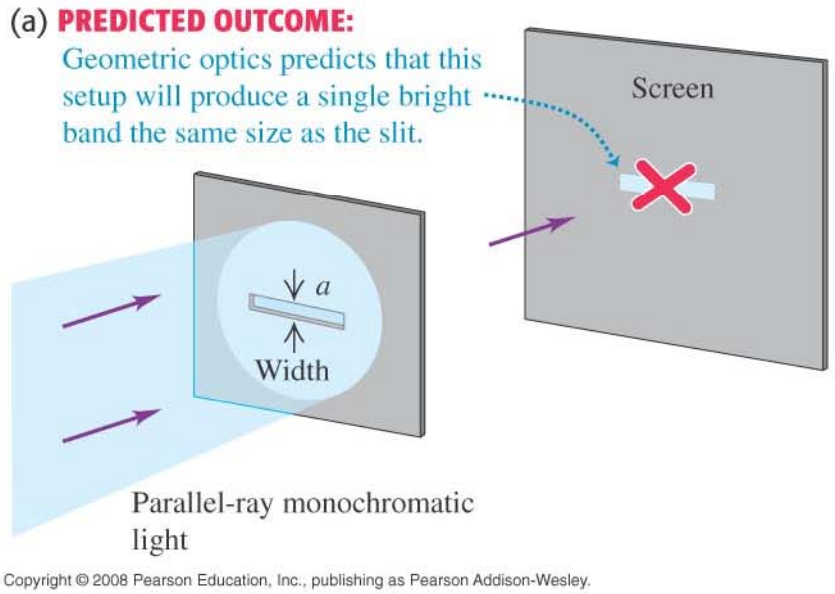
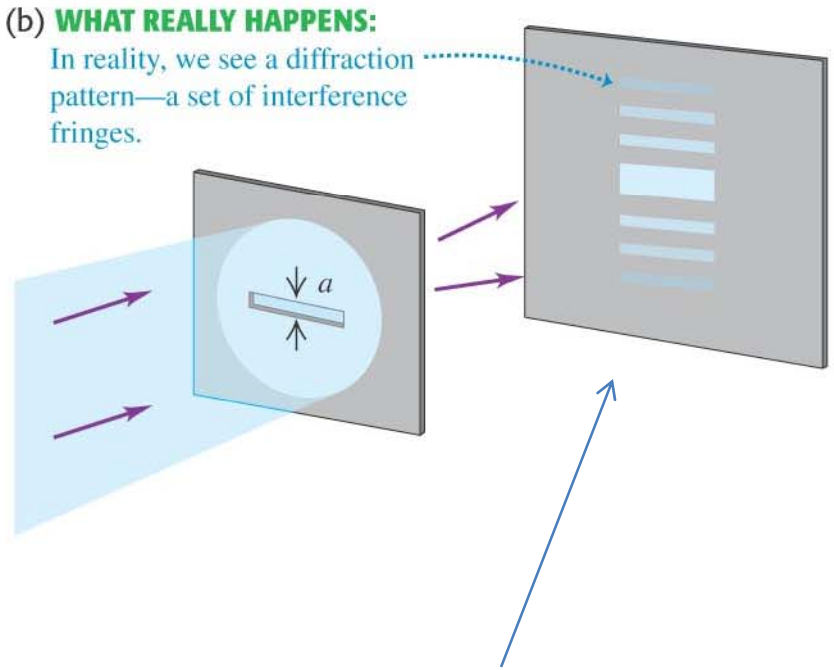
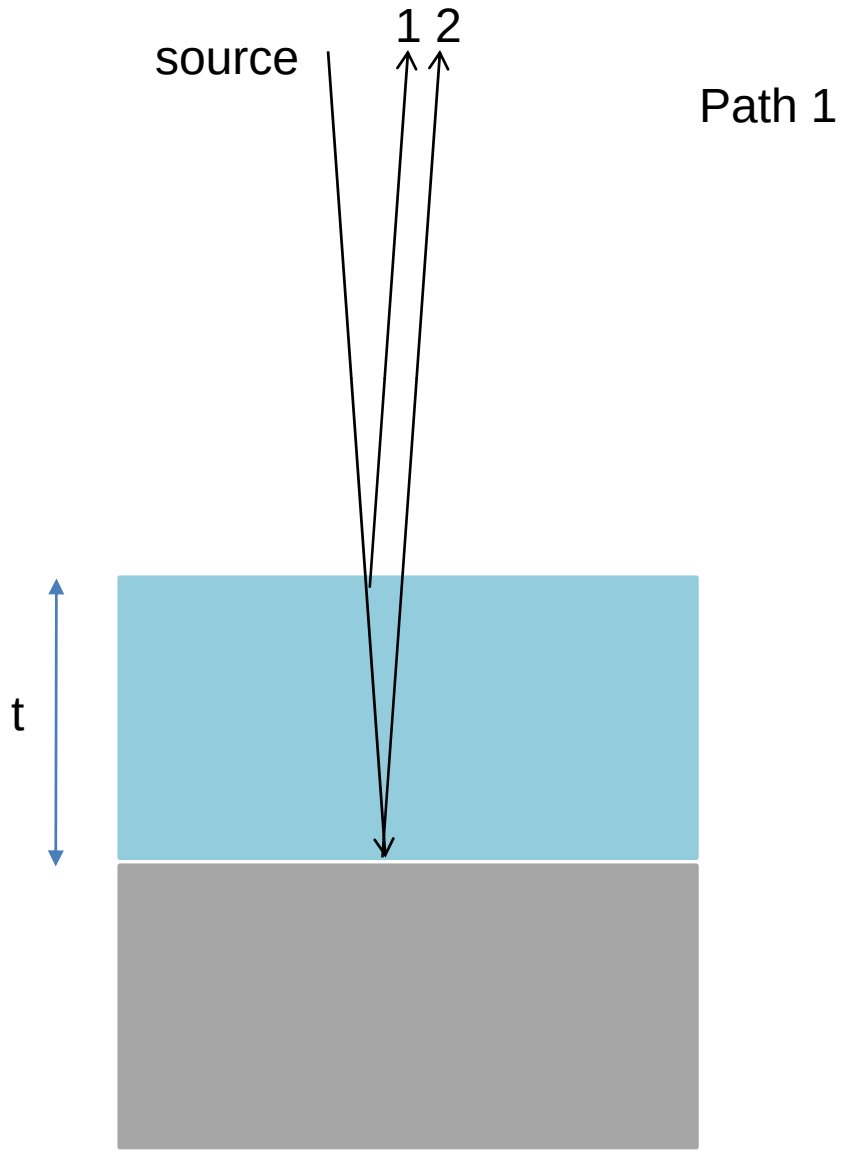
Puzzle

