



# LASER CLASSROOM

Bringing STEM to light®

## BIG IDEAS

- Demonstrate that LASER light is collimated by comparing the area of light produced by LED lights to that of LASER light at various distances.

## WHAT YOU'LL NEED

- Light BLOX: Red, Green or Blue
- 1 Red Laser Pointer
- 2 blank sheets of paper
- A ruler

## RELATED PRODUCTS

Click the below to be taken right to the product page.



Red Laser Blox



Light Blox



Red & Green Laser Pointer

## COLLIMATED LASER LIGHT

LASERs Laser pointers are often used during presentations, to highlight important points information. One could not do this with a normal flash light, though, because the light spreads too quickly to be a useful pointing tool! Why can LASERs shine so much further than LED or flash lights, without spreading out or getting dimmer?

## HOW LIGHT MOVES

We can represent a beam of light as a collection of light rays, as shown in *Figures 1 and 2*. These light rays follow a very specific set of rules. The most important of these is that these rays always travel in straight lines. They cannot curve, and unless they are refracted, they cannot bend.

## WHY IS LIGHT BRIGHT?

The light rays making up a beam of light can be arranged in a lot of different ways. This affects how bright the light is.

Take a look at the ray diagram in *Figure 1*. The rays making up this beam of light are many and very close together, so the beam will be bright. The more and closer together the rays of light, the brighter, or more intense, the beam.

Conversely, *Figure 2* shows a dim beam of light. The light rays are fewer and farther apart, so the beam is less intense, or less bright, than the first one.

Often, when the rays of a beam

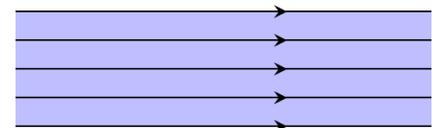


Figure 1: Bright Beam of Light

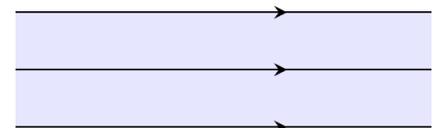


Figure 2: Dim Beam of Light

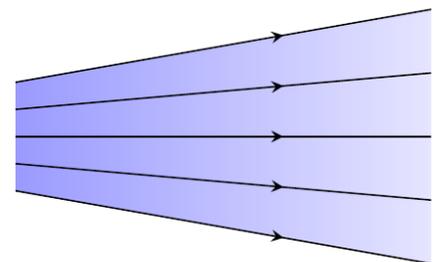


Figure 3: Light Rays Spreading Out

of light leave its source, like an LED or flash light, the light rays start to spread out. This is shown in *Figure 3*. This means the beam starts out brightly, but loses intensity as the rays move further away from each other.

When the rays don't spread out, but instead remain parallel to each other over long distances, we say the beam of light is collimated.

## CALCULATING AREA

In order to complete the activity sheet, you'll need to know how to calculate the area of a circle and a rectangle.

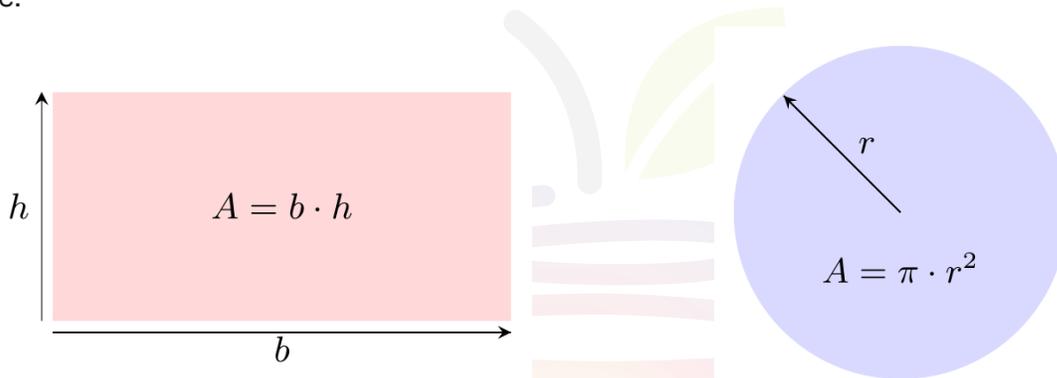


Figure 4: Area of a Rectangle

Figure 5: Area of a Circle

*Figure 4* shows the measurements required of a rectangle, which need to be substituted into  $A = b \cdot h$

*Figure 5* shows how to measure the radius of a circle, in order to calculate the area using  $A = \pi \cdot r^2$

## COLLIMATED LIGHT IN REAL LIFE: MICROSCOPY

While parallel light rays are a well-known property of LASERs, you can collimate any light source with the right equipment. One of the uses of collimated light is in microscopes.

In order to ensure clear, accurate images in high-powered microscopes, a collimated beam of light must travel from the light source below the specimen being viewed, to the eyepiece. This light can originate from either a LASER or an LED. Note: it would be nice to have a description of how normal light is collimated ie with special lenses or whatever. It's a little mysterious sounding as is.

# ACTIVITY SHEET: COLLIMATED LASER LIGHT

This activity will showcase one of the properties of LASER light that makes it so unique.

1. Stick one of the blank sheets of paper against the wall, in line with the table top.
2. Stick the other sheet to the table, short end flush with the wall.
3. Mark off 1", 3" and 6" lines on the paper on the table.
4. Place the Light Blox at the 1" mark, and switch it on. Use a pencil to mark off the area of the circle of light created. Repeat at 3" and 6".
5. Remove the paper from the wall and calculate the area of each of the circles. Record your data in the table below.
6. Repeat steps 4 and 5 with the red LASER pointer and the Light Blox.

	1"	3"	6"
LIGHT BLOX			
LASER			

The circle of light becomes bigger the further away the source of light is from the wall. The rectangle behaves the same way. This is because the light rays spread out as they leave the light source.

What do you notice about the size of the spot of LASER light? What could this mean?

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The light from the LASER, however, stays the same size. This is because LASER light is collimated, i.e. the light rays are parallel to one another. They do not spread out as they leave the light source. This is why the light doesn't lose brightness like the Light BLOX.