## 25.1 The Human Eye*

**1.** **MC** The rods of the retina (a) are responsible for $20/20$ vision, (b) are responsible for black-and-white twilight vision, (c) are responsible for color vision, (d) focus light.

**2.** **MC** An imperfect cornea can cause (a) astigmatism, (b) nearsightedness, (c) farsightedness, (d) all of the preceding.

**3.** **MC** The image of an object formed on the retina is (a) inverted, (b) upright, (c) the same size as the object, (d) all of the preceding.

**4.** **MC** The focal length of the crystalline lens of the human eye varies with muscle action. When a distant object is viewed, the radius of the lens is (a) large, (b) small, (c) flat, (d) none of the preceding.

**5.** **CQ** People and other animals often exhibit "red eye" when photographed with a flash camera. Light reflected from the retina is red because of blood vessels near the surface. Some cameras have an anti-red-eye option, which, when activated, gives a quick flash before the longer picture-taking flash. Explain how this option reduces red eye.

**6.** **CQ** Which parts of the camera correspond to the iris, crystalline lens, and retina of the eye?

**12.** ●● A woman cannot see objects clearly when they are farther than 12.5 m away. (a) Does she have (1) nearsightedness, (2) farsightedness, or (3) astigmatism? Explain. (b) Which type of lens will allow her to see distant objects clearly, and of what power should the lens be?

## 25.2 Microscopes*

**26.** **MC** A magnifying glass (a) is a concave lens, (b) forms virtual images, (c) magnifies by effectively increasing the angle the object subtends, (d) both b and c.

**27.** **MC** A compound microscope has (a) unlimited magnification, (b) two lenses of the same focal length, (c) a diverging objective lens, (d) an objective of relatively short focal length.

**28.** **CQ** With an object at the focal point of a magnifying glass, the magnification is given by $m = (25\text{ cm})/f$ (Eq. 25.4). According to this equation, the magnification could be increased indefinitely by using lenses with shorter focal lengths. Why, then, do we need compound microscopes?

**32.** ● A biology student uses a converging lens to examine the details of a small insect. If the focal length of the lens is 12 cm, what is the maximum angular magnification?

## 25.3 Telescopes

**46.** **MC** An astronomical telescope has (a) unlimited magnification, (b) two lenses of the same focal length, (c) an objective of relatively long focal length, (d) an objective of relatively short focal length.

**47.** **MC** An inverted image is produced by (a) a terrestrial telescope, (b) an astronomical telescope, (c) a Galilean telescope, (d) all of the preceding.

**48.** **MC** Compared with large refracting telescopes, large reflecting telescopes have the advantage of (a) greater light-gathering capability, (b) freedom from chromatic aberration, (c) lower cost, (d) all of the preceding.

**49.** **CQ** In Fig. 25.12b, part of the light entering the concave mirror is obstructed by a small plane mirror that is used to redirect the rays to a viewer. Does this mean that only a portion of a star can be seen? How does the size of the obstruction affect the image?

**50.** **CQ** Why is chromatic aberration an important factor in refracting telescopes, but not in reflecting telescopes?

**51.** **CQ** If you are given two lenses with different focal lengths, which one should you use as the eyepiece for a telescope? Explain.

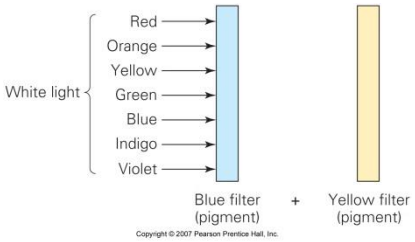
**53.** ● An astronomical telescope has an objective and an eyepiece whose focal lengths are 60 cm and 15 cm, respectively. What are the telescope's (a) magnifying power and (b) length?

## *25.5 Color

**78.** **MC** An additive primary color is (a) blue, (b) green, (c) red, (d) all of the preceding.

**79.** **MC** A subtractive primary color is (a) cyan, (b) yellow, (c) magenta, (d) all of the preceding.

**80.** **MC** White light is incident on two filters as shown in >Fig. 25.23. The color of light that emerges from the yellow filter is (a) blue, (b) yellow, (c) red, (d) green.




**81.** **CQ** Describe how the American flag would appear if it were illuminated with light of each of the primary colors.

**82.** **CQ** Can white be obtained by the subtractive method of color production? Explain. It is sometimes said that black is the absence of all color or that a black object absorbs all incident light. If so, why do we see black objects?

**83.** **CQ** Several beverages, such as root beer, develop a "head" of foam when poured into a glass. Why is the foam generally white or light colored, whereas the liquid is dark?

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* Assume that corrective lenses are in contact with the eye (contact lenses) unless otherwise stated.

* The normal near point should be taken as 25 cm unless otherwise specified.