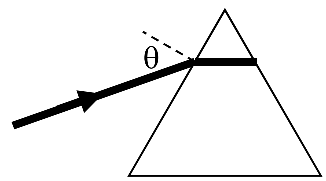
Homework Set #1 **Due: 4-2-12**

1) An equilateral prism is made of glass with an index of refraction of 1.7. **(a)** Find the input angle θ such that the light travels parallel to the prism base inside the prism. **(b)** What is the output angle of the light when it exits the prism back into air?



A prism configured this way is said to be at "minimum deviation" and has properties that are useful for some applications, including inside laser cavities.

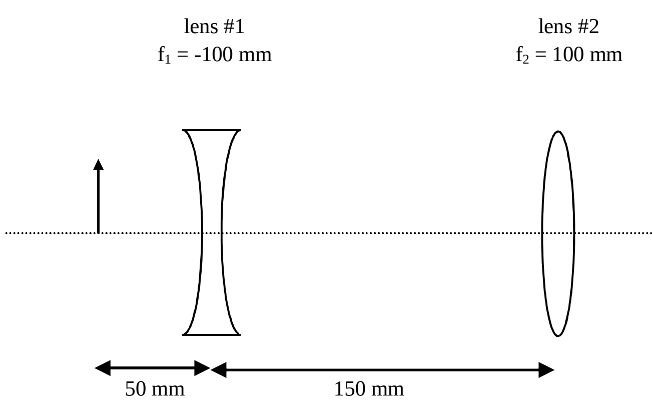
Review: When light travels from one medium (#1) to another (#2) across a sharp interface, it refracts according to Snell's Law: $n_1 \sin\theta_1 = n_2 \sin\theta_2$. The angles are measured with respect to the normal to the interface. The index of refraction of air is about 1.0003 and can usually be taken to be unity. *Always use $n_{air} = 1$, unless specified otherwise.*

2) An arrow is followed by a diverging lens and a converging lens. The two lenses together form an image.

(a) Where is the final image? (Specify distance from the converging lens and whether it is to the left or right of it.)

(b) Is the final image real or virtual? Which way is the arrow's image pointing: up or down?

(c) What is the magnification of the system?



Review: If f is the focal length, o the distance to the object and i the image distance for a given lens: $1/f = 1/o + 1/i$. All distances measured from the center of the lens. Sign convention: the object distance is positive if the object lies before the lens and the image distance is positive if it comes after. A positive image distance means the image is "real" – you can see it on a card or screen. A negative image distance means the image is "virtual" – the output light appears to be coming from the image, but a screen placed at the image will not show one. The magnification $m = -i/o$. A negative magnification means the image is inverted. For multi-lens problems you handle the first lens first, and then use the image of the first lens as the object for the second lens. Note this means the second lens's object can come after the second lens itself.

(3) Text 1.9
Also, find the wavelength and wave number.
In problems like this, assume numerical constants and variables have units such that the phase is dimensionless, as it must be. In addition, assume SI units unless otherwise specified.

(4) Text 1.16

(5) Text 1.17, parts (a) and (d) only.

(6) Text 1.22

(7) Text 1.32