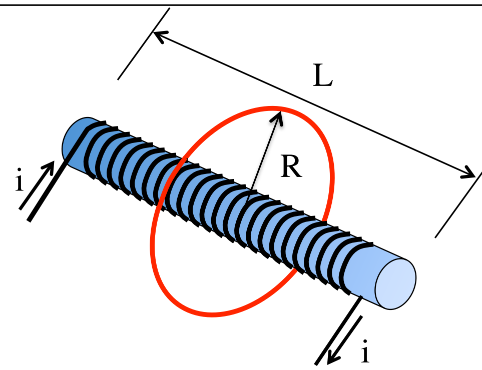
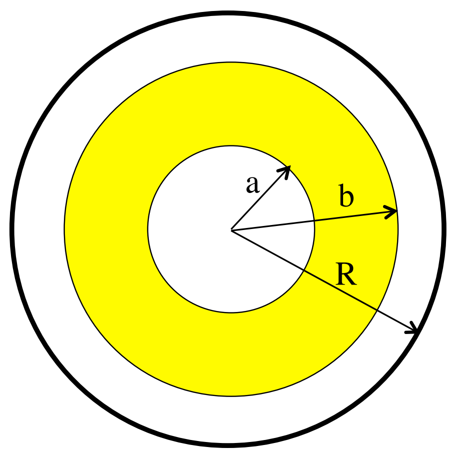
Problem 30.47



a.) Assuming the central axis of the solenoid is along the x-axis, the area vector will also be along the x-axis and the magnetic flux through the circle (disk) will be:

$$\begin{aligned}
\Phi_B &= \vec{B} \bullet \vec{A} \\
&= BA\cos 0^0 \\
&= (\mu_o ni)(\pi R^2) \\
&= \left[\left(4\pi x10^{-7}\ T\bullet m/A\right)\left(\frac{300\ \text{turns}}{.3\ m}\right)(12\ A)\right]\left[\pi(.012\ m)^2\right] \\
&= 7.4x10^{-6}\ \text{Webers}
\end{aligned}$$



b.) Because the magnetic field is essentially constant down the axis of a solenoid, the on thing tricky in the flux calculation is determine the area of the annulus's face. As such, we can write:

$$\begin{aligned}
\Phi_B &= \vec{B} \bullet \vec{A} \\
&= BA\cos 0^0 \\
&= (\mu_o ni)(\pi b^2 - \pi a^2) \\
&= \left[\left(4\pi x10^{-7}\ T\bullet m/A\right)\left(\frac{300\ \text{turns}}{.3\ m}\right)(12\ A)\right]\left[\pi\left((.012\ m)^2 - (.012\ m)^2\right)\right] \\
&= 2.27x10^{-6}\ \text{Webers}
\end{aligned}$$