Name:_____Date:_____Class:_____

Student Worksheet

Gelatin Waveguides: Independent Inquiry

Safety
Never shine a laser into anyone's eyes. It can cause permanent blindness.

Materials
- gelatin square
- laser pointer
- graph paper
- protractor
- plastic knife
- 1/2 teaspoon of sugar
- 1 in. square of sandpaper

This activity provides an alternative to the guided inquiry version to allow independent investigation.

Procedure

Using a laser pointer, gelatin square, and graph paper, describe how light is refracted as it passes into the gelatin. Explore how light behaves as it travels in the gelatin and when it encounters corners or walls of the gelatin. Prepare to share at least one insight with the rest of the class.

Students may notice that the light ray bends towards the normal as it travels into the gelatin. This indicates that the gelatin has a greater index of refraction than air. Students may also notice that the light ray can be internally reflected off of the walls of the gelatin and hence stay within the gelatin.

Challenge #1

Examine the effects of sidewall roughness on the internal reflection of your light ray. You may use the materials available (sandpaper, plastic knife and sugar) to damage the sidewalls and/or use a material of your own. Create a table describing the type of damage and the effect it has on the internal reflection of the light ray.

Students may notice that sidewall roughness dramatically decreases internal reflection of the light ray. Roughness due to damage from the sandpaper or the grooves produced by the plastic knife serve to provide surfaces from which light escapes. Particles such as the sugar granules also serve as exit points for the light ray.

Challenge #2

Design a waveguide made of gelatin that will turn a beam of light 180° and occupy the smallest footprint (surface area) possible.

Students will produce a variety of designs. Students may even cut various pieces and set them end on end to produce a curved waveguide. Recognize innovative designs; however, the most efficient will be the design with the smallest surface area.

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