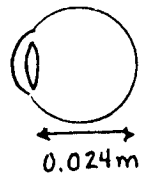
Additional Exercises

A-1: A photocopy machine is set to reduce the size of printed material by 50%. When the print is regular size, both the image and object distance are 16.0 cm. If the lens is then moved 24.0 cm from the object, how large is the new image distance?

A-2: The average normal human eye forms an image on the retina at a distance of about 0.0240 m from the lens, as shown. How much must the focal length of the lens change in order to accommodate an object moved from 10.0 m to 0.250 m? (This change in focal length is accomplished by small muscles in the eye called *cilliary muscles.* These muscles actually stretch and relax the lens.)



A-3: Lisa is posing for her senior class picture and sits 2.00 m from the camera lens whose focal length is 17.0 cm. The camera lens is positioned 21.0 cm in front of the film. Will the photographer obtain a clear image of Lisa? If not, by how much must the camera lens be moved in our out?

A-4: Cindy is lying on the beach focusing her camera on a friend standing 5.00 m away. Her camera has a focal length of 5.00 cm. a) Where must Cindy position the camera lens relative to the film for the sharpest focus? b) What type of lens must her camera have, and why?

A-5: Sherlock Holmes discovers some telltale hairs at the scene of a crime. He views the hairs with his magnifying glass from a distance of 6.0 cm. If the hairs are magnified 4.0 times, how far is the magnified image from the lens?

A-6: Jacob attaches a solar filter to his telescope and projects an image of the sun through the objective lens that has a focal length of 2.00 m. Jacob can't decide whether to use a 40.0-mm eyepiece or a 16.0-mm eyepiece to study the solar features. a) What amount of magnification will each eyepiece provide?
b) Someone may look through a telescope and ask, "What is the magnification of this instrument?" Why is it impossible to give one standard answer to the question? c) If the sun appears to be 1.00 cm across to the naked eye, how large will it appear when viewed with the 16.0-mm eyepiece?

A-7: To the naked eye, Jupiter appears to be about 0.10 cm in diameter. In a telescope whose objective lens has a focal length of 2.0 m, Jupiter appears to be 1.2 cm in diameter. What is the focal length of the eyepiece used to produce this image?

A-8: Ms. Chang is standing by the slide projector in the back of the room when she realizes that the screen is in the wrong location to get a clear image. a) If the projector has a lens with a focal length of 20.0 cm, and the slides sit 20.6 cm behind the lens, in which direction should one of the students move the screen that sits 7.00 m from the lens? b) How far away should the screen be from the projector lens?

A-9: Beverly wears bifocals. She can read close up when she looks through the bottom portion and can read far away when she looks through the top portion. a) The top of her glasses has a focal length of -0.25 m. What is the power, in diopters, of this part of the glasses? b) The bottom portion has a power of 3.5 diopters. What is the focal length of this part of the glasses?

A-10: In exercise A-9, if Beverly can see to infinity with her glasses on, a) what is the maximum distance she can see clearly with the glasses off? b) If Beverly can see an object at 25 cm with her glasses on, what is the minimum distance she can see clearly with the glasses off?

A-11: Rachel brings a note home from school. The note advises her mother that "Rachel is having a difficult time reading the words on the board and can only see the words if she is sitting closer than 2.0 m." If Rachel wants to be able to read the words from 3.0 m away, what power glasses does she need?

A-12: Joon puts on a pair of diffraction grating glasses that he bought in a novelty shop and looks at a mercury vapor street lamp that is 5.00 m away. He sees a yellow spectral line 1.16 m on either side of the light source. If the diffraction grating glasses have a slit separation of 2.49×10^{-6} m, what is the wavelength of the light Joon is observing?

A-13: Radio station WLLH has two transmitters that sit atop nearby hillsides broadcasting a wave that is 214 m long. As Kiesha drives down the interstate parallel to the two transmitters at a distance of 1000. m, she hears an increase in signal from the station every 30.0 m. How far apart are the two transmitters?

A1. 12.0 cm

A3. 2.4 cm

A5. 24 cm

A7. 0.17 m

A9. a) -4.0 diopters

b) 0.29 m

A11. -0.17 diopters

A13. 7130 m