

11. (I) If the nearsighted person in Example 25–6 wore contact lenses corrected for the far point ($= \infty$), show that the near point would be 41 cm. (Would glasses be better in this case?)
12. (II) Reading glasses of what power are needed for a person whose near point is 115 cm, so that he can read a computer screen at 55 cm? Assume a lens–eye distance of 1.8 cm.
13. (II) A person has a far point of 14 cm. What power glasses would correct this vision if the glasses were placed 2.0 cm from the eye? What power contact lenses, placed on the eye, would the person need?
14. (II) A person struggles to read by holding a book at arm’s length, a distance of 45 cm away ($=$ near point). What power of reading glasses should be prescribed for him, assuming they will be placed 2.0 cm from the eye and he wants to read at the normal near point of 25 cm?
15. (II) A person’s left eye is corrected by a -3.50 -diopter lens, 2.0 cm from the eye. (a) Is this person’s left eye near- or farsighted? (b) What is this eye’s far point without glasses?
16. (II) A person’s right eye can see objects clearly only if they are between 25 cm and 75 cm away. (a) What power of contact lens is required so that objects far away are sharp? (b) What will be the near point with the lens in place?
17. (II) About how much longer is the nearsighted eye in Example 25–6 than the 2.0 cm of a normal eye?
18. (II) One lens of a nearsighted person’s eyeglasses has a focal length of -22.0 cm, and the lens is 1.8 cm from the eye. If the person switches to contact lenses that are placed directly on the eye, what should be the focal length of the corresponding contact lens?
19. (II) What is the focal length of the eye–lens system when viewing an object (a) at infinity, and (b) 33 cm from the eye? Assume that the lens–retina distance is 2.0 cm.
20. (III) A nearsighted person has near and far points of 10.0 and 20.0 cm, respectively. If she puts on contact lenses with power $P = -4.00$ D, what are her new near and far points?

25–3 Magnifying Glass

21. (I) What is the magnification of a lens used with a relaxed eye if its focal length is 12 cm?
22. (I) What is the focal length of a magnifying glass of $3.5\times$ magnification for a relaxed normal eye?
23. (I) A magnifier is rated at $2.5\times$ for a normal eye focusing on an image at the near point. (a) What is its focal length? (b) What is its focal length if the $2.5\times$ refers to a relaxed eye?
24. (II) Sherlock Holmes is using a 9.00-cm-focal-length lens as his magnifying glass. To obtain maximum magnification, where must the object be placed (assume a normal eye), and what will be the magnification?
25. (II) A 3.30-mm-wide beetle is viewed with a 9.50-cm-focal-length lens. A normal eye views the image at its near point. Calculate (a) the angular magnification, (b) the width of the image, and (c) the object distance from the lens.

26. (II) A small insect is placed 5.55 cm from a $+6.00$ -cm-focal-length lens. Calculate (a) the position of the image, and (b) the angular magnification.
27. (II) A magnifying glass with a focal length of 8.5 cm is used to read print placed at a distance of 7.5 cm. Calculate (a) the position of the image; (b) the angular magnification.
28. (III) A magnifying glass is rated at $3.0\times$ for a normal eye that is relaxed. What would be the magnification of this lens for a relaxed eye whose near point is (a) 55 cm, and (b) 16 cm? Explain the differences.

25–4 Telescopes

29. (I) What is the magnification of an astronomical telescope whose objective lens has a focal length of 76 cm and whose eyepiece has a focal length of 2.8 cm? What is the overall length of the telescope when adjusted for a relaxed eye?
30. (I) The overall magnification of an astronomical telescope is desired to be $25\times$. If an objective of 78-cm focal length is used, what must be the focal length of the eyepiece? What is the overall length of the telescope when adjusted for use by the relaxed eye?
31. (I) An $8.0\times$ binocular has 2.8-cm-focal-length eyepieces. What is the focal length of the objective lenses?
32. (II) An astronomical telescope has an objective with focal length 85 cm and a $+35$ -D eyepiece. What is the total magnification?
33. (II) An astronomical telescope has its two lenses spaced 75.2 cm apart. If the objective lens has a focal length of 74.5 cm, what is the magnification of this telescope? Assume a relaxed eye.
34. (II) A Galilean telescope adjusted for a relaxed eye is 32.8 cm long. If the objective lens has a focal length of 36.0 cm, what is the magnification?
35. (II) What is the magnifying power of an astronomical telescope using a reflecting mirror whose radius of curvature is 6.0 m and an eyepiece whose focal length is 3.2 cm?
36. (II) The Moon’s image appears to be magnified $120\times$ by a reflecting astronomical telescope with an eyepiece having a focal length of 3.2 cm. What are the focal length and radius of curvature of the main (objective) mirror?
37. (II) A $170\times$ astronomical telescope is adjusted for a relaxed eye when the two lenses are 1.25 m apart. What is the focal length of each lens?
38. (III) A reflecting telescope (Fig. 25–21b) has a radius of curvature of 3.0 m for its objective mirror and a radius of curvature of -1.50 m for its eyepiece mirror. If the distance between the two mirrors is 0.90 m, how far in front of the eyepiece should you place the photographic film to record the image of a star?

* 25–5 Microscope

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