HW7: #12, 15, 34

Manuel Alvarez

12-6-20

12) $B(t) = B_0 \cos(\omega t)\,\hat{z}$, $r = a/2$, R

$I(t) = ?$

$I(t) = \frac{\mathcal{E}}{R}$, $\Phi(t) = B \cdot A = B_0 \cos(\omega t) \cdot \pi\left(\frac{a}{2}\right)^2$

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

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

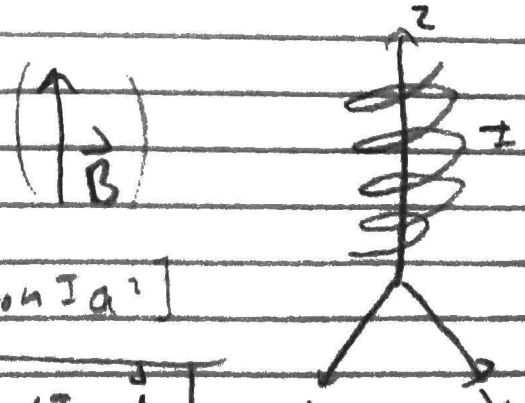
$$\mathcal{E} = \frac{B_0 \sin\omega(\omega t)\, \pi a^2}{4}$$

$$\boxed{I(t) = \frac{B_0 \omega \sin(\omega t)\, \pi a^2}{4R}}$$

15) ➢ solenoid
- a = radius
- n turns

$$\boxed{E_{out} = -\frac{\mu_0 n a^2}{2s} \cdot \frac{dI}{dt}}$$

$E(s) = ?$, $\oint E \cdot d\ell = -d/dt \int B \cdot da$



$E(2\pi s) = -d/dt[\mu_0 n I a^2]$

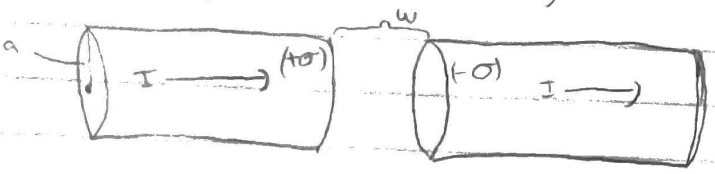
$$\boxed{E_{in} = -\frac{\mu_0 n a}{2} \cdot \frac{dI}{dt}\,\hat{\phi}}$$

34)

a - radius

I - current

B - ? , w/ (s < a) , w << a



$J_d = \varepsilon_0 \frac{\partial E}{\partial t} = \frac{I}{A}$; thus $I_{enc} = J_d(\pi a^2)$

$A = \pi a^2$ $\qquad J_d = \frac{I}{\pi a^2}$

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

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

$$B_{g.r} = \frac{\mu_0 I s}{2\pi a^2}\,\hat{\phi}$$