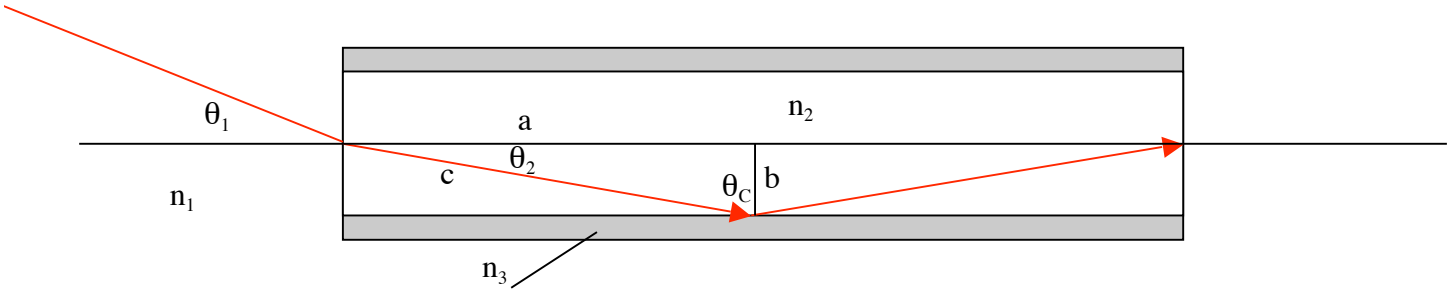
Homework problems for Chapter 35 (due Nov 30):

Chapter 35: 2,15,18,29,30,41 and S1, S2

And special problems:
S1:
A swimmer at the bottom of a pool 3 m deep looks up and sees a circle of light. If the index of refraction of the water in the pool is 1.33, find the radius of the circle.

S2:
An optical fiber consists of a core material with refractive index n_2 and radius b, surrounded by a cladding material of index $n_3 < n_2$.



a) The numerical aperture of the optical fiber is defined as $\sin(\theta_1)$ where θ_1 is is the angle of incidence of the ray of light impinging the end of the fiber that reflects of the core-cladding interface at the critical angle. Using the figure as a guide, show that the numerical aperture is given by $\sqrt{n_2^2 - n_3^2}$ assuming that the ray is incident from air. (Hint: Use of the Pythagorean theorem may be useful)

b) What is the maximum angle of incidence of light at which the fiber still works and total internal reflection still occurs for the following case: $n_2 = 1.5$ and $n_3 = 1.2$ and n_1(air)=1 and b = 65μm.