Name_____ **Section**_____

Partner(s)_____ **Date**_____

A REASON FOR THE SEASONS

Why is it warmer in the season we call summer and colder in the time called winter?

What have you observed about the path of the Sun during the day in the summer compared to winter?

Procedure:

1. Securely tape or rubber band a pencil onto the lens end of a flashlight so that pencil sticks out about 5 cm. This will help you set the angles for the light source (fake sun) and keep a constant distance from the recording surface. Place a piece of graph paper on the table as the recording surface.

2. With the room darkened and the flashlight on, hold the flashlight perpendicular to the graph paper with the pencil touching the paper.

   Trace the bright area. This is the 0E measurement. Tilt flashlight 10E from perpendicular using a protractor to set an accurate angle. Trace the bright area. Repeat for 20E, 30E, 40E, and 50E from the perpendicular. Trace the areas. Make a note of the relative brightness of each of the areas as you are tracing them.

3. Determine the area for each angle. Count the blocks on the graph paper or use the following formulas.

   Circle A = ðr^2 Ellipse A = ðab

ANGLE	AREA	RELATIVE INTENSITY
0E		
10E		
20E		
30E		
40E		
50E		

4. Assuming the output or luminosity of the flashlight remains constant, how does illuminated area vary with angle? Plot area versus angle size.

5. What happens to the intensity of light at a given point as the angle increases?

6. Calculate relative intensity for each angle using the formula below:

$$\text{R.I. (relative intensity)} = \frac{\text{area of light at 0E}}{\text{area of light at angle}}$$

This normalizes data for comparison with other class members.

7. Plot R.I. versus angle. Draw the best-fit straight line through the data.

8. The angle, as we measured it, is related to the tilt of a planet's rotation axis. Using the graph, estimate the R.I. for the following angles:

23.5E_____ 45E _____

9. Answer the following questions for a planetary body with a vertical rotation axis (no tilt with respect to the plane of the ecliptic).

What is the latitude with highest relative solar intensity?

How does intensity vary as latitude increases to the north?

How does intensity vary as latitude increases to the south?

Does the planet have seasons? Explain.

10. Answer the following questions for or a planetary body with a tilted rotation axis like Earth or Mars.

Where on the planet's surface does the highest relative intensity of sunlight occur?

Is the variation of intensity the same in both hemispheres?

When the planet revolves to be on the other side of the Sun in its orbit (half a year later), what happens to the seasons?

How does increasing the tilt of the rotation axis influence seasons?