3.3 EXERCISES

Instruments

Ex 3.3.1. A diverging lens has a focal length of 20 cm. What is the power of the lens in diopters? Ans: -5 D.

Ex 3.3.2. Two lenses of focal lengths f_1 and f_2 are glued together with transparent material of negligible thickness. Show that the total power of the two lenses simply add.

Ex 3.3.3. Generalize Ex 3.3.2 for N-lenses. Show an explicit proof.

Ex 3.3.4. What will be the angular magnification of a convex lens with the focal length 2.5 cm? Ans: 11.

Ex 3.3.5. What will be the formula for the angular magnification of a convex lens of focal length f if the eye is very close to the lens and the near point is located a distance D from the eye? Ans: $M = 1 + \frac{D}{f}$.

Ex 3.3.6. Find the angular magnification of an image by a magnifying glass of $f = 5.0$ cm if the object is placed $p = 4.0$ cm from the lens and the lens is close to the eye. Ans: 6.

Ex 3.3.7. Let objective and eyepiece of a compound microscope have focal lengths of 2.5 cm and 10 cm respectively and separated by 12 cm. A 70 μm object is placed 6.0 cm from the objective. How large is the virtual image formed by the objective/eyepiece system? Ans: 87 μm.

Ex 3.3.8. Draw rays to scale to locate the image at the retina if the eye lens has a focal length 2.5 cm and the near point is 24 cm. Hint: Place an object at the near point.

Ex 3.3.9. The objective and the eyepiece of a microscope have the focal lengths 3 cm and 10 cm respectively. The objective forms an image 5 cm from the objective. Decide about the distance between the objective and the eyepiece if we need a 10 $\times$ magnification from the objective/eyepiece compound system.