PHY 207 Practice Test III

Name: ________________________________

Student ID: ____________________________

Answer the all four problems. Partial credits are based on the clarity and the quality of the work you show.

$\vec{E} = \frac{kq}{r^2}\hat{r}$, $k=\frac{1}{4\pi\varepsilon_o}$ =9x10^9 NM^{2}C^{-2}, $\vec{F} = q\vec{E}$, $\oint \vec{E}\cdot d\vec{A} = \frac{Q_{in}}{\varepsilon_o}$,

$V = \frac{kq}{r}, V = \int \frac{kdq}{r}$

$dV = \frac{dU}{q} = -\vec{E}\cdot dl = -(E_x dx + E_y dy + E_z dz),\ \vec{E} = -\nabla V = -(\frac{\partial V}{\partial x}\hat{i} + \frac{\partial V}{\partial y}\hat{j} + \frac{\partial V}{\partial z}\hat{k})$,

$V = Ed, C = \frac{Q}{V}, U = \frac{1}{2}\sum q_i V_i, U = \frac{1}{2}CV^2 = \frac{1}{2}\frac{Q^2}{C}, u_e = \frac{1}{2}\varepsilon E^2, \varepsilon = K\varepsilon_o$

$V = IR, P = IV = I^2 R,\ I = \frac{dQ}{dt} = nqvA,\ J = \frac{I}{A},\ E = \rho J,\ R = \frac{\rho l}{A}, R = R_1 + R_2 + ...,\ \frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + ...$

$I = I_o \exp(\frac{-t}{RC}),\ F = qv\times B, dF = Idl\times B, \mu = NIA\hat{n}, \tau = \mu\times B$

$B = \frac{\mu_o}{4\pi}\frac{qv\times\hat{r}}{r^2}, dB = \frac{\mu_o}{4\pi}\frac{Idl\times\hat{r}}{r^2}, u_m = \frac{B^2}{2\mu_o}, B = \mu_o nI$

$\oint B\cdot dl = \mu_o(I + \varepsilon_o\frac{d\Phi_E}{dt}), \mu_o = 4\pi\times 10^{-7}\,Tm/A,$

$\oint E\cdot dl = -\frac{d\Phi_M}{dt}, \Phi_M = \int B\cdot dA, \Phi_M = LI$

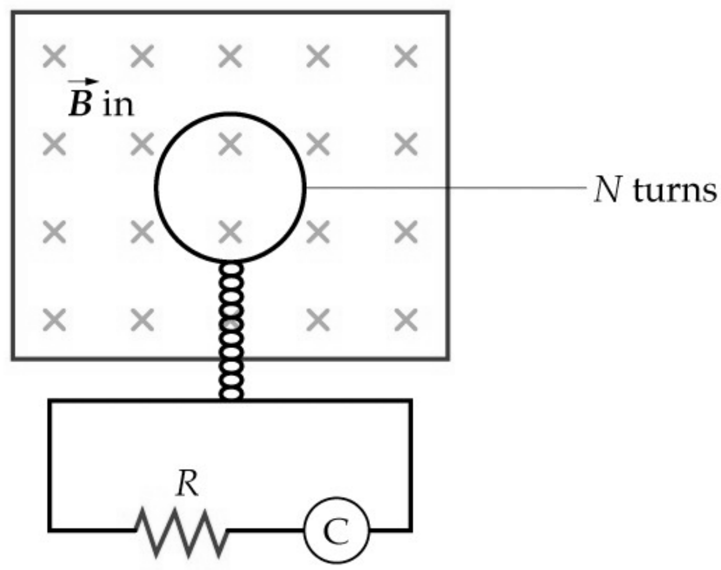
$\varepsilon = Blv, \varepsilon = -\frac{d\Phi_M}{dt}, \varepsilon = -L\frac{dI}{dt},\ I = I_o\exp(\frac{-R}{L}t)$

$A_{sph} = 4\pi r^2, V_{sph} = \frac{4}{3}\pi r^3, dV_{sph} = 4\pi r^2 dr$

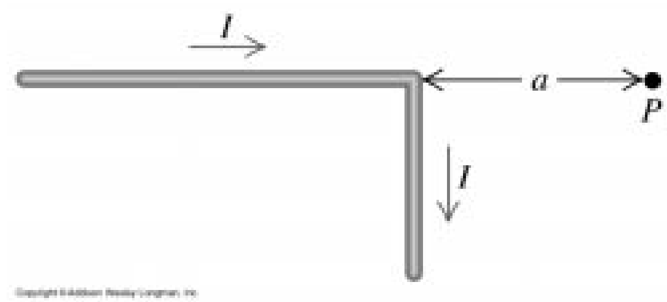
$A_{cyl} = 2\pi rL, A_{cir} = \pi r^2, dV_{cyl} = 2\pi r dr L$

$dq = \lambda dl = \sigma dA = \rho dV$

A small coil of N turns has its plane perpendicular to a uniform magnetic field B as shown. The coil is connected to a current integrator, a device used to measure the total charge passing through it. Find the charge passing through the coil if the coil is rotated through 180^{o} about its diameter.



The wire in the figure is infinitely long and carries a current I. Calculate the magnitude and the direction of the magnetic field at point P.



A long, cylindrical wire of radius *a* carries current *I* uniformly distributed over its cross-sectional area. A) Find the magnetic field everywhere ($r<a$, and $r>a$); B) Find the magnetic field energy per unit length within the wire.

A long straight wire carries a constant current I. A square conducting loop of length L is moving at a velocity **V,** as shown in the figure. At the instant when the near side of the loop to the wire is x, find the direction and magnitude of the induced currrent in the loop. Assume the resistance of the loop is R.