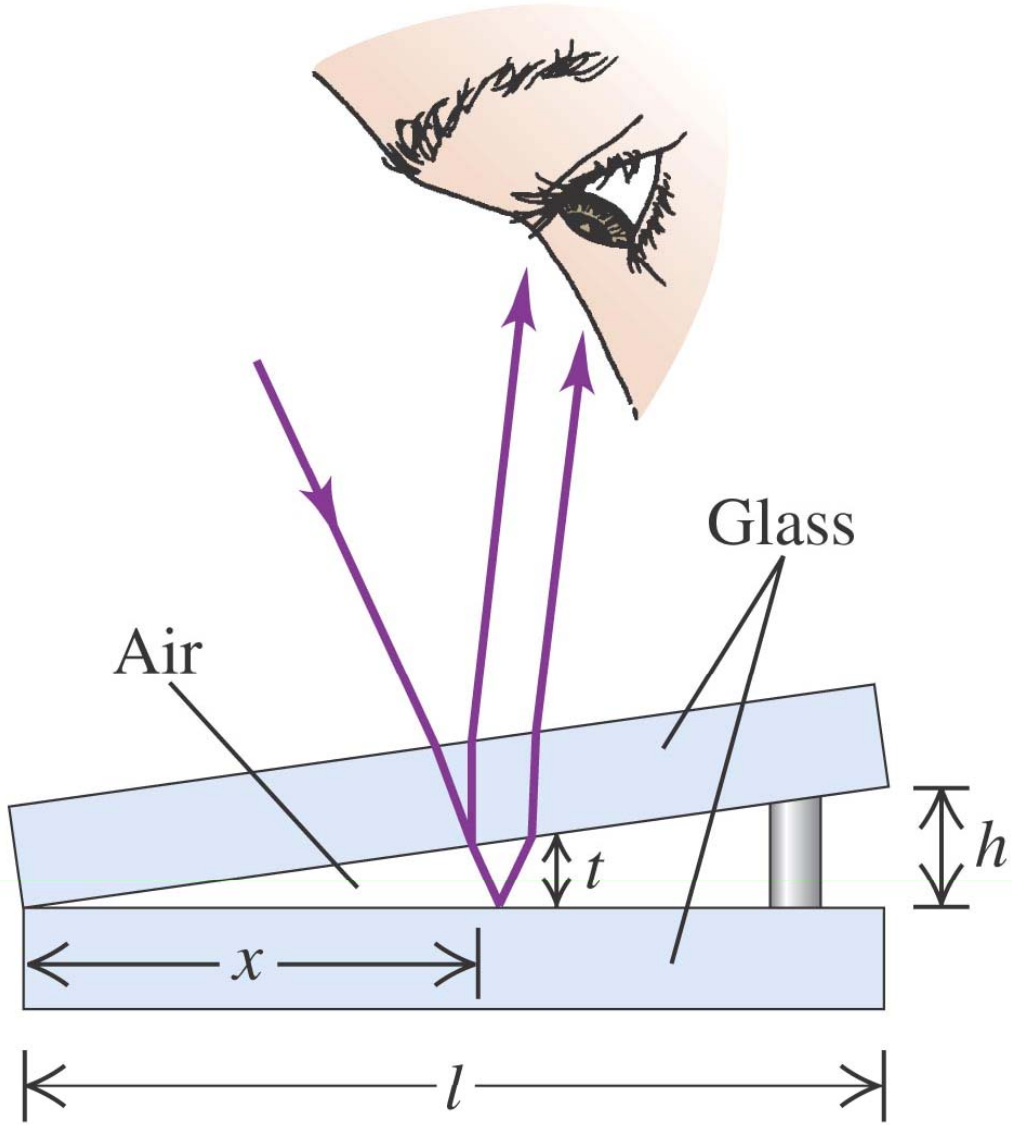




And, when the slit gets narrower, the central fringe gets WIDER

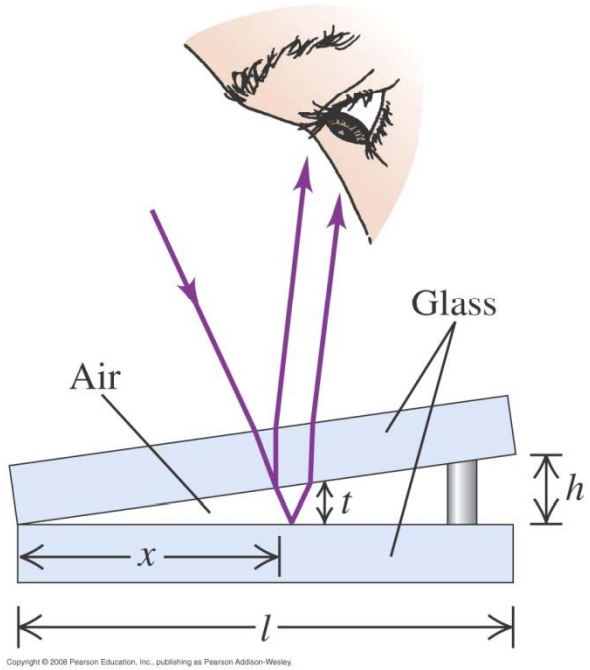
Thin film interference





Q35.6

An air wedge separates two glass plates as shown. Light of wavelength λ strikes the