Workshop module 10 - Physics 114, Spring 2010

1. You hold two thin, converging lenses. One is thicker in the middle than the other. Which has the longer focal length? Explain.

2. Two thin lenses with a focal length of magnitude 10.0 cm, the first converging and the second diverging, are placed 8.0 cm apart. An object 2.00 mm tall is placed 18.0 cm to the left of the first (converging) lens. A) How far from this first lens is the final image formed? B) Is the final image real or virtual? C) Is the final image erect or inverted? What is the height of the image?

3. When a converging lens is immersed in water, does its focal length increase or decrease in comparison with the value in air? Explain and make a drawing showing how the angles of the rays at the interfaces vary in the two cases.

4. If you have normal vision, you can't see clearly underwater without a mask or goggles. Why is this? Why can you see clearly with a mask or goggles? Instead of goggles, could you just wear eyeglasses? If so, should the lenses of the eyeglasses be converging or diverging?

5. Where is the near point of an eye for which a contact lens with a power of +2.75 diopter is prescribed?

6. The focal length of the eyepiece of a certain microscope is 2.50 cm. The focal length of the objective is 16.0 mm. The distance between objective and eyepiece is 22.6 cm. The final image formed by the eyepiece is at infinity. Treat all lenses as thin. a) What is the distance from the objective to the object being viewed? B) What is the magnitude of the linear magnification produced by the objective? C) What is the overall magnification of the microscope?

7. A two-slit interference experiment is set up, and the fringes are displayed on a screen. Then the whole apparatus is immersed in a swimming pool. How does the fringe pattern change?

8. Monochromatic light is directed at normal incidence on a thin film. There is destructive interference for the reflected light, so its intensity is very low. What happened to the energy of the incident light? How does this relate to the need for coatings on a camera lens?

9. The human ear is especially sensitive to sounds at frequencies around 3500 Hz. Show that this can be understood by regarding the ear's auditory canal, which extends about 2.5 cm from the outside ear to the eardrum, as a "nonreflecting coating" for sound. … waves is waves! Ain't this cool?

10. A plane transmission grating has 4000 slits/cm. Assume normal incidence. The α and δ lines emitted by atomic hydrogen have wavelengths 656 nm and 410 nm, respectively. Compute the angular separation in degrees between these lines in a) the first order spectrum and b) the second order spectrum.