Homework Problems V

1. An optometrist finds that a far sighted person has a near point at 125 cm. What power will be required for contact lenses if they are effectively to move that inward to a more workable distance of 25 cm so that a book could be read comfortably? Use the fact that if the object is imaged at the near point, it can be seen clearly.

2. In the microscope the objective lens (L₁) forms a magnified image. Then a magnifier configuration consisting of two lenses (L₁ and L₃, the latter being the eye) is applied and forms a real, final image on the retina.

   a. Find the final image location for an object S₀₁ of 2.5 cm, f₁ = 2 cm, f₂ = 6 cm, and f₃ = 2 cm. Assume the distance between the first lens and the second lens is 16 cm and the distance between the second and third lens is 1 cm. Calculate S₁₁, S₁₂, and S₁₃, and make a sketch (ray diagram).

   b. Find the total magnification.

3. The telescope is similar to the microscope. But the objective lens forms a real image from a far away object. This object is looked at with a magnifier configuration. Assume that for the magnifier configuration, the image of this object is at $-\infty$.

   a. For f₁ = 30 cm, f₂ = 6 cm, f₃ = 2 cm, d₂₃ = 2 cm, s₀₁ = $-\infty$, and S₂ = $-\infty$, calculate S₁₁, S₀₂, and S₁₃, and make a sketch. (ray diagram).

   b. What is the distance between lenses 1 and 2?

   c. The angular magnification is defined as $M_\alpha = f₁ / f₂$. Calculate the value for $M_\alpha$.

4. The diameter of the moon is 3.5 x10³ km and its distance from earth is 3.8 x 10⁵ km. Find the angular diameter of the image of the moon formed by a telescope if the focal length of the objective is 4 m and the eyepiece 10 cm.