NAME PERIOD DATE

INTENSITY OF LIGHT

How does the intensity of light change with distance?

Objectives

- Learn how to use a light sensor to take careful measurements
- Discover the relationship between light intensity and distance from the light source

Materials and Equipment

- Data collection system
- Wireless Light sensor
- Light Source
- Meter Stick

Safety

Follow regular laboratory safety precautions.

Procedure

1. Connect the wireless light sensor to the data collection system and create a digits display of the spot light sensor white measurement that measures the relative intensity of the light at a given distance.

2. Place the wireless light sensor on a table so that it is oriented narrow side down. This reduces the amount of light reflecting from the table entering the light sensor. See Figure 1.

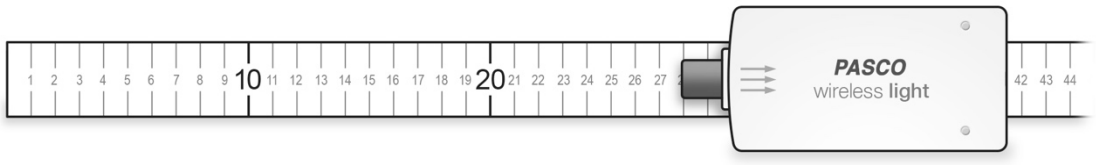


Figure 1

3. Place the light source on the table so it is at about the same level as the black collection tube on the end of the wireless light sensor and pointing straight toward it. See Figure 1.

4. Place the meter stick on the table so that the 0.0 cm mark is even with the light source. Place the part of the light sensor where the black collection tube meets the white body at the 30 cm (0.3 m) mark. This is where the active part of the sensor is physically located. See Figure 1.

5. Start recording data. Write the white intensity measurement in Table 1 in the Data Collection section.

6. Move the light sensor so it is an additional 10 cm from the light source and record the intensity measurement in Table 1.

7. Repeat step until you have 6 data points. Stop recording.

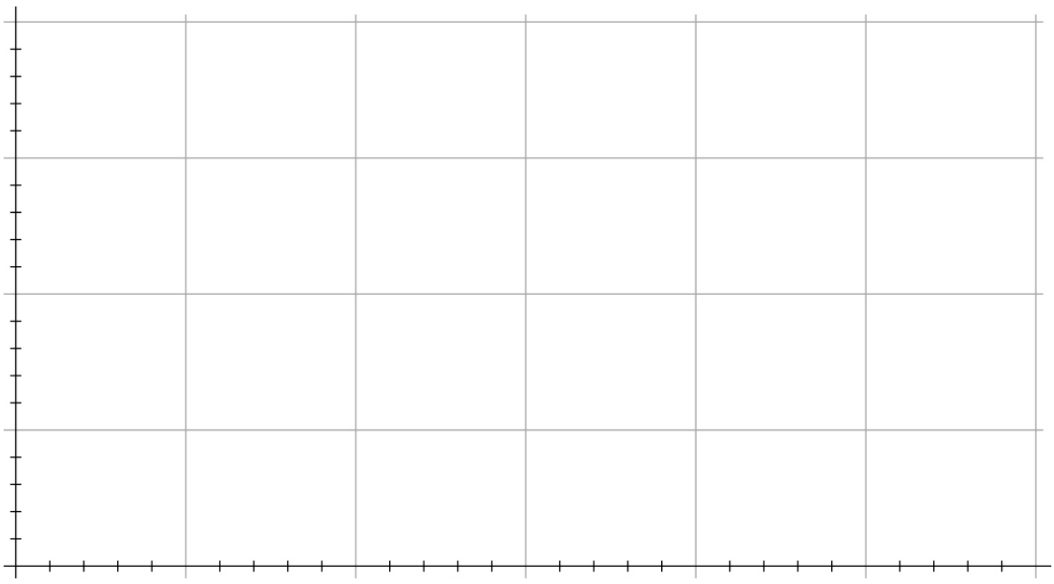
Data Collection

Table 1:

