Homework 2A

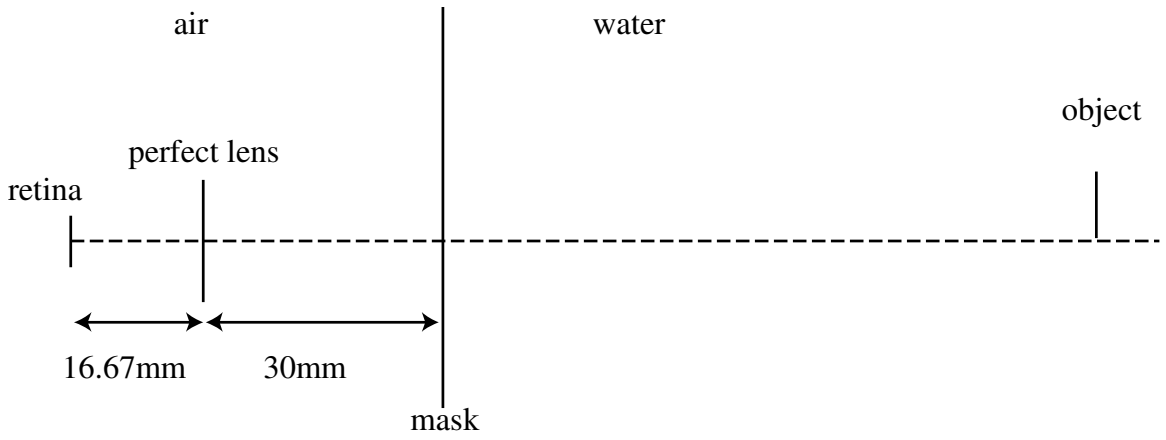

Figure 1

I was told that the apparent object location and size change when you are using a mask underwater. Use a refractive index of n_{water}=1.33 for the water. Use ABCD matrices and a program like Matlab. See Figure 1.

1. Calculate the difference in magnification if the object is located between 0.1m and 10m away from the mask. Start with an arbitrary vector $\begin{bmatrix} 1 \\ \theta \end{bmatrix}$ at the object. Vary the distance between the mask and the object and calculate the required focal length to produce an output ray that is independent of θ. Use this value of the focal length to compute the ray height. Do this calculation in water and air. The relative change in size is given by $\left(\frac{h_{water} - h_{air}}{h_{air}} \right) \times 100$. Plot this calculation for distances between the mask and object of 0.1m to 10m.
2. Calculate the difference in the relative position. This is accomplished by starting with an arbitrary vector $\begin{bmatrix} 1 \\ \theta \end{bmatrix}$ at the retina. Vary the lens power and calculate the required distance between the lens and the object that is independent of θ. Do this calculation in water and air. The position change is given by $\left(\frac{d_{water} - d_{air}}{d_{air}} \right) \times 100$. Plot this calculation for lens power that range from 60D to 75D (an accommodation of 15D).
3. If a person has an accommodation of 10D, calculate the near and far points in air and water. This is accomplished by finding the distance with a lens power of 60D and 70D. This should just be ready off of the plot produced in part 1.