upper plate at normal incidence. At a point where the air wedge has thickness *t*, you will see a bright fringe if *t* equals



A. $\lambda/2$.

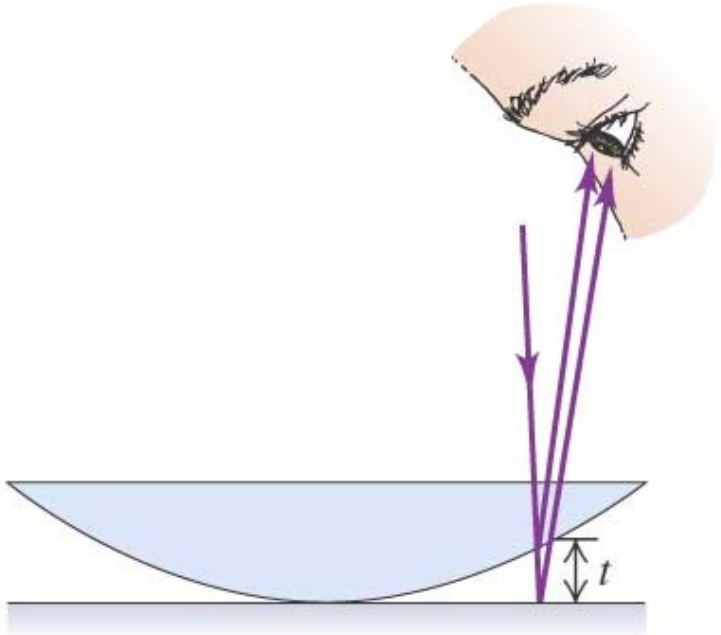
B. $3\lambda/4$.

C. λ.

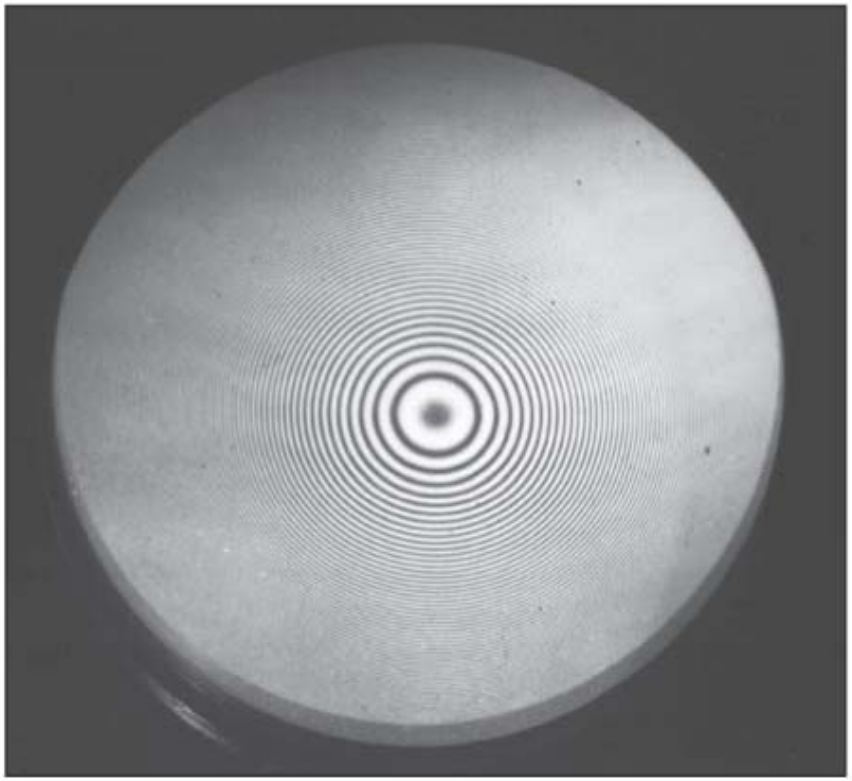
D. either A. or C.

