Curiosity Guide #203
Refraction of Light

Accompanies Curious Crew, Season 2, Episode 3 (#203)

Making Jell-O Lenses

STEM Challenge

Description

What can you learn from a lens made of Jell-O? Amazing!

Materials

- Two 8-ounce lemon flavored, yellow Jell-O Jigglers
- Shape templates such as plastic cups, Petri dishes, and cookie cutters. Direction #5 lists the shapes that are needed.
- Sharp knife to cut around templates when needed
- Cooking spray
- Two 9 by 13 inch pans
- Wax paper
- Graph paper
- Markers
- Protractors
- Red laser pointer

Procedure #1: Making Jell-O Lenses

1) Prepare Jell-O according to package directions. Adding ice water will help stiffen the gelatin.
2) Spray one 9 by 13 inch pan with cooking spray.
3) Pour gelatin into pan so that it is no thicker than a half inch. Refrigerate.
4) Lay out wax paper in a transport pan.

5) When Jell-O is set, use templates and the knife to cut out two different sized triangles, a rectangular rod, a bi-concave shape, and a semi-circle, which will represent a Plano-convex lens. Be sure to keep edges as smooth as possible.
6) Lay each shape in the transport pan.

Procedure #2: Experimenting with the Jell-O Lenses

1) Place a triangular prism on the graph paper.
2) Predict what will happen to the light when you shine the red laser through the yellow triangular prism. Try it.
3) Using a marker, note the laser entry and exit points on the graph paper.
4) Repeat by moving the entry point of the light to different locations.
5) Remove the prism. On the graph paper, use your markings of the entry and exit points to trace the path of the beam.
6) Use the protractor to measure the angle at which the beam is bent.
7) Repeat with the long yellow rod, the semi-circle, and the bi-concave lens.

My Results

Results, continued

Explanation

Light energy travels in straight lines and in waves. When light strikes a plane or a flat surface, it reflects in a manner that is predictable. For example, looking directly into a mirror provides a reflection that is straight back from the source. However, if light strikes the plane surface mirror on an angle, then it will bounce off with an equal angle. The angle in to the mirror is called the angle of incidence and the angle out from the mirror is called the angle of reflection.

When two different media meet, light behaves differently at the boundary. Light is refracted in substances with different densities such as the gelatin, which was cut into different shapes resembling lenses.

There are 5 different kinds of lenses. The bi-convex and the bi-concave lenses are most commonly used. A bi-convex lens is an elliptical shape with outward curves on both sides. A bi-concave lens

also has two curved surfaces, but these surfaces are bent inwards instead. The Plano-convex lens has an outward curve on one side and flat surface on the other, while a Plano-concave lens has an inward concave surface on one side and a flat plane surface on the other. Finally, a concave-convex lens has an inward curve on one side and an outward curve on the other.

No light is refracted in the central point of both concave and convex lenses. This is called the optic center. The light that enters the lens on either side of that center will be refracted one way or another. In the case of a convex lens, the light refracts toward the midline. The light in a concave lens bends away from the midline. In either case, the light beam will bend toward the denser part of the lens.

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