344. Malachite has two indices of refraction: $n_1 = 1.91$ and $n_2 = 1.66$. A ray of light in air enters malachite at an incident angle of 35.2°. Calculate both of the angles of refraction.

345. A ray of light in air enters a serpentine figurine ($n = 1.555$). If the angle of refraction is 33°, what is the angle of incidence?

346. The critical angle for light traveling from an aquamarine gemstone into air is 39.18°. What is the index of refraction for aquamarine?

347. A 15 cm tall object is placed 44 cm in front of a diverging lens. A virtual image appears 14 cm in front of the lens. What is the lens's focal length?

348. What is the image height in problem 347?

349. A lighthouse converging lens has a focal length of 4 m. What is the image distance for an object placed 4 m in front of the lens?

350. What is the magnification in problem 349?

351. Light moves from olivine ($n = 1.670$) into onyx. If the critical angle for olivine is 62.85°, what is the index of refraction for onyx?

352. When light in air enters an opal mounted on a ring, the light travels at a speed of 2.07×10^8 m/s. What is opal's index of refraction?

353. When light in air enters albite, it travels at a velocity of 1.95×10^8 m/s. What is albite's index of refraction?

354. A searchlight is constructed by placing a 500 W bulb 0.5 m in front of a converging lens. The focal length of the lens is 0.5 m. What is the image distance?

355. A microscope slide is placed in front of a converging lens with a focal length of 3.6 cm. The lens forms a real image of the slide 15.2 cm behind the lens. How far is the lens from the slide?

356. Where must an object be placed to form an image 12 cm in front of a diverging lens with a focal length of 44 cm?

357. The critical angle for light traveling from almandine garnet into air ranges from 33.1° to 35.3°. Calculate the range of almandine garnet's index of refraction.

358. Light moves from a clear andalusite ($n = 1.64$) crystal into ivory. If the critical angle for andalusite is 69.9°, what is the index of refraction for ivory?

Chapter 15 Interference and Diffraction

359. Light with a 587.5 nm wavelength passes through two slits. A second-order bright fringe forms 0.130° from the center. Find the slit separation.

360. Light passing through two slits with a separation of 8.04×10^{-6} m forms a third bright fringe 13.1° from the center. Find the wavelength.

361. Two slits are separated by 0.0220 cm. Find the angle at which a first-order bright fringe is observed for light with a wavelength of 527 nm.

362. For 546.1 nm light, the first-order maximum for a diffraction grating forms at 75.76°. How many lines per centimeter are on the grating?

363. Infrared light passes through a diffraction grating of 3600 lines/cm. The angle of the third-order maximum is 76.54°. What is the wavelength?

364. A diffraction grating with 1950 lines/cm is used to examine light with a wavelength of 497.3 nm. Find the angle of the first-order maximum.

365. At what angle does the second-order maximum in problem 364 appear?

366. Light passes through two slits separated by 3.92×10^{-6} m to form a second-order bright fringe at an angle of 13.1°. What is the light's wavelength?

367. Light with a wavelength of 430.8 nm shines on two slits that are 0.163 mm apart. What is the angle at which a second dark fringe is observed?

368. Light of wavelength 656.3 nm passes through two slits. The fourth-order dark fringe is 0.548° from the central maximum. Find the slit separation.

369. The first-order maximum for light with a wavelength of 447.1 nm is found at 40.25°. How many lines per centimeter does the grating have?

370. Light through a diffraction grating of 9550 lines/cm forms a second-order maximum at 54.58°. What is the wavelength of the light?

Chapter 16 Electric Forces and Fields

371. Charges of -5.3 μC and $+5.3$ μC are separated by 4.2 cm. Find the electric force between them.

372. A dog's fur is combed, and the comb gains a charge of 8.0 nC. Find the electric force between the fur and comb when they are 2.0 cm apart.

373. Two equal charges are separated by 6.5×10^{-11} m. If the magnitude of the electric force between the charges is 9.92×10^{-4} N, what is the value of q?