E. any of A., B., or C.

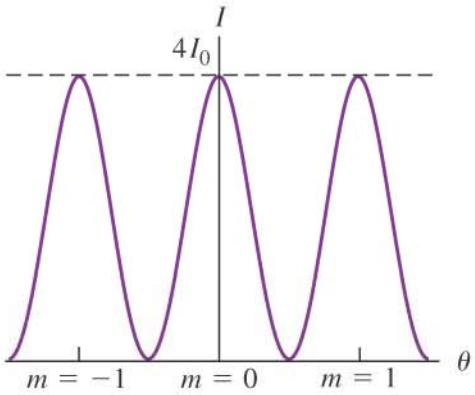
(a) A convex lens in contact with a glass plane



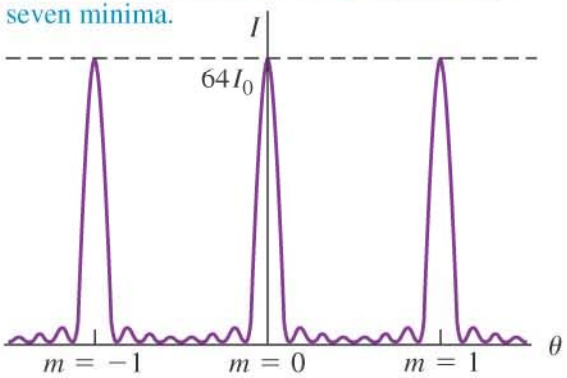
(b) Newton's rings: circular interference fringes



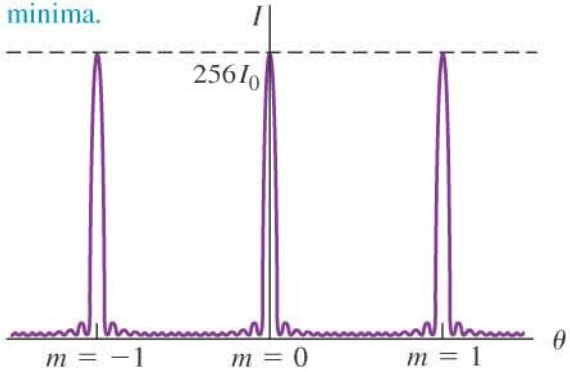
(a) $N = 2$: two slits produce one minimum between adjacent maxima.

