Name KEY

Quiz 11
PH361

$\vec{p} = \int \vec{r}' \rho(r') d\tau'$
solenoid $B = \mu_0 n I$
$\vec{F} = (\vec{p} \cdot \vec{\nabla}) \vec{E}$
$E = \frac{1}{4\pi\epsilon_0} \frac{1}{r^3} (3\vec{p} \cdot \hat{r}\, \hat{r} - \vec{p})$
$\vec{\nabla} t = \frac{\partial t}{\partial r} \hat{r} + \frac{1}{r} \frac{\partial t}{\partial \theta} \hat{\theta} + \frac{1}{r \sin\theta} \frac{\partial t}{\partial \phi} \hat{\phi}$
$\hat{r} = \sin\theta \cos\phi\ \hat{x} + \sin\theta \sin\phi\ \hat{y} + \cos\theta\ \hat{z}$
$\hat{\theta} = \cos\theta \cos\phi\ \hat{x} + \cos\theta \sin\phi\ \hat{y} - \sin\theta\ \hat{z}$
$\hat{\phi} = -\sin\phi\ \hat{x} + \cos\phi\ \hat{y}$
$\vec{D} = \epsilon_0 \vec{E} + \vec{P}$
$\vec{D} = \epsilon \vec{E}$
$\vec{F} = q\vec{v} \times \vec{B}$
$d\vec{F} = I d\vec{l} \times \vec{B} = \vec{K} \times \vec{B}\, da = \vec{J} \times \vec{B}\, d\tau$
$\vec{dA} = \frac{\mu_0}{4\pi} \int \frac{I}{|\vec{r} - \vec{r}'|} d\vec{l}' = \frac{\mu_0}{4\pi} \int \frac{J(\vec{r}')}{|\vec{r} - \vec{r}'|} d\tau'$

1. A long solenoid of radius a, carrying current n turns per unit length, is looped by a wire with resistance R. The current I in the solenoid is constant but the solenoid is pulled out of the loop, turned around, and reinserted. Derive an expression for the total charge which passes through the resistor.

B inside solenoid = $\mu_0 n I$ so $\Phi = \pi a^2 \mu_0 n I$

$Emf = -\frac{d\Phi}{dt} = IR = \frac{dQ}{dt} R$ cancel dt & integrate

$\Delta Q = \frac{1}{R} \Delta\Phi$ and $\Delta\Phi = \Phi_{final} - \Phi_{initial}$

$\Delta\Phi = 2\pi a^2 \mu_0 n I$