

Internal Reflection

Materials

Transparent plastic bottle (and lid) with one hole pierced through the wall, about one-third of the way up from the bottom.

Tub to catch the water pouring out of the hole and large enough for performing the experiment.

A water-proof stand or upside-down beaker in the tub and on which to place the bottle. This object must elevate the bottle high enough so that the hole is higher than the edge of the tub. (There must be a horizontal line of sight across the breadth of the bottle and to the hole.)

White paper standing upright

Red laser pointer (< 5 mW)

Caution: Avoid direct eye exposure. Do not look or stare directly into the laser beam.

Instructions

1. Fill the bottle with water to the top and quickly secure the lid to stop the flow of water through the hole. (This is because if there is no air coming from the neck of the bottle to replace the water, the water can't flow out of the hole.)
2. Place the bottle on the stand at one side of the tub with the hole directed to the center of the tub. Place the upright paper on the opposite side of the tub. Get the laser ready.
3. In a series of quick movements, unscrew the lid, ensure that the stream of water is pouring into and toward the center of the tub. Direct the laser through the water in the bottle from the opposite side of the hole. The laser beam must be horizontal and must be lined up to exit the hole.
4. What do you see? Does a laser spot show up straight across the bottle on the paper or does the laser light "bend" with the water spout, or both? What do you think is happening?

This phenomenon is the same one that takes place in fiber optics to send light signals in communications systems. When no light gets out of the fiber optic, it is called "total internal reflection".