1



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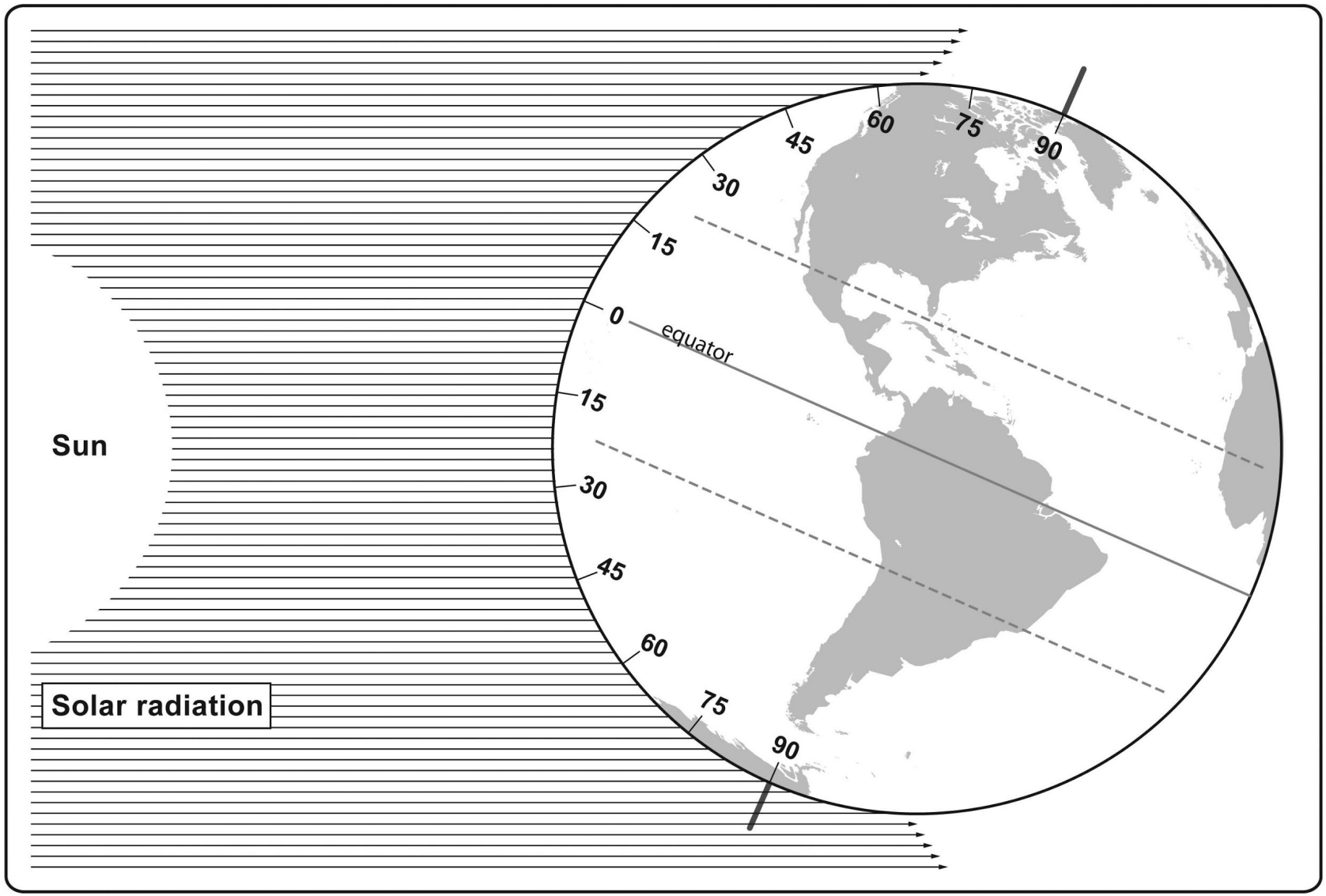
Sun's Incoming Energy with Tilt - Position 3



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Data Table

Number of Sun's Incoming Rays by Season at Different Latitudes		
	Position 1 Season:_____ (Northern Hemisphere) Season:_____ (Southern Hemisphere)	**Position 3** Season:_____ (Northern Hemisphere) Season:_____ (Southern Hemisphere)
Latitude 60˚–75˚N (near Alaska)		
Latitude 30˚–45˚N (near Denver)		
Latitude 0˚–15˚N (north of the equator)		
Latitude 0˚–15˚S (south of the equator)		
Latitude 30˚S–45˚S (near the bottom of South America)		
Latitude 60˚S–75˚S (near northern Antarctica)		