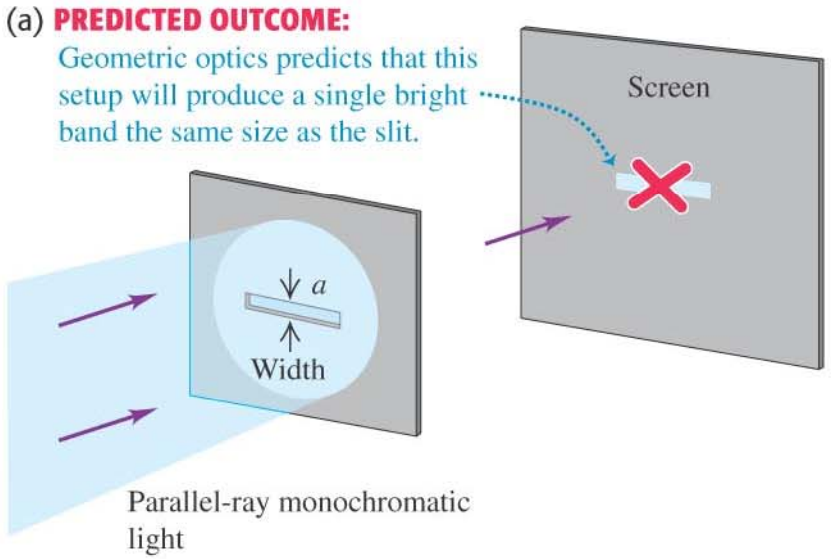


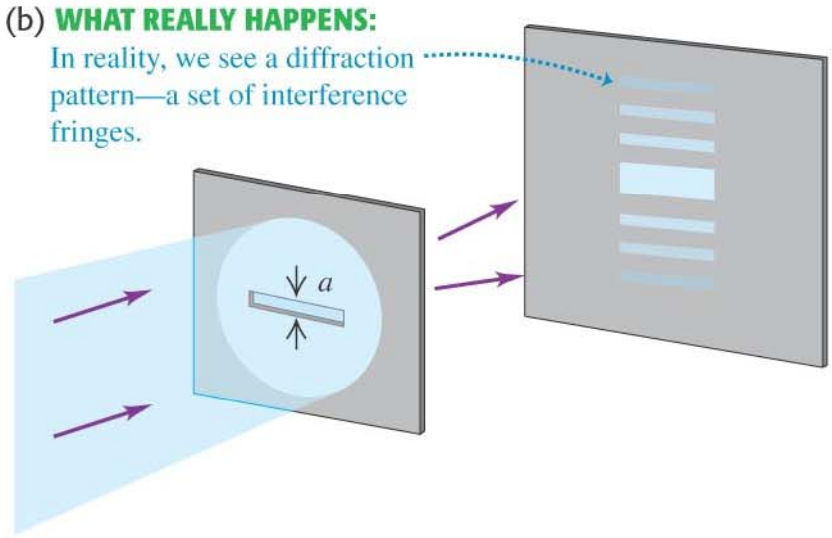
(b) $N = 8$: eight slits produce taller, narrower maxima in the same locations, separated by seven minima.



(c) $N = 16$: with 16 slits, the maxima are even taller and narrower, with more intervening minima.

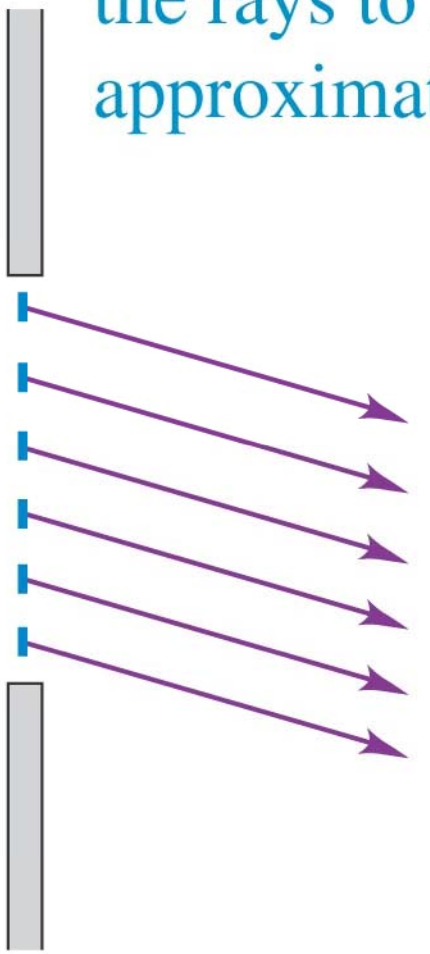


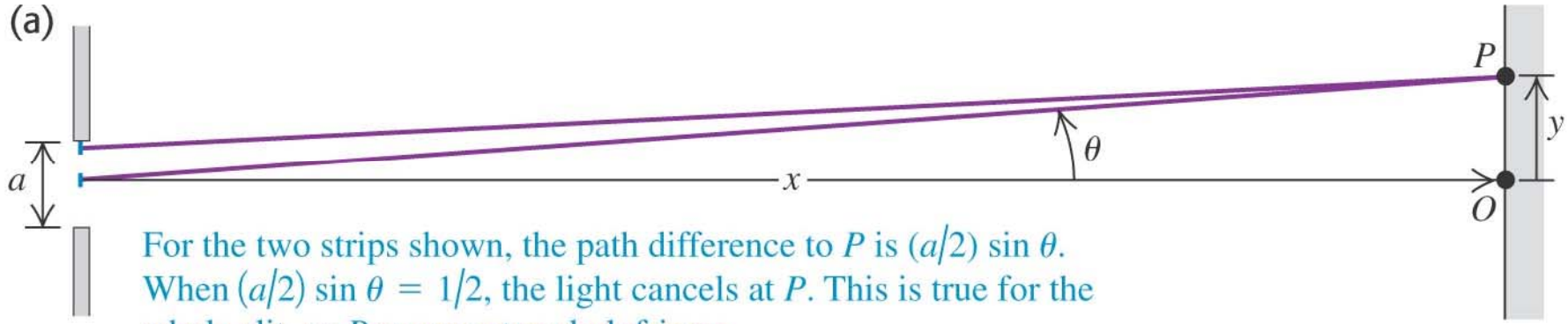




(c) Fraunhofer (far-field) diffraction

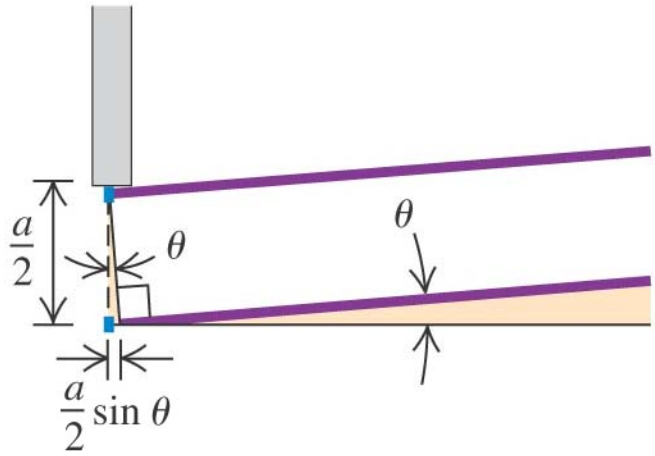
If the screen is distant, the rays to P are approximately parallel.