Distance (m)	Intensity (Relative)	Inverse Square of Distance (m^{-2})
0.3		
0.4		
0.5		
0.6		
0.7		
0.8		

1. Create a graph with Intensity on the y-axis and Distance on the x-axis on Graph 1 below.

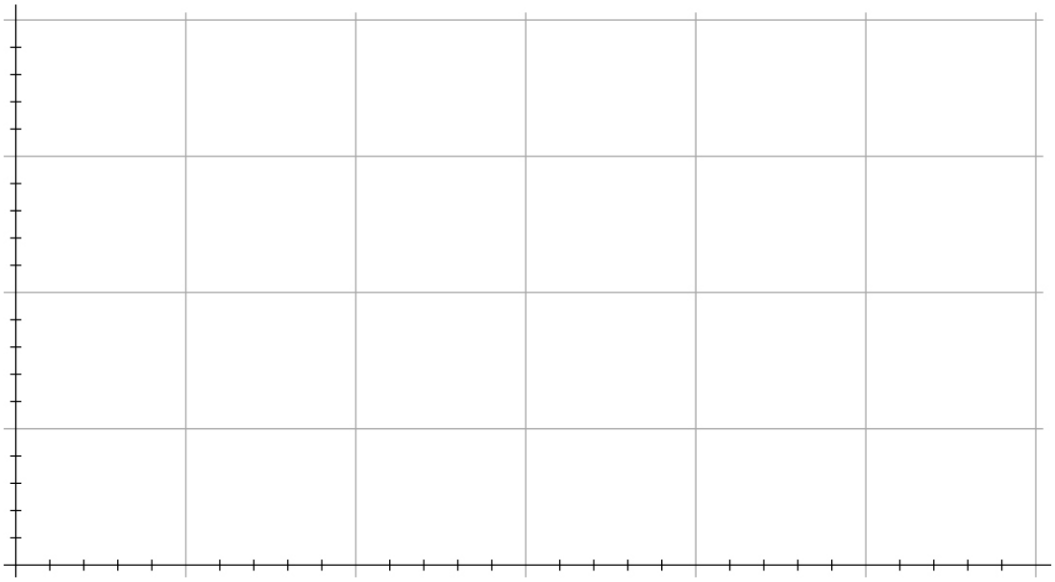
Graph 1: Relative Intensity vs Distance



2. Complete the inverse square of the distance column in Table 1 by dividing 1 by the square of each distance.

3. Create a graph with Intensity on the y-axis and Inverse Square of Distance on the x-axis on Graph 2 below.

Graph 2: Relative Intensity vs Inverse Square of Distance



Questions and Analysis

1. Carefully inspect Graph 1. What does the graph tell you about the intensity of light as the distance increases? Is this relationship linear? If so, draw a best fit line using a straight edge. If not, draw a smooth curve connecting your data points.

2. Carefully inspect Graph 2. What does the graph tell you about the intensity of light as the inverse of the square of the distance increases? Is this relationship linear? If so, draw a best fit line using a straight edge. If not, draw a smooth curve using your data points as a guide. It does not need to pass through each point, use your judgement to draw it smoothly through as many points as possible.

3. The relationship between intensity and the inverse square of the distance shown by your data in Graph 2 should be linear. Pick two points on your best fit line and find the slope. Use Graph 2 to find the y intercept. Write the equation for the line in y = mx + b form below.

4. Using the equation of your line for Graph 2, predict the intensity of the light for a distance of 0.90 m. Show your work below. Use your experimental setup to check your result.

5. Describe in detail one reason your predicted intensity in question 4 is not equal to the measured intensity. Propose a possible solution for this source of error.

6. The planet Neptune is 30 times as far from the Sun as the Earth. What is the intensity of sunlight striking Neptune compared to that striking Earth?