9. Light with a vacuum wavelength of 500.0 nm passes into benzene, which has an index of refraction of 1.5. What is the wavelength of the light within the benzene?

A. 0.0013 nm
B. 0.0030 nm
C. 330 nm
D. 750 nm

10. Which of the following is *not* a necessary condition for seeing a magnified image with a lens?

F. The object and image are on the same side of the lens.
G. The lens must be converging.
H. The observer must be placed within the focal length of the lens.
J. The object must be placed within the focal length of the lens.

SHORT RESPONSE

11. In telescopes, at least two converging lenses are used: one for the objective and one for the eyepiece. These lenses must be positioned in such a way that the final image is virtual and very much enlarged. In terms of the focal points of the two lenses, how must the lenses be positioned?

12. A beam of light passes from the fused quartz of a bottle ($n = 1.46$) into the ethyl alcohol ($n = 1.36$) that is contained inside the bottle. If the beam of the light inside the quartz makes an angle of 25.0° with respect to the normal of both substances, at what angle to the normal will the light enter the alcohol?

13. A layer of glycerine ($n = 1.47$) covers a zircon slab ($n = 1.92$). At what angle to the normal must a beam of light pass through the zircon toward the glycerine so that the light undergoes total internal reflection?

EXTENDED RESPONSE

14. Explain how light passing through raindrops is reflected and dispersed so that a rainbow is produced. Include in your explanation why the lower band of the rainbow is violet and the outer band is red.

Use the ray diagram below to answer questions 15–18.

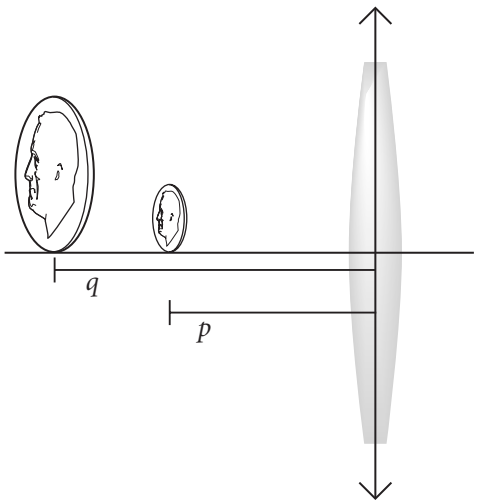
A collector wishes to observe a coin in detail and so places it 5.00 cm in front of a converging lens. An image forms 7.50 cm in front of the lens, as shown in the figure below.

15. What is the focal length of the lens?

16. What is the magnification of the coin's image?

17. If the coin has a diameter of 2.8 cm, what is the diameter of the coin's image?

18. Is the coin's image virtual or real? upright or inverted?



Test TIP When calculating the value of an angle by taking the arcsine of a quantity, recall that the quantity must be positive and no greater than 1.