

## CHAPTER 19

1. Monochromatic light passes through two slits that are 0.0300 cm apart and it falls on a screen 120 cm away. The first-order image is 0.160 cm from the middle of the center band. What is the wavelength of the light used?
2. Green light passes through a double slit for which  $d = 0.20$  mm and it falls on a screen 2.00 m away. The first-order image is at 0.50 cm. What is the wavelength of the light?
3. Yellow light that has a wavelength of  $6.00 \times 10^2$  nm passes through two narrow slits that are 0.200 mm apart. An interference pattern is produced on a screen 180 cm away. What is the location of the first-order image?
4. Violet light that has a wavelength of  $4.00 \times 10^2$  nm passes through two slits that are 0.0100 cm apart. How far away must the screen be so the first-order image is at 0.300 cm?
5. Two radio transmitters are 25.0 m apart and each one sends out a radio wave with a wavelength of 10.0 m. The two radio towers act exactly like a double-slit source for light. How far from the central band is the first-order image if you are 15.0 km away? (Yes, this really happens. Radio stations can and do fade in and out as you cross the nodals and the antinodals.)
6. Monochromatic light passes through a single slit, 0.500 mm wide, and falls on a screen 1.0 m away. If the distance from the center of the pattern to the first band is 2.6 mm, what is the wavelength of the light?
7. Red light that has a wavelength of  $7.50 \times 10^2$  nm passes through a single slit that is 0.1350 mm wide. How far away from the screen must the slit be if the first dark band is 0.9000 cm away from the central bright band?
8. Microwaves with a wavelength of 3.5 cm pass through a single slit 0.85 cm wide and fall on a screen 91 cm away. What is the distance to the first-order band?
9. Radio waves that are emitted by two adjacent radio transmitters behave like light waves coming from a double slit. If two transmitters, 1500 m apart, each send out radio waves with a wavelength of 150 m, what is the diffraction angle?
10. What is the average distance between the lines of a diffraction grating if the number of lines per millimeter is 425?
11. A transmission grating with  $5.85 \times 10^3$  lines/cm is illuminated by monochromatic light that has a wavelength of 492 nm. What is the diffraction angle for the first-order image?
12. Monochromatic light illuminates a transmission grating having 5900 lines/cm. The diffraction angle for a first-order image is  $18.0^\circ$ . What is the wavelength of the light in nanometers?
13. A transmission grating,  $5.80 \times 10^3$  lines/cm, is illuminated by a monochromatic light source that has a wavelength of 495 nm. How far from the center line is the first-order image if the distance to the grating is 1.25 m?
14. A pinhole camera uses a 1.5-mm hole instead of a lens to form an image. What is the resolution of this camera for green light, 545-nm wavelength, if the film is 6.0 cm behind the pinhole?