

FIFTH MIDTERM

3

Name: _____ Student ID #: _____

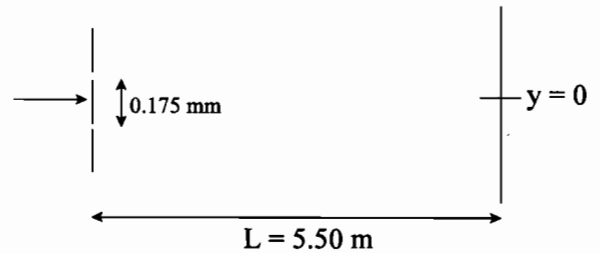
Discussion Instructor (circle): Eric Gary Jose Monica

SHOW ALL WORK!!!!

REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!

Use the conversion constants and data given on the front page.

In a 2-slit experiment, the slits are narrow and a distance apart of 0.175 mm. Yellow light ($\lambda = 594.0 \text{ nm}$) is incident from the left, perpendicular to the slits and screen.



- (a) If $y = 0$ is exactly opposite to the slits, calculate the position of the third dark band from the center.
 (b) If light that is a mixture of $\lambda = 600 \text{ nm}$ and $\lambda = 650 \text{ nm}$ is incident on the slits, determine the position closest to $y = 0$ where their maxima overlap exactly.

Ⓐ for dark band $y = \frac{\lambda L}{d} \left(m + \frac{1}{2}\right)$ $m = 0, 1, 2, \dots$

$y = \frac{(594 \text{ nm})(5.5 \text{ m})(2 + \frac{1}{2})}{(0.175 \text{ mm})} = 0.0467 \text{ m}$ The third dark band $\Rightarrow m = 2$

Ⓑ for bright band (maxima) $y = \frac{\lambda L}{d} m$

$y_1 = y_2$

$\frac{\lambda_1 L}{d} m_1 = \frac{\lambda_2 L}{d} m_2$

$\frac{12}{13} = \frac{600 \text{ nm}}{650 \text{ nm}} = \frac{\lambda_1}{\lambda_2} = \frac{m_2}{m_1} \Rightarrow$ so $m_1 = 13, m_2 = 12$

$y_1 = \frac{\lambda_1 L}{d} m_1 = \frac{(600 \text{ nm})(5.5 \text{ m})(13)}{(0.175 \text{ mm})} = 0.245 \text{ m}$