1. A two-slit Fraunhofer interference-diffraction pattern is observed using light that has a wavelength equal to 500 nm. The slits have a separation of 0.100 mm and an unknown width. (a) Find the width if the fifth interference maximum is at the same angle as the first diffraction minimum. (b) For this case, how many bright interference fringes will be seen in the central diffraction maximum?

2. Suppose that the central diffraction maximum for two slits has 17 interference fringes for some wavelength of light. How many interference fringes would you expect in the diffraction maximum adjacent to one side of the central diffraction maximum?

3. The colors of many butterfly wings and beetle carapaces are due to the effects of diffraction. The Morpho butterfly, for example, has structural elements on its wings that effectively act as a diffraction grating that has an 880-nm spacing. At what angle will the first diffraction maximum occur for normally incident light diffracted by the butterfly's wings? Assume the light is blue and has a wavelength of 440nm.

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4. The red light from a helium-neon laser has a wavelength of 632.8 nm in air. Given $n_{air} = 1.00$, $n_{H_2O} = 1.33$, and for this particular glass, $n_g = 1.50$.

   (a) Find the speed of this light in air, water, and glass.

   (b) Find the wavelength of this light in air, water, and glass.

   (c) Find the frequency of this light in air, water, and glass.

5. A slab of glass that has an index of refraction of 1.50 is submerged in water that has an index of refraction of 1.33. Light in the water is incident on the glass. Find the angle of refraction if the angle of incidence is 60°, 45°, and 30°. **Given:** $n_{air} = 1.00$**.**

6. A point source of light is located 5.0 m below the surface of a large pool of water. Find the area of the largest circle on the pool's surface through which light coming directly from the source can emerge. *Hint: Search for the angle of total internal reflection.* **Given: The index of refraction of the air is 1.00 and of the water is 1.33**.

7. When monochromatic ultraviolet light that has a wavelength equal to 300 nm is incident on a sample of potassium, the emitted electrons have a maximum kinetic energy of 2.03 eV. **Given:** $hc = 1240eV(nm)$.

   (a) What is the energy of an incident photon?

   (b) What is the work function for potassium?

   (c) What would be the maximum kinetic energy of the electrons if the incident electromagnetic radiation had a wavelength of 430 nm?

   (d) What is the maximum wavelength of incident electromagnetic radiation that will result in the photoelectric emission of electrons by a sample of potassium?

End of solutions