Critical Thinking Items

16.1 Reflection 7.

Why are diverging mirrors often used for rear-view mirrors in vehicles? What is the main disadvantage of using such a mirror compared with a flat one?

a. It gives a wide range of view. The image appears to be closer than the actual object.
b. It gives a narrow range of view. The image appears to be farther than the actual object.
c. It gives a narrow range of view. The image appears to be closer than the actual object.
d. It gives a wide range of view. The image appears to be farther than the actual object.

16.2 Refraction 8.

A high-quality diamond may be quite clear and colorless, transmitting all visible wavelengths with little absorption. Explain how it can sparkle with flashes of brilliant color when illuminated by white light.

a. Diamond and air have a small difference in their refractive indices that results in a very small critical angle. The light that enters a diamond may exit at only a few points, and these points sparkle because many rays have been directed toward them.
b. Diamond and air have a small difference in their refractive indices that results in a very large critical angle. The light that enters a diamond may exit at only a few points, and these points sparkle because many rays have been directed toward them.
c. Diamond has a high index of refraction with respect to air, which results in a very small critical angle. The light that enters a diamond may exit at only a few points, and these points sparkle because many rays have been directed toward them.
d. Diamond has a high index of refraction with respect to air, which results in a very large critical angle. The light that enters a diamond may exit at only a few points, and these points sparkle because many rays have been directed toward them.

9.

The most common type of mirage is an illusion in which light from far-away objects is reflected by a pool of water that is not really there. Mirages are generally observed in deserts, where there is a hot layer of air near the ground. Given that the refractive index of air is less for air at higher temperatures, explain how mirages can be formed.

a. The hot layer of air near the ground is lighter than the cooler air above it, but the difference in refractive index is small, which results in a large

critical angle. The light rays coming from the horizon strike the hot air at large angles, so they are reflected as they would be from water.

b. The hot layer of air near the ground is lighter than the cooler air above it, and the difference in refractive index is large, which results in a large critical angle. The light rays coming from the horizon strike the hot air at large angles, so they are reflected as they would be from water.

c. The hot layer of air near the ground is lighter than the cooler air above it, but the difference in refractive index is small, which results in a small critical angle. The light rays coming from the horizon strike the hot air at large angles, so they are reflected as they would be from water.

d. The hot layer of air near the ground is lighter than the cooler air above it, and the difference in the refractive index is large, which results in a small critical angle. The light rays coming from the horizontal strike the hot air at large angles, so they are reflected as they would be from water.

16.3 Lenses 10.

When you focus a camera, you adjust the distance of the lens from the film. If the camera lens acts like a thin lens, why can it not be kept at a fixed distance from the film for both near and distant objects?

a. To focus on a distant object, you need to increase the image distance.

b. To focus on a distant object, you need to increase the focal length of the lens.

c. To focus on a distant object, you need to decrease the focal length of the lens.

d. To focus on a distant object, you may need to increase or decrease the focal length of the lens.

11.

Part A—How do the refractive indices of the cornea, aqueous humor, and the lens of the eye compare with the refractive index of air?

Part B—How do the comparisons in part A explain how images are focused on the retina?

a. (A) The cornea, aqueous humor, and lens of the eye have smaller refractive indices than air.
(B) Rays entering the eye are refracted away from the central axis, which causes them to meet at the focal point on the retina.

b. (A) The cornea, aqueous humor, and lens of the eye have greater refractive indices than air.
(B) Rays entering the eye are refracted away from the central axis, which causes them to meet at the focal point on the retina.

c. (A) The cornea, aqueous humor, and lens of the eye have smaller refractive indices than air.
(B) Rays entering the eye are refracted toward the central axis, which

causes them to meet at the focal point on the retina.

d. (A) The cornea, aqueous humor, and lens of the eye have greater refractive indices than air.
(B) Rays entering the eye are refracted toward the central axis, which causes them to meet at the focal point on the retina.