SEASONS
Session 4: Sun Angle and Energy

Activity: Modeling Light from the Sun

In this activity you will use a flashlight and grid paper to model sunlight hitting the ground at different angles. You will explore how Sun angle affects the amount of ground illuminated by the Sun, which determines the amount of energy we receive from the Sun (and therefore, temperature).

A. Procedure:

1. Place the gridded paper on your desk. Place the bottom of the meter stick where the gridded paper tells you to.
2. Use a protractor (or half-SunTracker) to position the meter stick pointing straight up, at an angle of 90°. Turn off the room lights and turn on the flashlight. This represents a Sun angle of 90°.
3. Use a pencil to draw an outline around the area illuminated on the gridded paper. Label the outline with the current Sun angle.
4. Repeat step 2 at 60°, 30°, and 10°. Use your protractor (or half-SunTracker) to measure the angle. Keep the bottom of the meter stick on the bold line of the gridded paper for each trial.
5. Turn on the lights when everyone is finished.
6. For each Sun angle, count the number of squares illuminated by the flashlight, estimating if some squares are only partially lit. Record data in the table below.
7. For each Sun angle, determine the fraction of light striking each square and record it in the table. For example, if the flashlight illuminated 15 squares, then each square receives 1/15 of the light.

B. Collect data:

Complete this table with your group:

Sun Angle (in degrees)	**Number of Squares Illuminated** (area in cm^2)	**Fraction of Total Light Received by Each Square** (as a fraction)
90°	Different for each group	Different for each group
60°	Different for each group	Different for each group
30°	Different for each group	Different for each group
10°	Different for each group	Different for each group

C. Compare and analyze:

At which Sun angle was the largest area of ground illuminated? **10°**

At which Sun angle was the smallest area of ground illuminated? **90°**

At which Sun angle did each square of ground receive the most amount of light (and therefore, the most intense light)? **90°**

When sunlight is more intense, the temperature will be (warmer / cooler). **warmer**

At which Sun angle did each square of ground receive the least amount of light (and therefore, the least intense light)? **10°**

When sunlight is less intense, the temperature will be (warmer / cooler). **colder**

D. Record your ideas:

Based on **what we have learned so far**, explain ***why*** you think it is warmer in the summer than in the winter.

Try to connect what you have learned about:

(1) how the Sun appears to move in the sky during different seasons;
(2) how the Earth's axis affects the mid-day Sun angle; and
(3) how the Sun's angle in the sky affects the intensity of light we receive.

It is warmer in the summer because the hemisphere is tipped towards the Sun, which results in a higher sun angle. Higher sun angles produce more intense sunlight, and therefore more concentrated energy (and warmth).