Earth's Tilt and Rotation Lab: Why Do We Have Seasons?

Background Information

Earth’s axis is tilted at approximately 23.5° from the vertical. As Earth rotates on its axis and revolves around the sun, this tilt causes different parts of the planet to receive varying amounts of sunlight throughout the year. This variation in sunlight results in the changing seasons. Without the axial tilt, we wouldn’t experience seasonal differences in temperature or day length. In this lab, you’ll use a model to observe how Earth’s tilt and orbit affect sunlight angles, day length, and seasonal change.

Objective

- Model how Earth’s tilt and rotation create day and night.
- Observe how axial tilt and revolution cause seasonal changes.
- Analyze the angle of sunlight and its impact on temperature and light intensity.

Develop a Hypothesis

The angle of sunlight affects how much energy a location on Earth receives. What do you predict will happen when the light is tilted compared to hitting Earth straight on?
Write your hypothesis as a complete sentence.

If . . . _____

_____ ,

then . . . _____

_____ .

Materials

- 1 flashlight (sun)
- 1 globe or foam ball (Earth)
- 1 protractor
- 2 rulers
- Graph paper
- Lab worksheet (for recording light beam width and intensity)

Procedures

Part 1: Modeling Day and Night

1. Place your globe in front of the flashlight (sun) with the tilt pointing away from the light.
2. Slowly rotate the globe counterclockwise.
3. Observe how a marked location on the globe moves in and out of light.
4. Observe which side of Earth experiences daylight? Which side experiences night?

Part 2: Modeling Earth's Tilt and the Seasons

5. Keep Earth tilted at 23.5° in the same direction throughout its orbit. Use your protractor to help maintain tilt.
6. Place the Earth model in 4 positions around the flashlight to represent:
    a. Summer Solstice
    b. Fall Equinox
    c. Winter Solstice
    d. Spring Equinox
7. At each position, observe which hemisphere is tilted toward or away from the sun.

Part 2: Modeling Earth's Tilt and the Seasons

8. Now, use a ruler to measure the size of the flashlight beam hitting a flat surface that is 20 cm away (using a second ruler) from the flashlight.
9. Record how wide the beam is in the Data Table (page 3) when the flashlight and is held at 90° (direct overhead), 45°, and 22.5°.
10. Graph the relationship between sunlight angle and beam width.

Results

Data Table:

Sunlight Angle	Beam Width (cm)	Light Intensity (narrow/wide)	Notes
90°			
45°			
22.5°			

Graph Your Results

Create a line graph below or on graph paper. **Label** your x-axis (Sunlight Angle in degrees) and y-axis (Beam Width in cm) and add a title.

Conclusion

Was your hypothesis supported?

_____

_____

_____

_____

Analysis Questions

1. Which angle gave the most intense light? Why?

2. Why does the beam spread out more at lower angles?

3. Why do we experience summer and winter at different times in the Northern and Southern Hemispheres?

4. What would happen if Earth were not tilted at all?

Adapted from:
https://flyingcolorsscience.com/wp-content/uploads/2024/10/Homeschool-Seasons-Lab.pdf