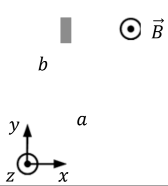
Exam III Review

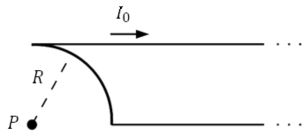
$\vec{B} = \frac{\mu_0}{4\pi}\frac{q\vec{v}\times\hat{r}}{r^2}$	$d\vec{B} = \frac{\mu_0}{4\pi}\frac{Id\vec{s}\times\hat{r}}{r^2}$	$B = \frac{\mu_0 I}{2\pi r}$	
$\mathcal{E} = -N\frac{d}{dt}\left[\int \vec{B}\cdot d\vec{A}\right]$	$\oint \vec{E}\cdot d\vec{s} = -\frac{d}{dt}\left[\int \vec{B}\cdot d\vec{A}\right]$		
$B = \mu_0 n I$	$\oint \vec{B}\cdot d\vec{s} = \mu_0 I_{\text{enc}} + \mu_0\epsilon_0\frac{d}{dt}\left[\int \vec{E}\cdot d\vec{A}\right]$		
$\vec{S} = \frac{1}{\mu_0}\vec{E}\times\vec{B}$	$I = \langle S\rangle = \frac{P}{A} = c\langle u\rangle = \frac{1}{2}c\epsilon_0 E_{\text{max}}^2 = \frac{1}{2}c\frac{B_{\text{max}}^2}{\mu_0}$		
$\frac{F}{A} = \langle P_{\text{rad}}\rangle = \frac{I}{c}$ or $\frac{2I}{c}$	$v = \lambda f$	$n = \frac{c}{v}$	$n_r \sin\theta_r = n_i \sin\theta_i$

Example: A thin silver rectangular plate of dimensions $a\times b$ ($a<b$) is in a region of uniform magnetic field $\vec{B} = \mathrm{B_0}\hat{\mathrm{k}}$. The plate is to be moved with $\vec{v} = \mathrm{v_0}\hat{\imath}$, $\vec{v} = \mathrm{v_0}\hat{\jmath}$ or $\vec{v} = \mathrm{v_0}\hat{\mathrm{k}}$. (a) Which direction yields the greatest $\mathcal{E}$ in the plate? (b) What is the $\mathcal{E}$ induced in the plate? (c) Identify the location and sign of any induced charges in the plate.



Example: A long wire lies along the x-axis carrying a current I_0 in the positive x direction. A proton passes through the point (0, $3a$, 0) with a constant velocity $\vec{v}$. Determine $\vec{v}$ if the magnetic field at (0, a, 0) is 0 at the moment the proton passes through (0, $3a$, 0).

Example: The loop carries a current I_0. Determine the magnetic field at point P.



Example: A conducting rod of mass m and length L is attached to a U-shaped conductor such that it can slide without friction. The apparatus with the rod has resistance R and is located in a uniform magnetic field $\vec{B}$. Determine the terminal velocity for the rod.