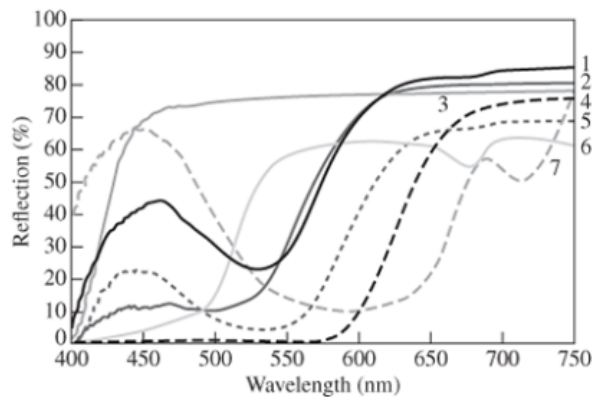


Homework 4

1. 4.98 from Hecht

4.98* The graphs in **Fig. P.4.98** are the reflection spectra for several roses seen in white light. The flowers were white, yellow, light pink, dark pink, blue, orange, and red. Associate each graph with a specific color.

Figure P.4.98



(Dr. Gottipaty N. Rao and Brian Capozzi, Adelphi University.)

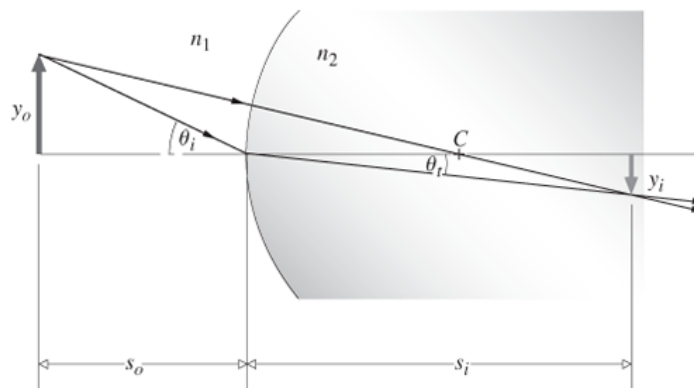
- Using the index of refraction, explain why silver is a good reflector for visible light but glass is not. (Note that the index of refraction of silver is given in problem 4.95.)
- 5.6 from Hecht:

- 5.6* Show that, in the paraxial domain, the magnification produced by a single spherical interface between two continuous media, as shown in **Fig. P.5.6**, is given by

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

Use the small-angle approximation for Snell's Law and approximate the angles by their tangents.

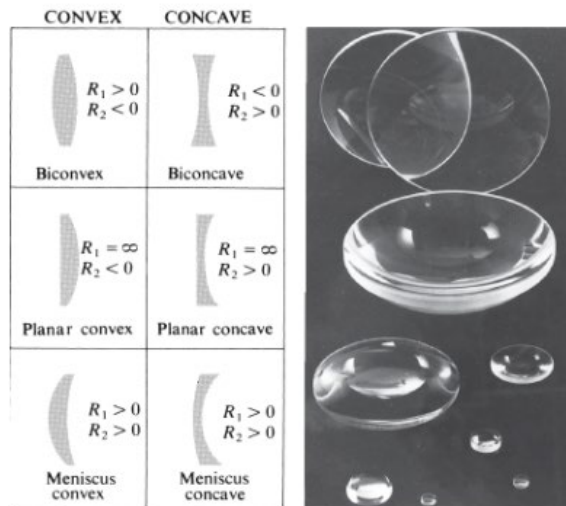
Figure P.5.6



4. 5.10 from Hecht
- 5.10* A biconvex glass ($n_l = 1.5$) thin lens is to have a $+10.0$ cm focal length. If the radius of curvature of each surface is measured to be the same, what must it be? Show that a spider standing 1.0 cm from the lens will be imaged at -1.1 cm. Describe that image and draw a ray diagram.
5. 5.12 from Hecht
- 5.12* A meniscus concave glass ($n_l = 1.5$) thin lens (see [Fig. 5.12](#)) has radii of curvature of $+20.0$ cm and $+10.0$ cm. If an object is placed 20.0 cm in front of the lens, show that the image distance will be -13.3 cm. Describe that image and draw a ray diagram.

Figure 5.12

Cross sections of various centered spherical simple lenses. The surface on the left is $\neq 1$, since it is encountered first. Its radius is R_1 .



(Melles Griot)

6. 5.32 from Hecht

5.32* A candle that is 6.00 cm tall is standing 10 cm from a thin concave lens whose focal length is -30 cm. Determine the location of the image and describe it in detail. Draw an appropriate ray diagram.

7. (E.C.) 5.37 from Hecht

5.37* A thin, straight piece of wire 4.00 mm long is located in a plane perpendicular to the optical axis and 60.0 cm in front of a thin lens. The sharp image of the wire formed on a screen is 2.00 mm long. What is the focal length of the lens? When the screen is moved farther from the lens by 10.0 mm, the image blurs to a width of 0.80 mm. What is the diameter of the lens? [Hint: Image a source point on the axis.]

Note: For problems asking for a ray diagram (5.10, 5.12, and 5.32), please draw at least 2 principal rays. Remember that a principal ray either goes through the lens vertex or is, at some point, parallel to the optical axis.