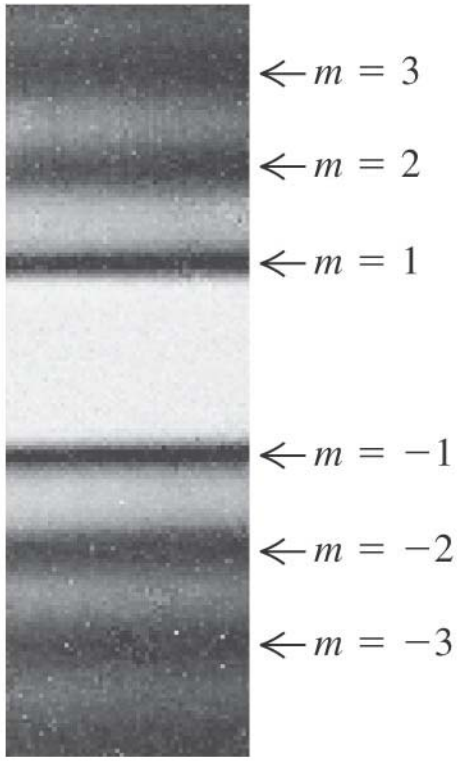
For the two strips shown, the path difference to P is $(a/2)\sin\theta$. When $(a/2)\sin\theta = 1/2$, the light cancels at P. This is true for the whole slit, so P represents a dark fringe.

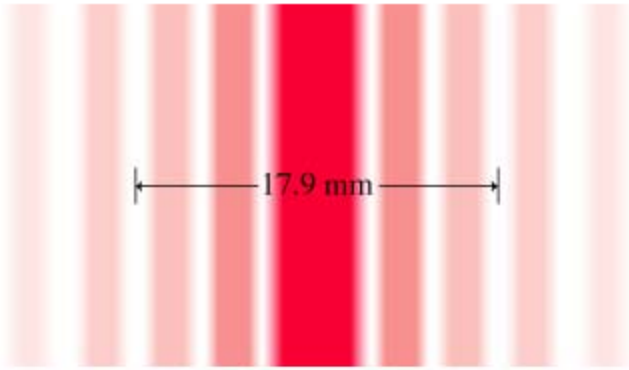
(b) Enlarged view of the top half of the slit



θ is usually very small, so we can use the approximations $\sin\theta = \theta$ and $\tan\theta = \theta$. Then the condition for a dark band is

$$y_m = x\,\frac{m\lambda}{a}$$





Q36.1

Light of wavelength λ passes through a single slit of width a. The diffraction pattern is observed on a screen that is very far from from the slit.

Which of the following will give the greatest *increase* in the angular width of the central diffraction maximum?

A. Double the slit width a and double the wavelength λ.

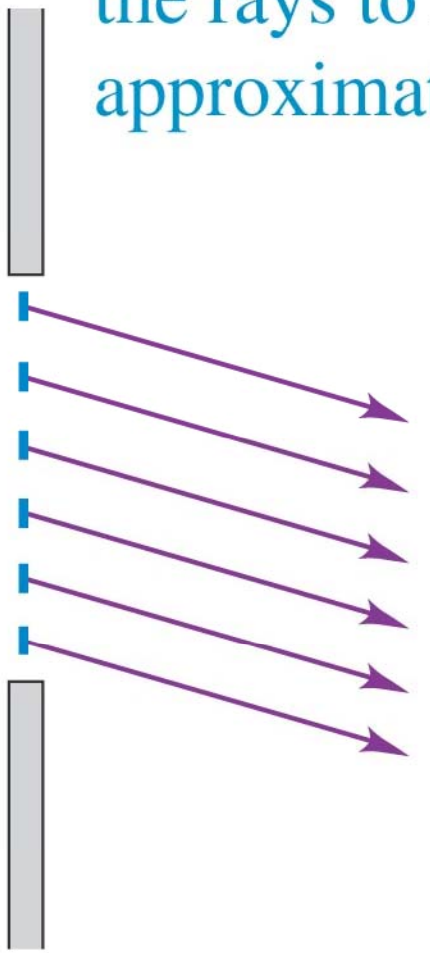
B. Double the slit width a and halve the wavelength λ.

