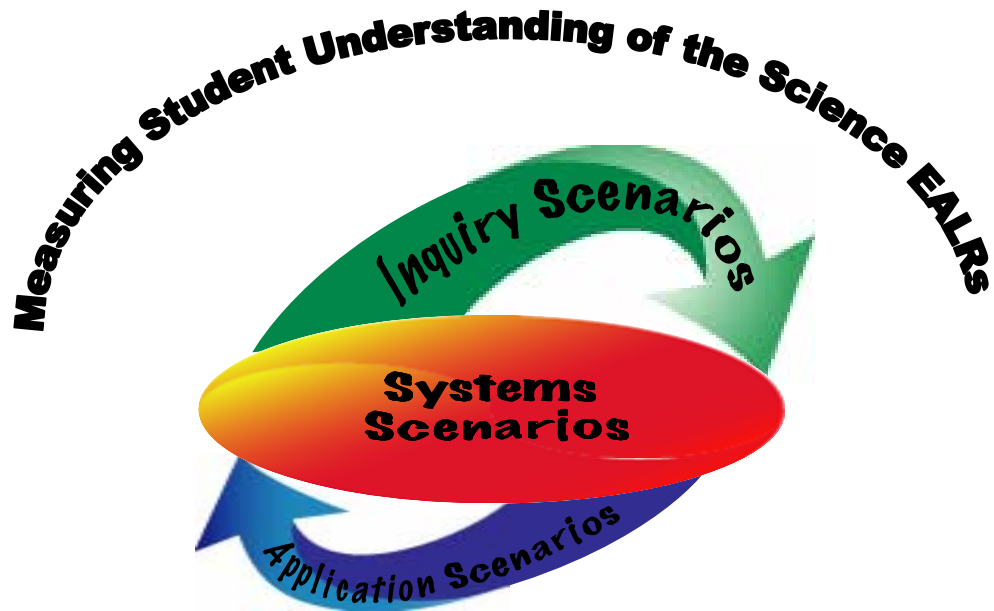


What's Your Angle?

Middle School Inquiry Scenario



Published by the Science Learning Team of the Washington Office of the Superintendent of Public Instruction on September 9, 2006

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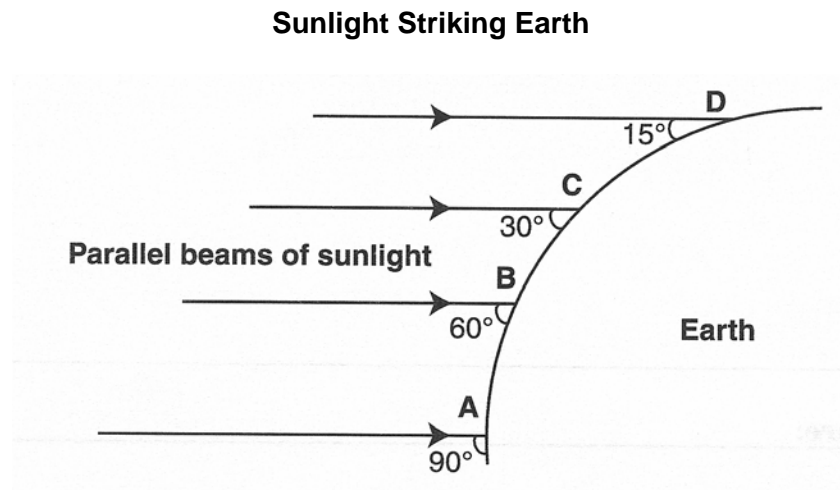
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What's Your Angle?

Directions: Use the following information to answer questions 1 through 10 on pages 4 through 11.

Sunlight strikes Earth at different angles due to the shape of Earth, as shown below.



Two students, Amy and Chris, wanted to know if the shape of Earth affects surface temperatures on Earth. They investigated this phenomenon with a model of the Earth-Sun system as described in the Earth-Sun Model.

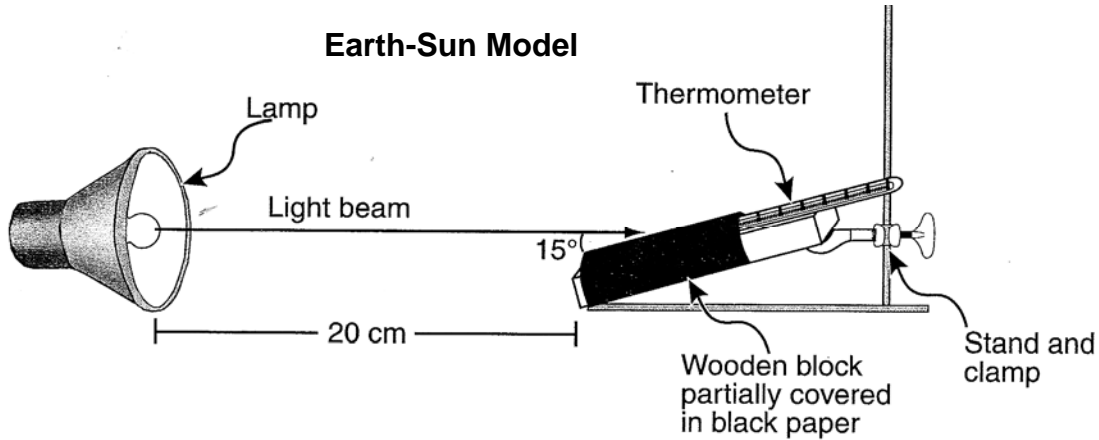
Question: What is the effect of the angle at which light strikes a wooden block on the surface temperature of that block?

