EXAM III Physics 208 2018

Last Name.....First Name .....Section Number.....

USEFUL INFORMATION

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

$$\vec{F} = q(\vec{v} \times \vec{B}) \qquad d\vec{F} = i(d\vec{s} \times \vec{B})$$

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

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

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

$$C = \frac{Q}{V} = \frac{A\epsilon_0}{d} \qquad R = \rho\frac{l}{A}$$

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

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

$$\frac{d\ln U}{dx} = \frac{dU}{dx}\frac{1}{U}$$

1.

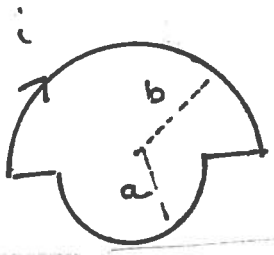
2.

3.

4.

You must mark all charges and currents on the appropriate figure so that your symbols are defined. Do not waste time on non-trivial integrals.

1. (25 points)A very thin loop of wire has the unusual shape shown below. The current going around the loop is i. Find the magnetic field at the center of the circular portions of the loop.

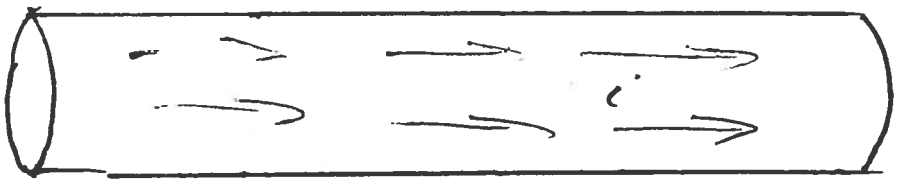


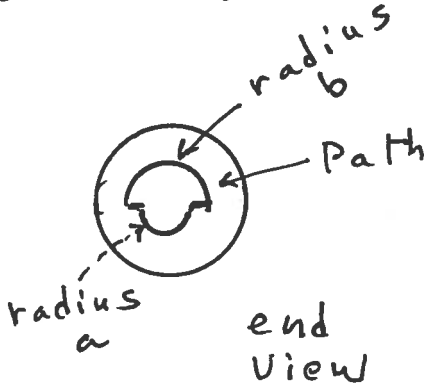
Law

Application

Result

2. (25 points) An infinitely long wire has a circular cross section of radius A. A current i flows uniformly through the wire as shown. Find the magnetic field everywhere. Using the result evaluate $\oint \vec{B} \cdot d\vec{r}$ for the path shown below.





Law

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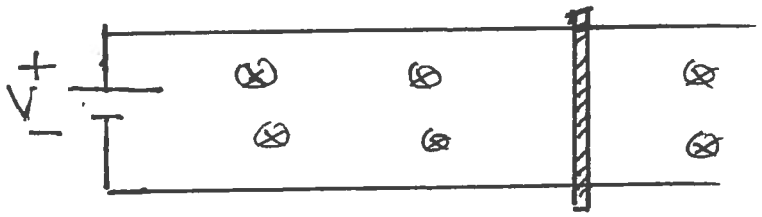
3. (25 points) A rod of length H with resistance R can slide without friction on perfectly conducting, horizontal rails. A uniform, constant magnetic field, magnitude B_0, points down as shown. A battery is connected to the rails. If the rod is at rest what will be the magnetic force on it? With what constant velocity would you have to pull or push the rod along the rails in order to make the magnetic force on it be zero? (Ignore self inductance.)



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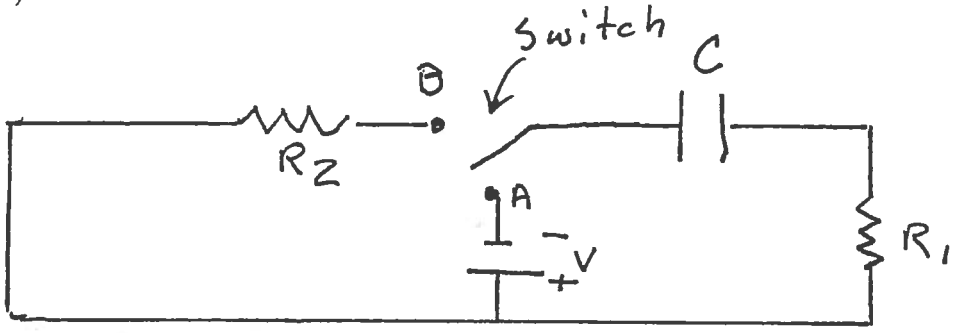
4. (25 points) The circuit below was put together a long time ago, with the switch in position A, so that the steady state was reached. At $t = 0$ the switch is moved to position B. Find the charge on the capacitor as a function of time for $t > 0$. (Ignoring self inductance.)



Law

Application

Result