Physics 422 - Spring 2013 - Assignment #5, Due April 4th

1. (*Hecht, 5.22*) Determine the focal length in air of a thin spherical planar-convex lens having a radius of curvature of 50.0 mm and an index of refraction of 1.50. What, if anything, would happen to the focal length if the lens were placed in a tank of water with $n = 1.33$?

2. (*Hecht, 5.13*) A biconcave lens ($n_l = 1.5$) has radii of 20 cm and 10 cm and an axial thickness of 5 cm. Describe the image of an object 1 cm tall placed 8 cm from the first vertex. Use the thin-lens equation to see how far off it is in determining the final image location.

3. (*Hecht, 5.6*) Show that when using the paraxial approximation, the magnification produced by a single spherical interface between two continuous media is given by

$$M_T = -\frac{n_1 s_i}{n_2 s_o}$$

in which the object is placed in the medium with index of refraction n_1.

4. (*Hecht, 5.40*) Two positive lenses are to be used as a laserbeam expander. An axial 1.0-mm diameter beam enters a short focal length positive lens, which is followed by a somewhat longer focal length positive lens from which it emerges with a diameter of 8.0 mm. Given that the first lens has a 50.0 mm focal length, determine the focal length of the second lens and the separation between the lenses. Draw a diagram.