

Homework # 8

Conceptual Questions

1. In Young's double-slit experiment, what happens to the spacing between the fringes if
 - (a) the slit separation is increased?
 - (b) the wavelength of the incident light is decreased?
 - (c) if the distance between the slits and the viewing screen is increased?
2. In Young's double-slit experiment, how would the interference pattern change if white light is used?
3. Explain why the light from the two headlights of a distant car does not produce an interference pattern.
4. What happens to the width of the central maximum in a single-slit diffraction if the slit width is increased?
5. In a single-slit diffraction, what happens to the intensity pattern if the slit width becomes narrower and narrower?
6. In calculating the intensity in double-slit interference, can we simply add the intensities from each of the two slits?
7. Conceptual question 22.4 (p. 693)

Exercises and problems Chapter 22; 22.30,
22.48, 22.68

8.1

In Young's double-slit experiment, suppose the separation between the two slits is $d=0.320$ mm. If a beam of 500-nm light strikes the slits and produces an interference pattern. How many maxima will there be in the angular range $-45.0^\circ < \theta < 45.0^\circ$?

8.2

In the double-slit interference experiment shown in Figure 14.2.3, suppose $d = 0.100$ mm and $L = 1.00$ m, and the incident light is monochromatic with a wavelength $\lambda=500$ nm.

(a) What is the phase difference between the two waves arriving at a point P on the screen when $\theta = 0.800^\circ$?

(b) What is the phase difference between the two waves arriving at a point P on the screen when $y = 4.00$ mm?

(c) If $\phi = 1/3$ rad, what is the value of θ ?

(d) If the path difference is $\delta = \lambda/4$, what is the value of θ ?

8.3

Coherent light rays of wavelength λ are illuminated on a pair of slits separated by distance d at an angle θ_1 , as shown in Figure 14.11.1.

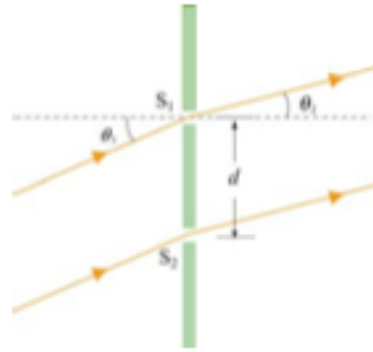


Figure 14.11.1

If an interference maximum is formed at an angle θ_2 at a screen far from the slits, find the relationship between θ_1 , θ_2 , d and λ .

8.4

Let the intensity on the screen at a point P in a double-slit interference pattern be 60.0% of the maximum value.

- What is the minimum phase difference (in radians) between sources?
- In (a), what is the corresponding path difference if the wavelength of the light is $\lambda = 500 \text{ nm}$?