Hypothesis (prediction): As the angle that the light strikes the block increases to 90°, the block's surface temperature will increase because the light will strike the block more directly.

Materials:

- wooden block
- thermometer
- black paper
- lamp
- protractor
- meter stick
- stand and clamp
- timer

Investigation Setup



Procedure:

1. Lay the thermometer on the wooden block.
2. Cover the lower end of the thermometer with black paper and attach the paper to the wooden block.
3. Tilt the block so the light beams will strike at a 15° angle as shown in the Investigation Setup diagram.
4. Record the starting temperature of the block's surface.
5. Turn on the lamp. Record the temperature after 2.5 minutes and again after 5 minutes.
6. Turn off the lamp and wait 10 minutes for the thermometer to return to room temperature.
7. Repeat steps 3 through 6 using 30°, 60°, and 90° angles. Keep the lamp at the same distance from the wooden block for each condition.
8. Repeat steps 1 through 7 two more times as trials 2 and 3.

Data:

Angle Light Strikes Block vs. Block's Surface Temperature

Angle Light Strikes Block (degrees)	Block's Surface Temperature (degrees Celsius)		
	Starting	2.5 minutes	5 minutes
15	26	31	36
30	27	35	41
60	28	38	46
90	28	46	56

Note: Temperatures are the averages of the three trials.



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1 Which variable was a controlled (kept the same) variable in this investigation?

- A. Time for the light beams to strike the paper
- B. Temperature change of the thermometer
- C. Tilt of the wooden block on the stand
- D. Light energy absorbed by the paper

2 Which variable was the manipulated (changed) variable in this investigation?

- A. Distance between the lamp and the thermometer
- B. Time for the black paper to change temperature
- C. Amount of heat energy absorbed by the paper
- D. Angle the light strikes the wooden block

3 Which variable was the responding (dependent) variable in this investigation?

- A. Color of paper on the block
- B. Surface temperature of the block
- C. Slope of the thermometer on the block
- D. Distance between the lamp and the block



What's Your Angle?, a Middle School Powerful Classroom Assessment (PCA)

5 Amy and Chris want to repeat their investigation with a different color paper over the thermometer. Which color would result in the lowest surface temperature of the block?

- A. Red
- B. Blue
- C. White
- D. Green

6 Describe how Amy and Chris could change their Earth-Sun Model to more accurately show how Earth is heated by the Sun.

In your description, be sure to:

- Identify **one** change that could be made to the model.
- Describe how this change would more accurately show how Earth is heated by the Sun.

Change:
How this change would more accurately show how Earth is heated by the Sun:



What's Your Angle?, a Middle School Powerful Classroom Assessment (PCA)

- 7 Based on the results of this investigation, what is a limitation of using energy from sunlight to heat homes?
- A. The amount of energy available changes as the angle of the Sun changes during the day.
 - B. The amount of sunlight striking a home changes with Earth's distance from the Sun.
 - C. There would be less energy during the winter because the Sun produces less light.
 - D. The angle of sunlight is only large enough to change surface temperatures at the Equator.



What's Your Angle?, a Middle School Powerful Classroom Assessment (PCA)

8 Describe **two** energy transfers that happened in Chris and Amy's investigation.

In your description, be sure to:

- Identify the energy forms before and after each energy transfer.
- Describe where in the system each energy transfer happened.

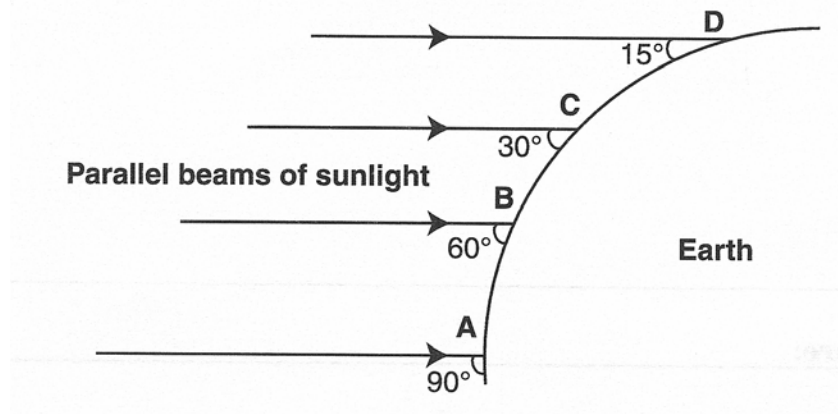
Use words, labeled pictures, and/or labeled diagrams in your response.

One transfer:
Another transfer:



What's Your Angle?, a Middle School Powerful Classroom Assessment (PCA)

- 9 Sunlight strikes Earth at different angles due to the shape of Earth as shown below.



At which location would shadows be **longest** at noon on a clear summer day?

- A. Location A
- B. Location B
- C. Location C
- D. Location D



