

Name: _____ Period: _____ Date: _____

What Causes the Seasons? Part IV - KEY

Purpose: To discover what makes summer warmer than winter.

Materials: Styrofoam ball on a dowel with the equator, 45°N and 45°S marked on it
sticky notes labeled A, B, C, D light protractor

Procedures:

1. You will be given a Styrofoam ball on a dowel as a model of the Earth. The sphere should have one line to represent the equator (red), and two other lines to represent 45°N and 45°S (black). (45°N represents the approximate latitude of Rhode Island.) Locate these lines on your model.
2. On a table with a light, one of four students should sit on each side of a table with a sticky note in front of them labeled A, B, C and D. The light will represent the sun. Point A should be the same location on each table in the classroom. (Prep-room side)
3. The person at point A should hold the sphere and the light should shine on this point. The person holding the sphere at each location will NOT observe (do not look into the light). To start, hold the dowel so that the axis is perpendicular to the table and spin the sphere once SLOWLY.
4. Pass the sphere and turn the light from position A to position B all the way through position D keeping the axis perpendicular to the table noting how the light hits the sphere. Draw your observation for each location by including your reference points: equator, 45°N and 45°S. Your frame of reference is always from the sun's point of view.
5. Move the sphere and light back to position A. Now using the protractor tilt the dowel towards the sun (about 25°). Spin the sphere once SLOWLY.
6. Keeping the axis pointing the same direction at all times (towards the wall with two windows), move the ball and rotate the light from position A through D again noting how the light hits the sphere. Draw your observations for each location using the same reference points.

Bonus: What is the name of the line that represents 23.5°N: Tropic of Cancer
What is the name of the line that represents 23.5°S: Tropic of Capricorn

	Axis is perpendicular to table	Sunlight Angle from Simulation	Avg. Daily Temp from Simulation	Axis tilted about 25°	Sunlight Angle from Simulation	Avg. Daily Temp from Simulation
Point A			 Hot Warm Mild Cool Cold			 Hot Warm Mild Cool Cold
Point B			 Hot Warm Mild Cool Cold			 Hot Warm Mild Cool Cold
Point C			 Hot Warm Mild Cool Cold			 Hot Warm Mild Cool Cold
Point D			 Hot Warm Mild Cool Cold			 Hot Warm Mild Cool Cold

Use the words in the word bank below to answer the questions that follow. Not all words will be used in each response.

Northern Hemisphere
direct sunlight
average sunlight

Southern Hemisphere
indirect sunlight
latitude

sphere
tilt (25°)

Questions:

1. When the sphere axis is **perpendicular** to the table (no tilt), does a person at 45°N "see" any **difference** in the **amount of sun**, as the Earth rotates and revolves around the sun at points A,B,C, and D excluding night time? **Explain why you think this is so.**

No difference in the amount of sun is seen at 45°N when the sphere is perpendicular because the sun hits that area with the same amount of light at all four points.

2. What does the top line on the globe represent? 45°N
3. What hemisphere is this line in? Northern Hemisphere
4. What does the middle (red) line represent? The Equator
5. Any part of the globe above the red line is in which hemisphere? Northern Hemisphere
6. Any part of the globe below the red line is in which hemisphere? Southern Hemisphere
7. What does the bottom line on the globe represent? 45°S
8. What hemisphere is this line in? Southern Hemisphere

Because the globe is tilted - Point A

9. What type of light reaches 45°N? direct
10. What season is occurring at 45°N? summer
11. What type of light reaches 45°S? indirect
12. What season is occurring at 45°S? winter
13. What is the date at this point? June 21st

Because the globe is tilted - Point B/D

14. What type of light reaches 45°N/S? average
15. What seasons occur at 45°N/S? spring/fall
16. What are the dates at this point? March 21st and September 21st

17. Why is the **amount of light and seasons similar** at these **two points**?

The amount of light and seasons are similar at these two points because the sphere is neither tilted away nor toward the sun.

Because the globe is tilted - Point C

18. What type of light reaches 45°N? indirect

19. What season is occurring at 45°N? winter

20. What type of light reaches 45°S? direct

21. What season is occurring at 45°S? summer

22. What is the date at this point? December 21st

23. When the **sphere is tilted at Point A**, compare and/or contrast the amount of sun a person at 45° N and 45°S "sees". Explain why you think this is so.

At 45°N more sun shines directly causing summer while at 45°S the sun shines indirectly causing winter.

Wrap up: Using the evidence

Remember: The purpose of this activity was to discover why summer is warmer than winter. Summarize the way in which the **tilt** of the Earth **changes the amount of sunlight** observed at 45°N as it revolves around the sun at each point (A-D). Also, state which season is caused by the amount of light.

When the northern hemisphere is tilted towards the sun, more direct sunlight is received and the season is summer. As the Earth revolves around the sun, at autumn time the Earth is not tilted towards or away from the sun and the season is mild. When the northern hemisphere is tilted away from the sun, the light is less direct causing winter. During spring, like autumn, the Earth is not tilted towards or away from the sun causing a mild season.