SHOW ALL WORK!!!!
REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
Use the conversion constants and data given on the front page.

Two optically flat, thick, glass plates with index of refraction \( n = 1.55 \), are set up as shown. At one edge the plates touch, and at the other edge they are separated by placing a hair between them. At the position of the hair there is bright interference band in reflection for \( \lambda = 550 \text{ nm} \) (yellow) and for 506 nm (green). There is no other place between the hair and the touching edge where the green and yellow maxima exactly coincide. There are no other wavelengths between 506 and 550 that give an interference maxima at the position of the hair.

20 points
(a) How thick is the hair?

Calculate the next wavelength, shorter than 506 nm, that will also show a maximum at the position of the hair?

\[
\begin{align*}
\lambda_1 &= \frac{n \lambda_0}{2} \\
\lambda_2 &= \frac{n \lambda_0}{2} = \frac{550 \text{ nm}}{2} \\
\frac{m_1 + \frac{1}{2}}{2} \lambda_1 &= \frac{m_2 + \frac{1}{2}}{2} \lambda_2 \\
\Rightarrow \quad m_1 &= \frac{25}{2} m_2 + \frac{1}{2} \\
m_1 &= 12 \\
m_2 &= 11 \\
\text{satisfies this equation.} \quad \Rightarrow \quad \lambda &= \left( \frac{12 + \frac{1}{2}}{2} \right) \frac{550 \text{ nm}}{2} = \left( \frac{11 + \frac{1}{2}}{2} \right) 506 \text{ nm} \\
\lambda &= 3.16 \mu \text{m}
\end{align*}
\]

10 points
(b) \( t = \left( \frac{m + \frac{1}{2}}{2} \right) \lambda \)

\[
\begin{align*}
\lambda &= \frac{2 t}{m+1/2} \\
\lambda &= \frac{4 t}{2m + 1} \\
m &= 13 \quad \text{next highest}
\end{align*}
\]

\[
\begin{align*}
\lambda &= \frac{4(t/3.1 \mu \text{m})}{2(13+1)} = 468.5 \text{ nm}
\end{align*}
\]