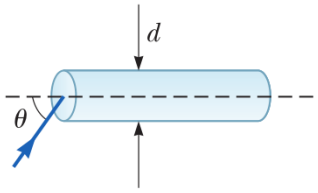
Physics 9B Fall 2013 - Discussion #9



1. *Cone of Acceptance*: Assume a transparent rod of diameter $d = 2.00\ \mu$m has an index of refraction of 1.36, and sits in a vacuum. A light beam of frequency 5.60×10^{14} Hz is incident at an angle θ on one end. (a) What is the speed of the light in the rod? (b) What is its frequency in the rod? (c) What is its wavelength in the vacuum? In the rod? (d) Determine the maximum angle θ for which the light rays are subject to total internal reflection along the walls of the rod. (e) At what angle will the internal rays strike the opposite end of the rod?

2. *Optical Doublets*: Two thin lenses of different indices of refraction n_1 and n_2 are cemented together along their optical axes. The first has one flat side, and one concave side with radius of curvature R. The second is biconvex with radii of curvature R. (a) Show that the focal length of the system is found from

$$\frac{1}{f} = \frac{2n_2 - n_1 - 1}{R}.$$

Hint: If the lenses are thin, you should notice that the image distance from the first lens will be the object distance for the second lens. (b) If $n_1 = 1.3$ and $n_2 = 1.5$ with $R = 7$ cm and an object is placed 6 cm from the lens system, where will the image form? (c) What type of image is it?

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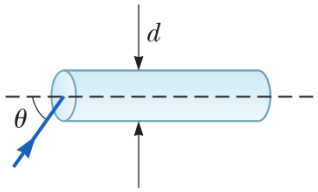

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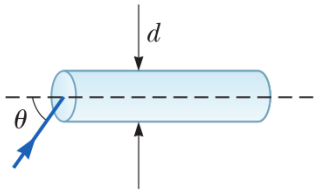

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