C. Halve the slit width a and double the wavelength λ.

D. Halve the slit width a and halve the wavelength λ.

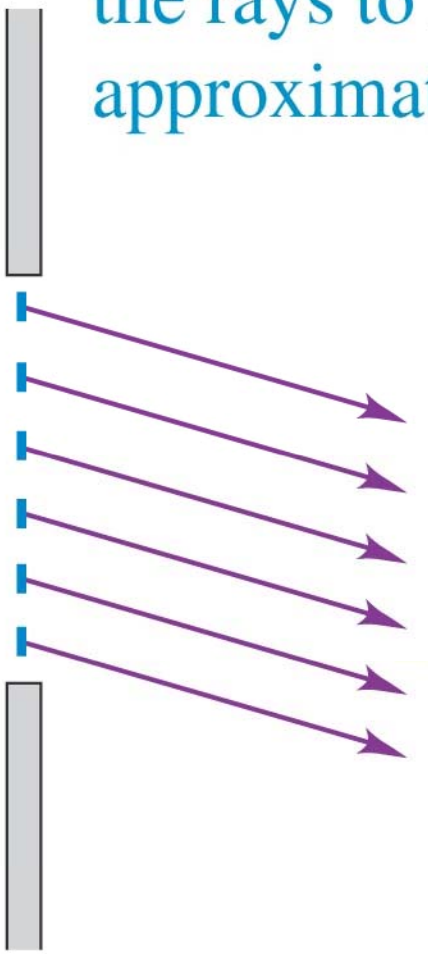
(c) Fraunhofer (far-field) diffraction

If the screen is distant, the rays to P are approximately parallel.



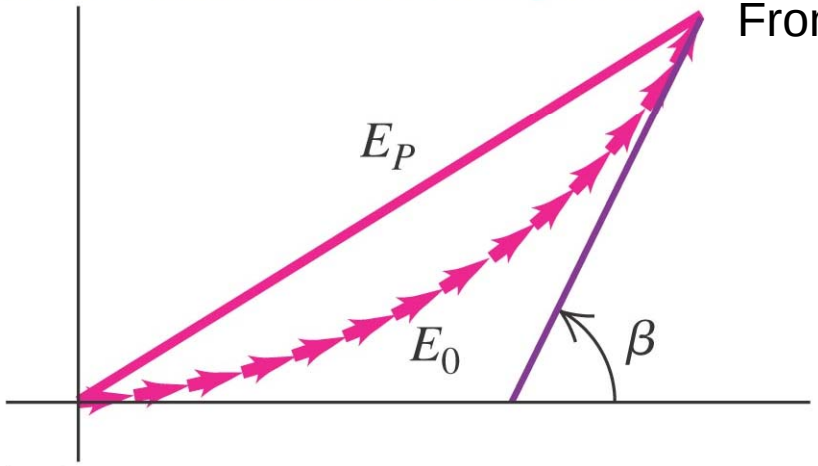
(c) Fraunhofer (far-field) diffraction

If the screen is distant, the rays to P are approximately parallel.



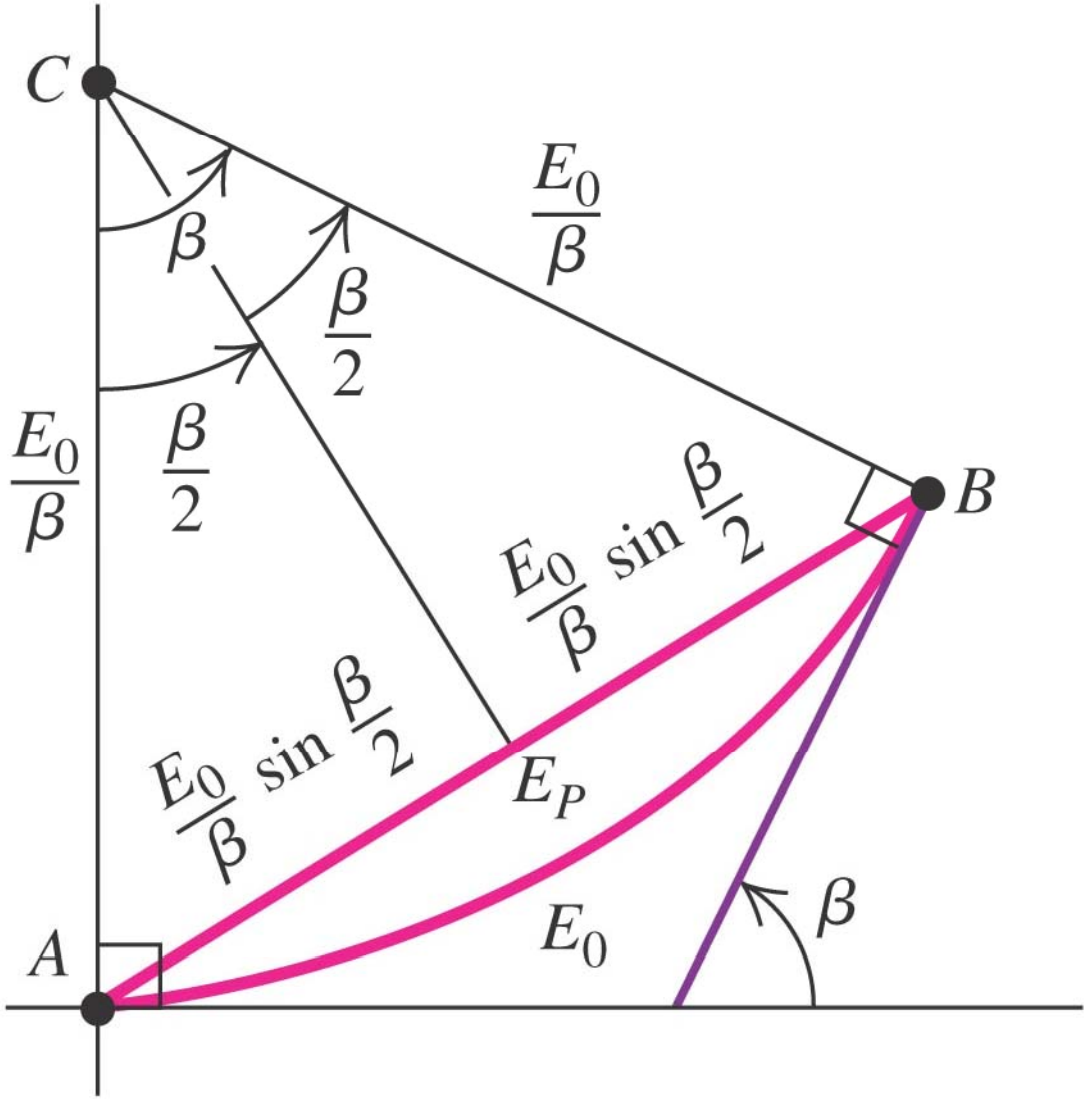
(c) Phasor diagram at a point slightly off the center of the pattern; β = total phase difference between the first and last phasors.

