PHYS 5041 Homework #8

Due Monday, Nov. 21

1) Hecht 7.45
2) 8.18
3) 8.22

Practical problems – Due Wednesday, Nov. 23

X.5 Determine the radius of curvature of the mirrors used in the floating frog illusion. Draw a convincing ray diagram for how the image is created and explain whether it is a real or virtual image.

Make use of the parts on the Pasco optics bench and associated “advanced optics parts kit” in MWAH 343 for the following 2 practical problems.

X.6 (a) Use the Pasco photometer with the fiber optic input to measure the laser beam intensity profile, $I(x)$, by stepping the fiber optic across the beam path with the linear translator attachment. Plot the profile. (b) Build a beam expander for the laser along the lines of problem 5.40, but use lenses available from the limited assortment of mounted lenses in the kit. Based on your design/choice of lenses, by what factor should the beam diameter be increased? Measure the profile of the expanded beam and compare to the original beam profile.

X.7 (a) Measure the intensity of unpolarized light before a linear polarizer and after. Add a second polarizer with the same orientation and measure the intensity of the light after the second polarizer. Apart from losses due to the polarizing action, some extra absorption occurs in each polarizer. From your measurements estimate what fraction, $f$, of incident light is lost to this additional absorption.

(b) Rotate the 2nd polarizer through a series of angles, $0<\theta<90$, relative to the first polarizer. Plot $I(\theta)$ and compare to the prediction of Malus’s Law $I(\theta) = I(0) \cos^2(\theta)$. You can use the fiber optic and Pasco photometer or the Vernier light sensor and Logger Pro for these polarizer measurements.