EXAM III Physics 208

Spring '08

Name.....Section Number.....

USEFUL INFORMATION

For two point particles

$$\vec{F} = \frac{1}{4\pi\epsilon_0}\frac{q_1 q_2}{r^2}\hat{r}$$

$$d\vec{B} = \frac{\mu_0 i}{4\pi}\frac{d\vec{s}\times\vec{r}}{r^3}$$

$$\frac{d\vec{r}}{dt} = \frac{dx}{dt}\vec{i}_x + \frac{dy}{dt}\vec{i}_y = \frac{dr}{dt}\vec{i}_r + r\frac{d\theta}{dt}\vec{i}_\theta$$

$$\oint \vec{E}\cdot d\vec{r} = -\frac{d}{dt}\int \vec{B}\cdot d\vec{S}$$

$$C = \frac{Q}{V} \qquad R = \rho\frac{l}{A}$$

$$\int \vec{B}\cdot d\vec{S} = \pm Li$$

$$\oint \vec{B}\cdot d\vec{r} = \mu_0 i_{enclosed}$$

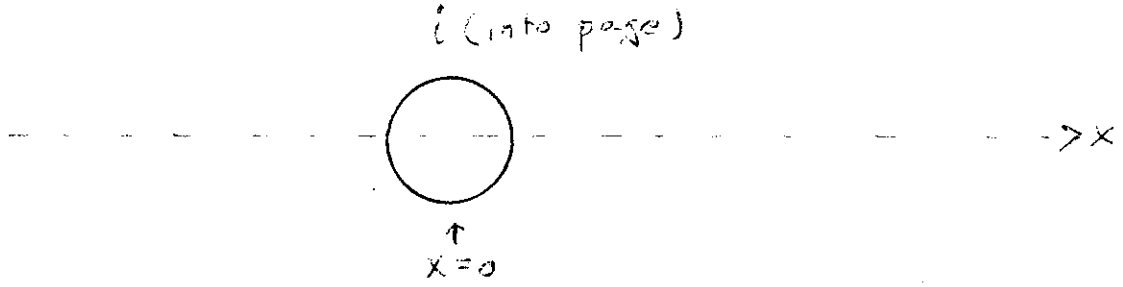
1

2

3

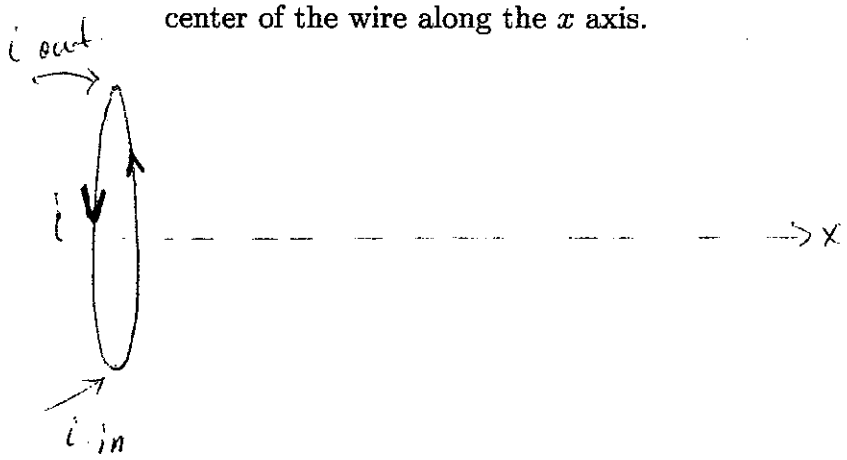
4

1. (25 points) An infinitely long wire carrying a current i has a circular cross section of radius W. The current is uniformly spread over the cross sectional area. If the center of the wire is at the origin, find the points on the x axis where the magnetic field has one half the magnitude of the magnetic field at the surface of the wire.

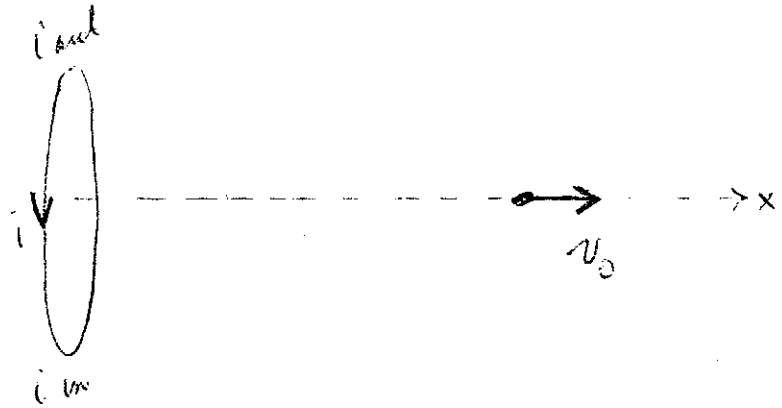


2. (25 points)A circular loop of very thin wire has radius R and carries a current i. It is in the y, z plane with its center at the origin.

a. Find the magnetic field produced by this wire at a point a distance x away from the center of the wire along the x axis.

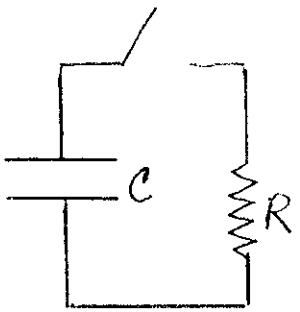


b. Find the force that would be exerted by this current carrying wire on a particle with charge q and mass m travelling with velocity v_0 at the point a distance x from the center.

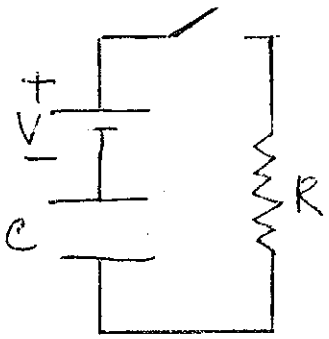


3. (25 points)In the circuit below the capacitor is originally charged with Q_0 on the top plate and $-Q_0$ on the bottom. At $t = 0$ the switch is closed.

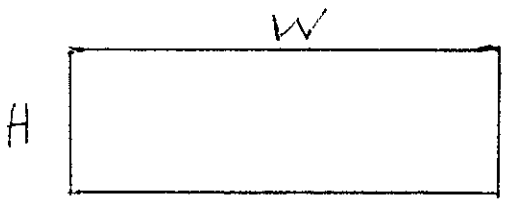
a. Find the charge on the plates as a function of time assuming the self inductance of the circuit can be ignored. Please note that all wires in this circuit have no resistance.



b. In the circuit below the capacitor is initially uncharged. At $t = 0$ the switch is closed. Find the charges on the capacitor plates as a function of time assuming the self inductance of the circuit can be ignored.



4. (25 points) A rectangular loop is made of wire having resistivity ρ and cross sectional area A. It has the dimensions shown below.



If there were a magnetic field that varied with time according to

$$B = 6t^4 + 7t + 11$$

and was directed perpendicular to the loop, pointing into the page, find the current that would flow in the loop, ignoring self inductance.