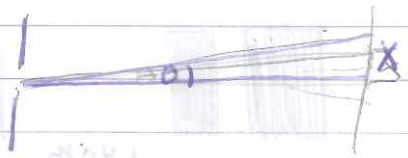
TSOKOS WAVES HW #4 p. 265 #1-4



① Single slit of width $b = 1.50\ \mu m$ is lit w/ light of $\lambda = 500.0\ nm$. What is angular width of central maximum?

Angular width = 2 × distance from center line to 1st minima

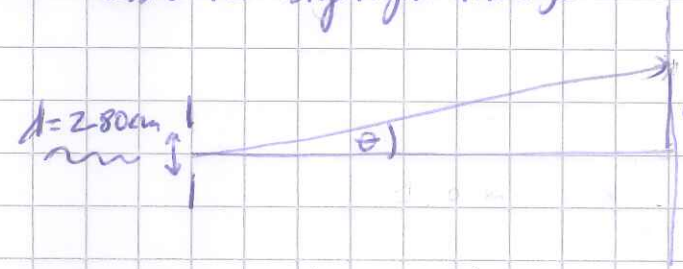
$$\sin\theta = \frac{\lambda}{b} = \frac{500\times10^{-9}m}{1.50\times10^{-6}m} = .333 \qquad \theta = 19.5^\circ \times 2 \approx \boxed{39^\circ}$$

$\theta = .33\ rad \times 2 = .66\ rad \approx \boxed{38^\circ}$

② Microwaves of $\lambda = 2.80\ cm$ fall on a slit and the central maximum at a distance of 1.0 m from the slit is found to have a half width of 0.67 m. What is width of slit b?

θ for big right triangle

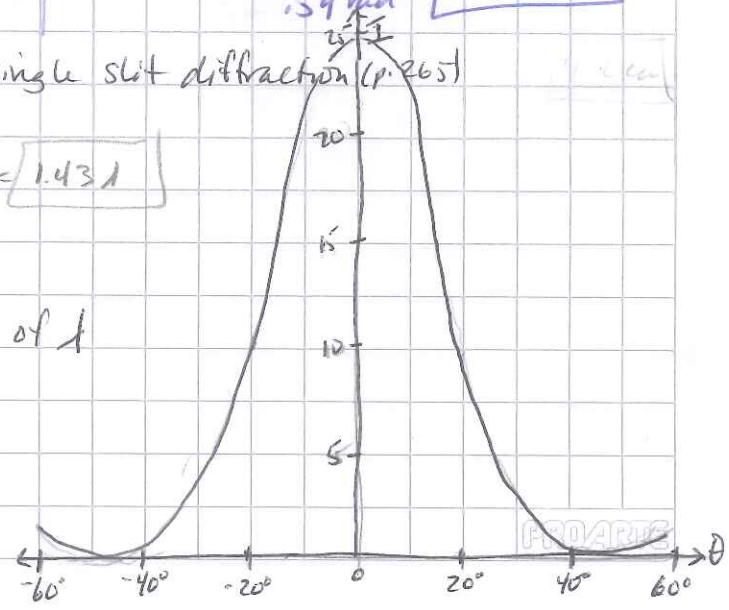
$\tan\theta = \frac{0.67}{1} = .59\ rad$



So $\theta \approx \frac{\lambda}{b}$ $\quad b = \frac{\lambda}{\theta}$

$b = \frac{2.80\ cm}{.59\ rad} = \boxed{4.7\ cm}$

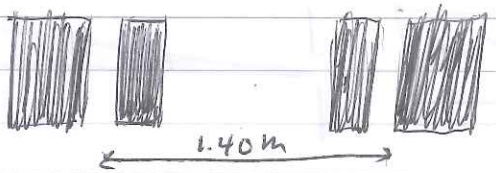
③ See diagram for intensity of single slit diffraction (p. 265)



$\theta \overset{(rad)}{\approx} \frac{\lambda}{b}$ $\quad b = \frac{\lambda}{\theta} = \frac{1}{.698}\lambda = \boxed{1.43\lambda}$

(a) Find width of slit in terms of λ

$\theta = 40^\circ = .698\ rad$



(4) From the diagram above, determine the λ used to obtain this pattern. The screen is 0.60 m from the slit and the slit width $b = 2.30\text{cm}$. What kind of wave is most likely being used?

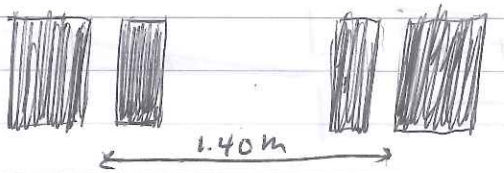
$\tan\theta = \frac{0.70}{0.60}$ so $\theta = .862\text{ rad}$

$\lambda = b \cdot \theta$

$\lambda = (.023)(.862)$

$\lambda = .0198\text{ m}$ or $\boxed{2.0\text{ cm}}$

Likely a large microwave or small radiowave



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