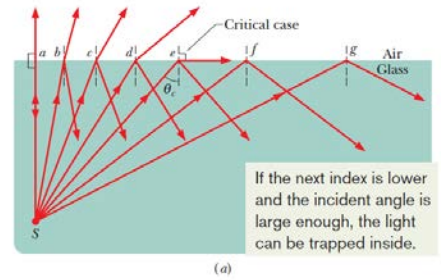# Chapter 25
Example Problems

1. The drawing shows a system of three polarizing sheets in the path of initially unpolarized light. The polarizing direction of the first sheet is parallel to the y-axis, that of the second sheet is at angle of 60° counterclockwise from the y-axis, and that of the third sheet is parallel to the x-axis. What fraction of the initial intensity I_0 emerges from the three sheet system?

Light is sent through this system of three polarizing sheets.

The sheet's polarization axis is vertical.

(a)
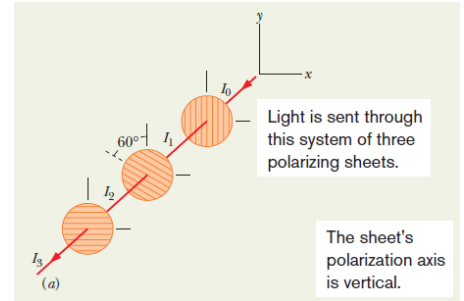
2. A beam of monochromatic, all colors of a single hue (like red, blue, or green), light reflects and refracts at point A on the interface between material 1 with index of refraction 1.33 and material 2 with index of refraction 1.77. The incident beam makes an angle of 50° with the interface. What is the angle of reflection and refraction at point A?
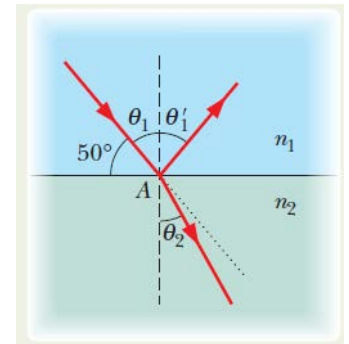
3. A point source of light is 80.0 cm below the surface of a body of water. Find the diameter of the circle at the surface through which light emerges from the water. Note that n_{water} = 1.33.

Critical case

Air
Glass

If the next index is lower and the incident angle is large enough, the light can be trapped inside.

(a)

4. A tarantula of height h sits cautiously before a spherical mirror whose focal length has absolute value of 40 cm. The image of the tarantula produced by the mirror has the same orientation as the tarantula and has height h' = 0.20h. Is the mirror concave or convex, and what is its focal length, sign included?

5. An object is moved along the central axis of a spherical mirror while the lateral magnification m of it is measured. The figure below gives m versus object distance p for the range p_a = 2.0 cm to p_b = 8.0 cm. What is m for p = 14.0 cm?
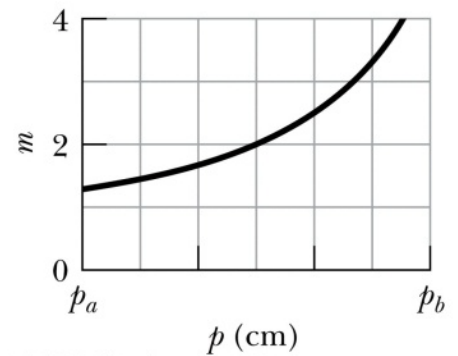
6. A Jurassic mosquito is discovered embedded in a chunk of amber, which has index of refraction 1.6. One surface of the amber is spherically convex with radius of curvature 3.0 mm. The mosquito's head happens to be on the central axis of the surface and, when viewed along the axis, appears to be buried 5.0 mm into the amber. How deep is it really?
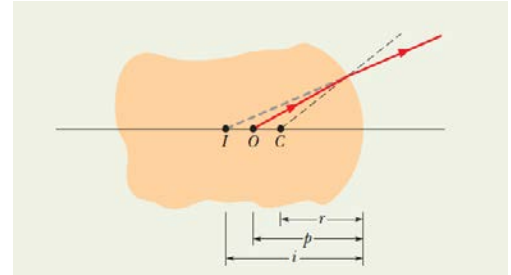
7. A praying mantis preys along the central axis of a thin symmetric lens, 20 cm from the lens. The lateral magnification of the mantis provided by the lens is m = -0.25, and the index of refraction of the lens material is 1.65. Determine the type of image produced by the lens, the type of lens, whether the object is inside or outside the focal point, on which side of the lens the image appears, and whether the image is inverted.