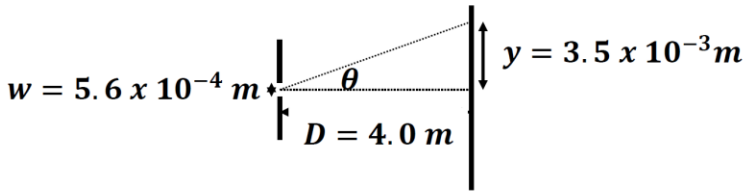
12. Light shines through a single slit whose width is 5.6 x 10^{-4} m. A diffraction pattern is formed on a flat screen located 4.0 m away. The distance between the middle of the central bright fringe and the first dark fringe is 3.5 mm. What is the wavelength of the light?



$$W \sin(\theta) = m\lambda = \lambda$$

Where m = 1 for first dark fringe.

$$\tan(\theta) = \frac{y}{D}$$

Solving for θ

$$\theta = \tan^{-1}\left(\frac{y}{D}\right) = \tan^{-1}\left(\frac{3.5\ x\ 10^{-3}\ m}{4.0\ m}\right) = 5.0\ x\ 10^{-2\circ} = 0.050^{\circ}$$

$$\lambda = W \sin(\theta) = (5.6\ x\ 10^{-4}\ m) \sin(0.050^{\circ}) = 4.89\ x\ 10^{-7}\ m$$

$$\boxed{\lambda = 4.9\ x\ 10^{-7}\ m = 490\ nm}$$

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