

# Laser Obstacle Course

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## Summary

This exercise will introduce you optical concepts such as reflection, refraction, and polarization. You will use a light source of a laser, and explore materials that are transparent, translucent, and opaque. The goal is to bend light around an obstructive object to hit the desired target. This will require understanding how light and matter interacts, and application of these concepts.

## Laser Safety

### **NEVER LOOK DIRECTLY INTO ANY LASER OR ANY BEAM! NEVER!**

There is a low, *but non-zero*, risk of eye damage this laser pointer, even for direct exposure to the full beam, because your natural blink response and head movement will limit the time of exposure. Even so, if the beam should enter your eye, you will not be able to see anything for awhile; it's like having your picture taken with a *really bright* flash camera, and it is not pleasant. Plus, there is some chance of permanent damage. Even if the laser is off, just don't do it! You cannot see what is inside a laser that way, so there is no reason to try, and it is a very unsafe practice. Repeat ten times, "Do not look into the laser."

## Materials

- Red laser pointer
- Targets
- Lenses
- Mirrors
- Prism
- Glass
- Other household items to discover the properties of!

## Background

You should take some time to explore the components on the table and learn what is there. There are a variety of objects, most which are mounted such that they are at the same height. What happens to the light when the objects are placed in the light beam path? Using the definitions below, create a table to describe the characteristics of these objects.

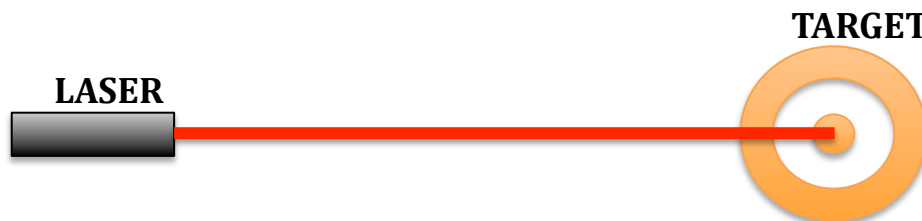


Figure 1: Laser pointed in a straight-line path to the target.

## Definitions

- **Reflect:** Light bounces off the surface of the object and an angle equal to the incident ray.
- **Refract:** Light goes through an object at a different angle depending on the refractive index of the medium. This is caused by the change in the speed of light as it travels through the medium.
- **Prism:** A prism can be used to show the colors that make up white light.
- **Transparent:** Light passes through the object.
- **Translucent:** Some light passes through the object.
- **Opaque:** No light passes through the object.
- **Beam splitter:** An optical device for dividing a beam into two or more separate beams.

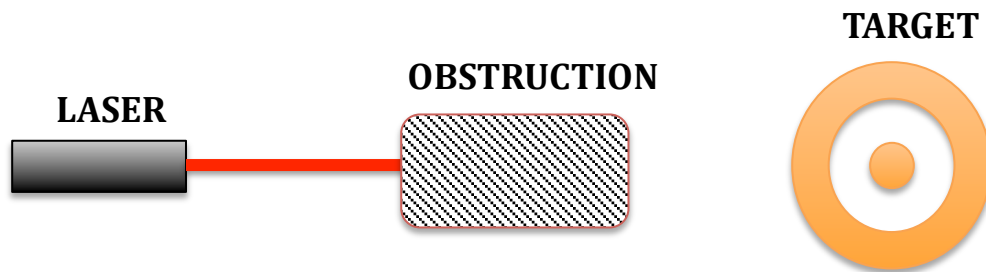
## Experiment

Recreate Figure 1:

The laser should be pointing straight at the target.

Recreate Figure 2:

Now add an object such that no light is transmitted to the target.

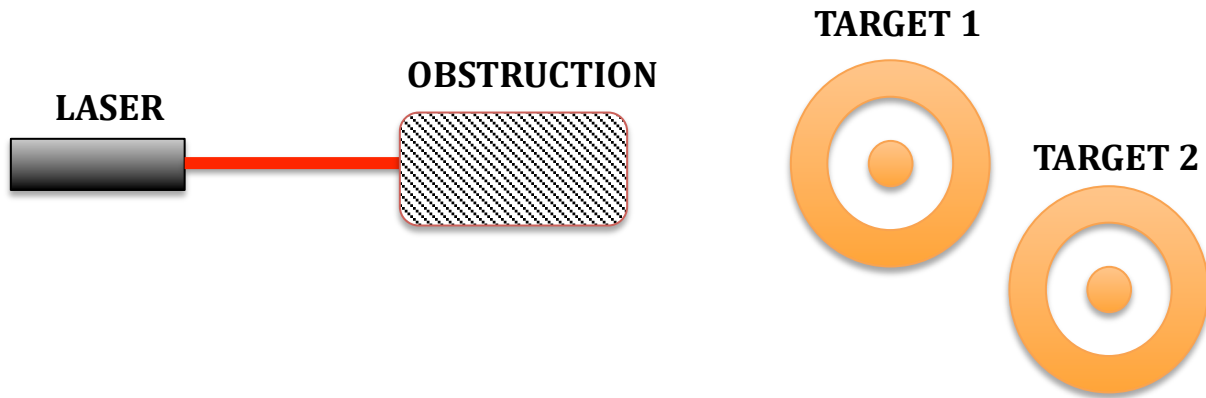


*Figure 2: Laser light is now blocked and does not reach the target.*

Is the object you added to block the laser light transparent, translucent, or opaque? Now the task have the laser light hit the target again. Use the items on the table to redirect the laser light to that target by placing the objects in the path of the laser. Not every object reflects light, how can you use an item that refracts light to get it to the target? Can you do it with less than 4 objects? The components can be ordered in many different configurations; feel free to play with them. BE CREATIVE! This process is called aligning a laser beam.

Recreate Figure 3:

Can you have one laser light beam hit two targets at the same time?



*Figure 3: Aim the laser light to hit two targets at once.*

Keep the same configuration you had for Figure 2, but now place a second target to the side of the first target. By adding one object and not moving anything else, can you also hit the second target? What kind of object can split light into two beams?

### **Test Your Understanding**

- Does a mirror reflect or refract light?
- How easy is it to direct light to a particular object?
- How can you split a laser beam into two beams of light?
- What's the difference between transparent, translucent, and opaque objects?
- When is it okay to look into a laser?