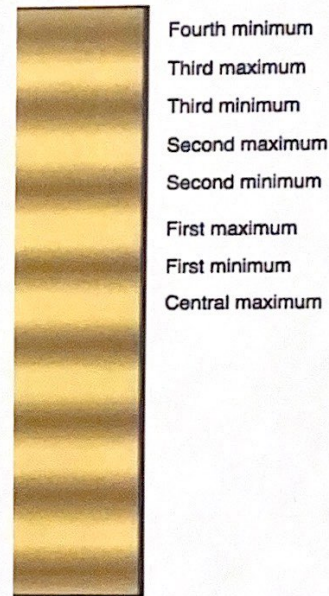


Quiz 27.1A

Light of wavelength 623 nm is incident on two slits separated by 0.120 mm, and the resulting interference pattern is projected on a screen 3.50 meters away. For clarity, I have labeled the minima and maxima for the top half of the pattern projected on the wall in the figure below.

- a) What is the path difference, in waves, for the light rays from the two slits that strike the location of the third minimum?
- b) What is the distance (in cm) between the central maximum and the third minimum?
- c) If the slit separation increases, does your answer for part (a) increase, decrease or stay the same? Assume no change in wavelength or L for this part.
- d) If the slit separation increases, does your answer for part (b) increase, decrease or stay the same? Assume no change in wavelength or L for this part.



a) 1st min: $\Delta\phi = \frac{1}{2}\lambda$
2nd min: $\Delta\phi = \frac{3}{2}\lambda$
3rd min: $\Delta\phi = \frac{5}{2}\lambda \rightarrow \boxed{2.50\lambda}$

b) $\frac{dy}{L} = 2.5\lambda$
 $\Rightarrow y = \frac{2.5\lambda L}{d}$
 $\frac{(2.5)(623 \times 10^{-9})(3.50)}{0.120 \times 10^{-3}} = 4.54 \times 10^{-2} \text{ m}$
or $\boxed{4.54 \text{ cm}}$

c) stays the same. The 3rd minimum is defined by the fact that $\Delta\phi = 2.5\lambda$.

d) decreases. $\frac{dy}{L} = 2.5\lambda \Rightarrow y = \frac{2.5\lambda L}{d}$

$y \propto \frac{1}{d}$ so if $d \uparrow$, $y \downarrow$