19 Diffraction and Interference of Light

1. Green light of a certain wavelength is incident upon two slits separated by 2.10×10^{-5} m. A screen is placed 0.800 m from the slits. The distance from the central bright line to the first-order line is 19.9 mm. What is the wavelength of the light?

2. A double-slit grating must be calibrated before use. A laser diode emitting light of wavelength 668.2 nm is shined on the slits. On a screen placed 1.000 m away, the first-order line appears 34.3 mm from the central bright line. What is the distance between the slits of the grating?

3. Light from a He-Ne laser ($\lambda = 632.8$ nm) strikes a single slit and is diffracted. On a screen placed 0.850 m away, the first dark band appears at a distance of 10.6 mm from the central bright line. What is the width of the slit?

4. Monochromatic blue light of unknown wavelength shines on a slit that is 0.052 mm wide. On a screen placed 1.15 m from the slit, the first dark band appears at a distance of 10.1 mm from the central bright line. Calculate the wavelength of the light.

5. A spectrometer has a grating in which lines are 1.50×10^{-6} m apart. If monochromatic red light having wavelength of 668 nm is shined on the grating, at what angle will the first-order bright line appear?

6. A certain spectroscope uses a grating having 1.00×10^{4} lines/cm. What wavelength of light will produce a first-order bright line at an angle of 37.5° from the axis?

7. A certain spectroscope produces a first-order line at an angle of 42.9° when 668-nm light from a He-Ne laser is used. What is the distance between the lines of the grating?

8. Light from a hydrogen discharge tube is shined through a grating that has a line density of 8550 lines/cm. At what angles from the center axis would you expect to find the 486-nm and the 656-nm lines of the hydrogen emission spectrum?

9. Light from the strong yellow ($\lambda = 589$ nm) emission line of a sodium vapor lamp is shined through a diffraction grating that has a distance of 1.04×10^{-6} m between slits. A screen stands 1.20 m from the grating. At what distance from the center bright line will the first-order bright line appear?