HW #6 Ch 7
7.12 7.15 7.34

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PHYS 390

7.12) $B(t) = B_0 \cos(\omega t)\hat{z}$ $\phi = \vec{B}\cdot\vec{A}$ Faraday's Law $\mathcal{E} = \frac{-d\phi}{dt}$

$\vec{A} = \pi\left(\frac{a}{2}\right)^2\hat{z}$ $\phi = B_0\cos(\omega t)\cdot\pi\left(\frac{a}{2}\right)^2\hat{z}$

$= \frac{B_0 \pi a^2 \cos(\omega t)}{4}$

$\mathcal{E} = \frac{-d}{dt}\left(\frac{B_0 \pi a^2 \cos(\omega t)}{4}\right) = \frac{\pi B_0 \omega a^2 \sin(\omega t)}{4}$

Ohm's Law: → $I(t) = \frac{\mathcal{E}}{R}$ $\boxed{I(t) = \frac{\pi B_0 \omega a^2 \sin(\omega t)}{4R}}$

7.15) $B(s) = \mu_0 n I$ $\phi = \vec{B}\cdot\vec{A}$ $A = \pi r^2$

magnetic flux in a circular loop

$$\phi \begin{cases} \mu_0 n I(\pi s^2) & (s<a) \\ \mu_0 n I(\pi a^2) & (s>a) \end{cases}$$

$\frac{-\partial\phi}{\partial t} = E\oint dl$ $\frac{-\partial}{\partial t}(B\cdot A) = E\oint dl$

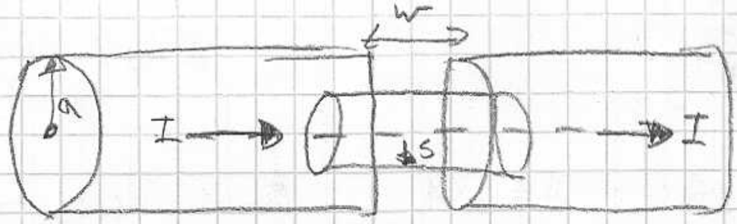
$-(\pi s^2)\left(\mu_0 n \frac{\partial I}{\partial t}\right) = E(2\pi s)$

$\boxed{\frac{-s}{2}\mu_0 n \frac{dI}{dt}\hat{\phi} = E}$ electric field inside solenoid

$-(\pi a^2)\left(\mu_0 n \frac{\partial I}{\partial t}\hat{\phi}\right) = E(2\pi s)$

$\boxed{\frac{-\pi a^2 \mu_0 n}{2\pi s}\frac{\partial I}{\partial t}\hat{\phi} = E}$ electric field outside solenoid

7.34)



$$J = \varepsilon_0 \frac{dE}{dt} = I/A \qquad J = \frac{I}{\pi a^2}\hat{z}$$

$$\oint B \cdot dl = B(2\pi s) = \mu_0 I_{denc}$$

$$B(2\pi s) = \mu_0 J(\pi s^2) = \mu_0 \frac{I}{\pi a^2}\pi s^2 = \mu_0 I \frac{s^2}{a^2}$$

$$\boxed{B = \frac{\mu_0 I s}{2\pi a^2}}$$ magnetic field between the gap