Assignment VIII, HONS 158 (Honors Physics II)
Spring 2016
Due 3/23/16 at start of class

As always, please put your answers on separate paper.

1. What is the frequency of green light (in air), assuming that green light has a wavelength of 550 nm?
2. In Charleston, Public Radio broadcasts at a frequency of 89.3 MHz. What is the wavelength of this broadcast?
3. The frequency of light doesn't change when light moves into media with different indicies of refraction. Given that information, what would the wavelength of 675 nm red light be inside a diamond?
4. An object with a height of 46 cm is placed 2.4 m in front of a concave mirror with a focal length of 0.50 m.
   a) Determine the approximate location and size of the image using a ray diagram.
   b) Is the image upright or inverted?
   c) Now use the mirror equation to determine the exact height of the image.
5. A shaving mirror often produces upright images that are magnified. If you have a shaving mirror that magnifies your image by a factor of 2.2 when your face is 25 cm from the mirror, what is the mirror's *radius of curvature*?
6. Telescopes try to contain mirrors as large as possible. The Hale telescope on Mount Palomar has one that is 200 inches in diameter. This concave mirror has a focal length of 16.9 m. An astronomer stands 20.0 m in front of this mirror.
   a) How far *from the astronomer* is her image located?
   b) Is the astronomer's image on the same side of the mirror as the astronomer?
   c) Is the astronomer's image real or virtual?
   d) What is the magnification of the astronomer's image?
7. When an object is placed a distance $d_\circ$ in front of a curved mirror, the resulting image has a magnification m. Find an expression for the focal length of the mirror f in terms of $d_\circ$ and m *only*.
8. Two colors (we'll call them "A" and "B") are sent through a prism. Color A is bent more than color B. Which color travels more rapidly in the prism? Explain.
9. Light is refracted as it travels from point "A" in medium 1 to point "B" in medium 2. If the index of refraction is 1.33 in medium 1 and 1.51 in medium 2, how long does it take the light to go from A to B assuming that it travels 3.31 m in medium 1 and 1.97 m in medium 2?

10. An object is a distance $f/2$ from a convex lens.

    a) Use a ray diagram to find the approximate location from the image.

    b) Is the image upright or inverted?

    c) Is the image real or virtual? Explain.

11. A diverging lens has a focal length of -32 cm. Find the image distance and magnification that result when an object is placed 29 cm in front of the lens.

12. An object and a screen are placed exactly 2.0 meters apart.

    a) Between the object and the screen, you place a converging lens with focal length 0.4 m. There are two (and only two) places you can place this lens and end up with a clear image on the screen. Where are they? (Give me the distance from the object to the lens).

    b) The two positions calculated in part (a) above give different magnifications. Which position would you put the lens at so that the final image is as large as possible?

13. A converging lens of focal length 8.000 cm is 20.0 cm to the left of a diverging lens that has a focal length -6.00 cm. A coin is placed 12.0 cm to the left of the converging lens.

    a) Find the location of the coin's final image. (Make sure your answer is descriptive enough to be unambiguous about the position).

    b) Find the magnification of the coin's final image.

14. A simple camera telephoto lens consists of two separate lenses. The objective (first) lens has a focal length $f_1 = +39.0$ cm. Exactly 36.0 cm behind this first lens is a concave lens with a focal length $f_2 = -10.0$ cm. The object to be photographed is 4.00 m in front of the objective lens.

    a) How far behind the concave lens should the film be placed?

    b) What is the total magnification of this lens combination?