

- Broken pencil demo (in glass of water)
 - Have students write about their thinking about: "In terms of light describe what you think might be happening here and why".
- Catch-throw analogy
- Notes on Refraction:
 - (Do after I've done catch & throw activity): The speed of an electromagnetic wave in a material depends on the optical density of that material.
 - Optical density is quantified by Index of Refraction: n
 - $n = c/v$
- Roller Skate analogy
- Notes:
 - (Do after roller skate analogy) (elicit student thinking about definition of refraction): Refraction: the change in direction of wave propagation at the boundary between media of different densities.
 - Or: Bending of the path of a wave as it passes from one material to another material.
 - (From Hewitt): Waves bend when one part of a wave is made to travel slower or faster than another part.
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- Act out the wave
- Wave tank demo
 - (fill a tank with enough water to barely cover a piece of glass. Different depths of water represent different optical densities. Place on overhead projector and with a straight wave generator observe waves).
 - Where do you see change in the wave?
 - What changes about the wave?
 - What remains the same?
 - How is this analogous to light?
- Do Formative Assessment Questions
- Pushpin Lab (observable experience with light bending)

- Ultimate Goal: determine the type of fluid in container.
 - Have students research light changing medium -> Snell's Law, use Snell's Law to identify the fluid.
- Physics by Inquiry Practice (as extension)
- Discuss fiberoptics
- Do Optics Maze as Summative Assessment