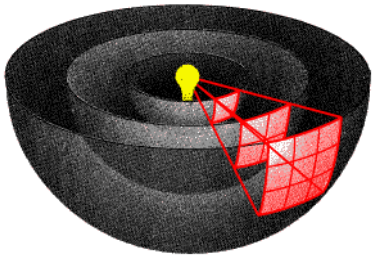


Not Your Typical Reciprocal

Student Instruction Sheet

Challenge

Explore the relationship between the intensity of light and the distance from the light source.

Equipment and Materials

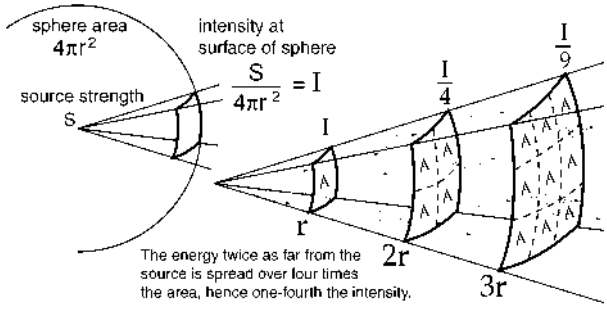
• Computer w/ USB Port	• Aperture Bracket
• PASPORT USB interface	• *Student Instruction Sheet*
• PASPORT Light Sensor	• *Student Response Sheet*
• Basic Optics System	

Safety Precautions

Remember, follow the directions for using the equipment.

Background

The light from a point light source spreads out uniformly in all directions. The intensity at a given distance *r* from the light will be equal to the power output of the light divided by the surface area of the sphere through which the light has spread. Since the area of the sphere varies as the square of its radius, *r*, the intensity will theoretically vary inversely as the distance squared, or $1/r^2$.



Predict

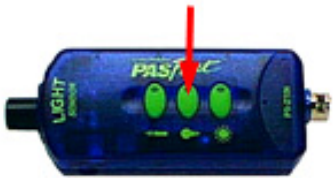
Before beginning the eLab, complete the prediction portion of the *Student Response Sheet*.

Explore

Computer Setup

1. Plug the USB interface into the computer's USB port.
2. Plug the Light Sensor into the USB interface. This will automatically launch the PASPortal window.

Note: Press the middle button on the Light Sensor to select the appropriate range before collecting data.



3. Choose the appropriate DataStudio configuration file entitled

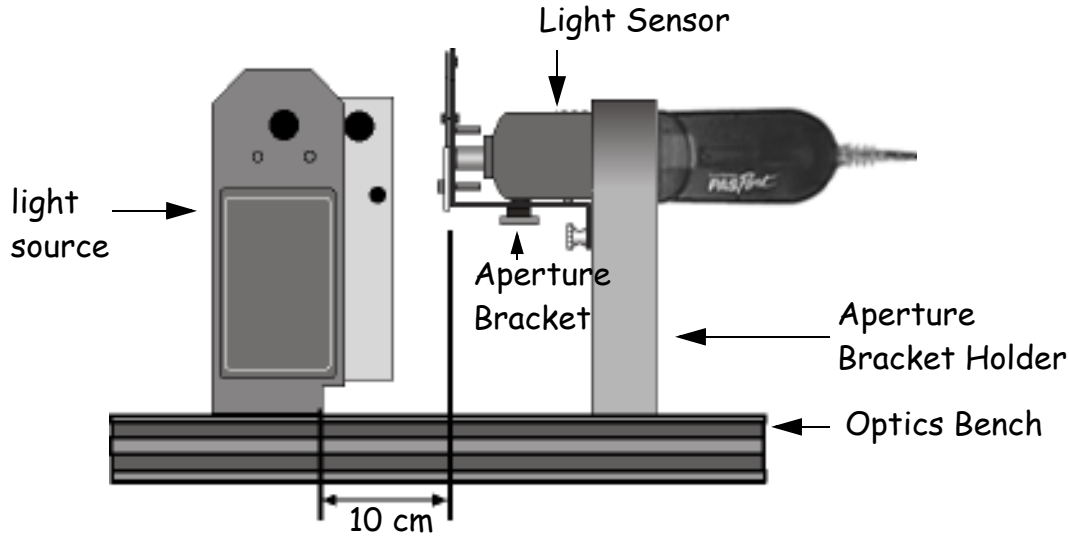
24 Inverse Square Law CF.ds

Note: Configuration files automatically launch the appropriate display(s), sampling rate(s), etc.

