

21. Consider the two waves, one from each slit, that produce the seventh bright fringe in the absence of the mica. They are in phase at the slits and travel different distances to the seventh bright fringe, where they have a phase difference of  $2\pi m = 14\pi$ . Now a piece of mica with thickness  $x$  is placed in front of one of the slits, and an additional phase difference between the waves develops. Specifically, their phases at the slits differ by

$$\frac{2\pi x}{\lambda_m} - \frac{2\pi x}{\lambda} = \frac{2\pi x}{\lambda}(n - 1)$$

where  $\lambda_m$  is the wavelength in the mica and  $n$  is the index of refraction of the mica. The relationship  $\lambda_m = \lambda/n$  is used to substitute for  $\lambda_m$ . Since the waves are now in phase at the screen,

$$\frac{2\pi x}{\lambda}(n - 1) = 14\pi$$

or

$$x = \frac{7\lambda}{n - 1} = \frac{7(550 \times 10^{-9} \text{ m})}{1.58 - 1} = 6.64 \times 10^{-6} \text{ m} .$$