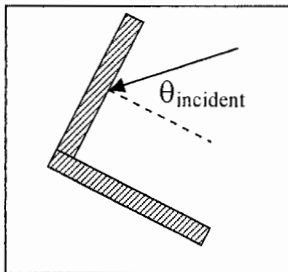


Name \_\_\_\_\_

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1. The index of refraction in a particular plastic block is 1.44; what's the speed of light inside the block?
2. In reality, the index of refraction is a function of the wavelength of incident light. Simple lenses will bring beams of pure light to different focal points; lenses which take care of this problem are called *achromats*. Suppose that you are given a cube of glass whose indices of refraction are 1.35 at 632 nm (red) and 1.42 at 470 nm (violet). An incident beam of white light ( $\theta_{\text{incident}} = 37^\circ$ ) contains these wavelengths. What's the angle between the beams inside the cube? Upon exiting the glass cube, what is the angle between the red and violet light beams?
3. A simple spectrograph, consisting of a double slit and two light-sensitive sensors, detects the presence of a toxic gas by identifying a characteristic spectral line. The spectral line (InfraRed, or IR) has a wavelength of  $1.223 \mu\text{m}$ . If the spacing between slits is  $0.050 \text{ mm}$  and the distance between the slits and the assembly containing the sensors is  $25.4 \text{ cm}$ , what minimum distances from the center line of the apparatus must the InfraRed sensors be located at so as to coincidentally observe the spectral line in the 1<sup>st</sup> and 2<sup>nd</sup> orders and thus detect the toxic gas?

4. A corner-reflector is depicted below. If  $\theta_{\text{incident}}$  is  $57^\circ$ , at what angle will the beam leave the lower mirror (measure this angle from surface normal to beam)?



5. A thin lens has a focal length of  $+5 \text{ cm}$ . What is the distance between the center of the lens and the image formed if the object is (i) at infinity and (ii)  $12.5 \text{ cm}$  distant from the lens? Classify the resulting images as either real or virtual and inverted or erect.