From bottom

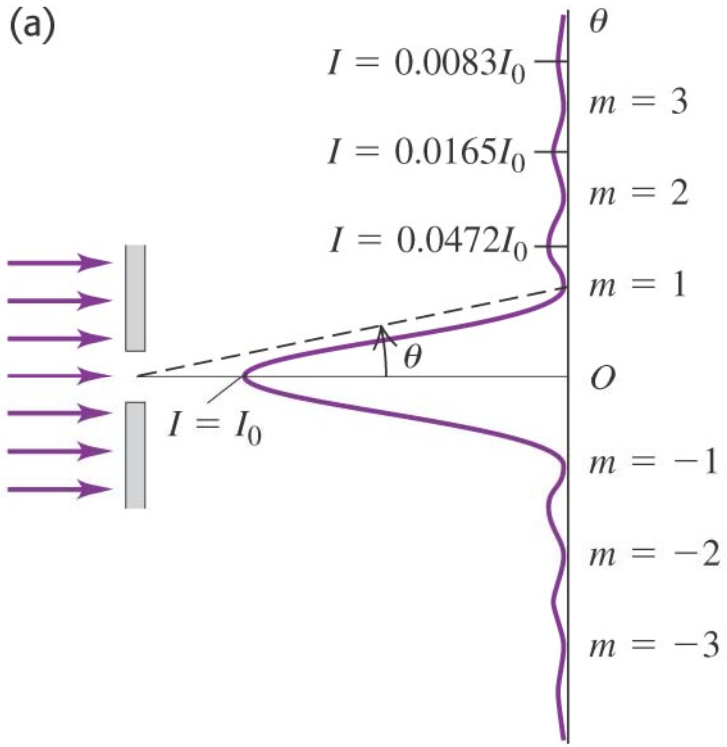


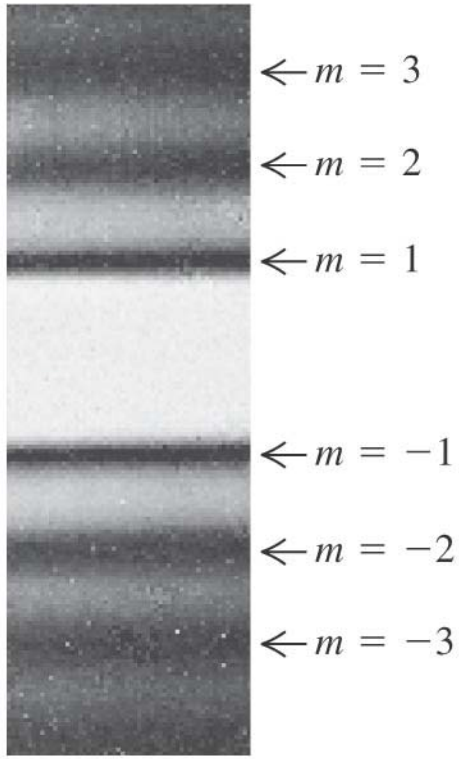
From top

(d) As in (c), but in the limit that the slit is subdivided into infinitely many strips



(a)





(b)