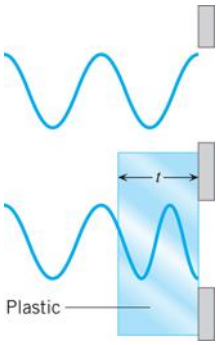
5. A sheet that is made of plastic (n = 1.60) covers *one slit* of a double slit (see the drawing). When the double slit is illuminated by monochromatic light (λ_{vacuum} = 586 nm), the center of the screen appears dark rather than bright. What is the minimum thickness of the plastic?



For the center of the screen to go from light to dark there must be a phase difference between the two waves that is equal to one-half a wavelength.

Optical path length is index of refraction times physical path distance. So the phase difference must result from optical path difference so

$$\frac{\lambda}{2} = nt - t = t(n-1)$$

Solve for t

$$t = \frac{\lambda}{2(n-1)} = \frac{586\ nm}{2(1.60-1)} = 488.3\ nm$$

$$\boxed{t = 488\ nm}$$

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