Equipment Setup

1. Setup an Optics Bench on a level table. Place the Basic Optics Light Source at the 0 centimeter mark.
2. Mount the PASPORT Light Sensor on the Aperture Bracket. Attach the Aperture Bracket to the Aperture Bracket Holder (Temporarily disconnect the sensor from the USB link if necessary). Put the Aperture Bracket Holder onto the Optics Bench.
3. Rotate the Aperture Disk so the open circular aperture is in line with the opening to the Light Sensor.

4. Move the Light Sensor so it's 10 cm away from the Basic Optics Light Source and turn on the light source.



Record Data

(*Hint:* Read this all the way through before you begin to take data.)

1. Click the **Start** (Start) button to begin recording the light intensity. The **Start** button will turn into a **Keep** (Keep) button. Click the **Keep** button to record the first value of light intensity and enter the distance value, in meters, that the sensor is away from the light source.
   - Remember to record all your distance values in meters.
2. Move the Light Sensor back 2 cm and click the **Keep** button. Enter the distance value. Move the sensor back another 2 cm, etc. Keep moving it back until the sensor is 24 cm from the starting point. Click the **Stop** ( ) button.

Analyze

1. Use the Graph's built-in analysis tools to fit a mathematical formula to the data.
2. Click the **Fit** (Fit) menu button on the graph toolbar. Select the proper curve fit. (*Hint:* Remember the formula.)

3. Use the cursor to click-and-draw a rectangle around the region of smoothest data in the Graph. The DataStudio program will attempt to fit the data to a mathematical formula.

   Note: To see the mathematical formula and its parameters, double-click the curve fit text box in the graph.

4. Save your DataStudio file (on the **File** menu, click **Save Activity As...**) to the location specified by your teacher.

5. Answer the questions and define the vocabulary words on the *Student Response Sheet*.

6. Follow your teacher's instructions regarding cleaning up your work space.

Student Response Sheet

Name:_____

Date:_____

Not Your Typical Reciprocal

Vocabulary

Use available resources to find the definitions of the following terms:

light: _____

_____

Predict

1. What do you think will happen to the intensity of light as the distance is increased?

_____

_____

_____

2. What do you think is the relationship between the distance to the light source and the measured light intensity?

_____

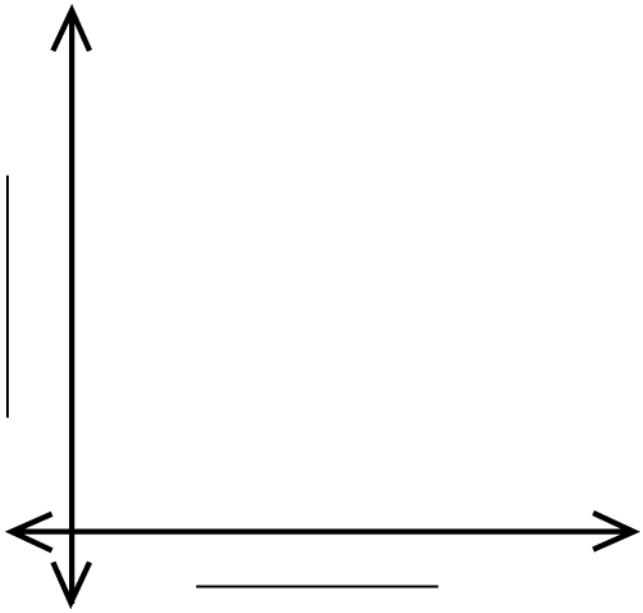
_____

_____

Data

Sketch your graph of light intensity versus distance.

Note: Do not forget to label your graph.



Analyze

1. What is the general shape of the plot of the light intensity and the distance?

_____

_____

_____

Synthesize

1. What can you conclude about the relationship between the light intensity and distance?

_____

_____

_____

2. Do your results support your predictions?

_____

_____

_____