



# Lasers and Prisms

**Amount of time Demo takes: 3-10 minutes**

**Try this in the classroom!**

## Lesson's Big Idea

- Light can be redirected and controlled using various prisms -- some of them cause light to come together, and others force beams apart.

## Materials

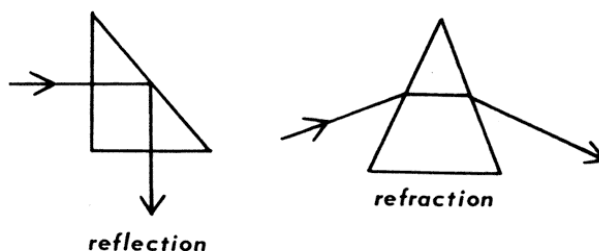
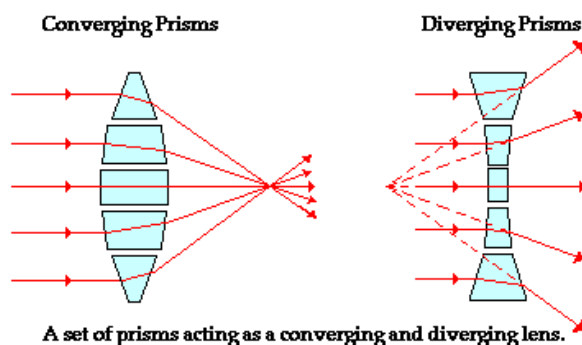
- Laser optics kit ([Arbor Scientific - Laser Ray Box and Lenses](#))
  - Mirror
  - Several prisms
  - Laser box
- Extension cord-**Needs electricity**
- Ray diagram sheets, key diagrams (all sheets [here](#))

## SAFETY!

- Ensure that the lasers are blocked at the end of the table by a non-reflective surface.
- Do not look directly into the lasers.

## Background Information

- Convex lenses: These lenses are thicker in the middle than at the ends and they refract parallel light rays so they come together at a single point. This is called convergence.<sup>1</sup>
- Concave lenses: These lenses are thinner in the middle than at the ends (bend inwards). A concave lens refracts parallel beams so that they spread out. This is called divergence.
- If the laser hits some prisms at



the correct angle, the light is reflected and doesn't exit the prism from the place we might expect, like it does when it refracts (image from Seiler):

### Setup Instructions

1. Place the laser block on the table.
2. Inventory and make sure all prisms and blocks are accounted for.
3. Press the red button to turn the box on; use the switch to change between 1, 3, and 5 beams. All Mind Trekkers puzzle require the laser box to emit 3 beams.

### Instructional Procedure

1. Demonstrate the operation of the laser block.
2. Show briefly how the lasers interact with the prisms. Point out what conditions make the beam reflect, converge, etc. Explain the differences between convex and concave lenses.
3. Challenge the audience to use the optical components to match the ray diagrams provided.

### Tips & Tricks

- Demonstrate to the students how the different prisms work.
- Once the students have an understanding of the task, let them try to solve the puzzles! Some of them may stick around for a while.

### Assessment Questions

1. What's the difference between convex and concave lenses?
  - a. Convex are thicker at the middle while concave are thinner.
2. Why do some of the lenses reflect the light without the light escaping through the other side?
  - a. That changes based on the angle in the prism. A true reflection is like a hard turn while refraction will just bend the light.

### Careers & Real World Application

- Light reflection and refraction can be used in many things from eye doctors to using telescopes.
- **Careers**
  - Ophthalmic Technician / Optometrist - Eye Doctor
  - Optical Design Engineer for Telescopes

- Lighting Artist

### **Clean Up**

- Clean up prisms/mirror down with alcohol or clorox wipe
- Carefully pack into bin so that prisms will not be broken in travel

### **References**

- <http://www.lessonplanspage.com/scienceconvexconcavelenses69-html/>
- Seiler Precision Microscopes

### **Related Next Generation Science Standards**

- K-5
  - 1-PS4 Waves and their Applications in Technologies for Information Transfer
  - 4-PS4 Waves and their Applications in Technologies for Information Transfer
- 6-8
  - MS-PS4 Waves and their Applications in Technologies for Information Transfer