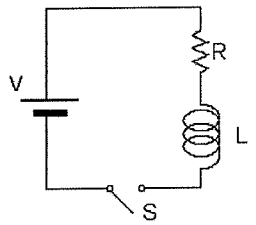
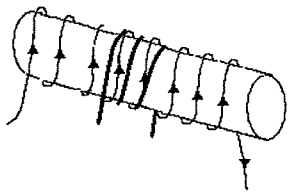
Physics 111 Homework Set #14 Chapter 32

1) A small air core solenoid has a length of 4 cm and a radius of 0.25cm. If the inductance is to 0.06mH, how many turns/cm are required?
2) A torioid has a major radius R and a minor radius r, and is tightly wound with N turns. If R>>r, the B-field inside the toroid is essentially that of a long solenoid bent into a large circle of radius R. Using the long solenoid approximartion, show that the self-inductance of the toroid is $\mathbf{L} = \frac{\mu_0 \mathbf{N}^2 \mathbf{A}}{2\pi \mathbf{R}}$.
3) An inductor (L=15H) and a resistor (R=30Ω) are connected across a 100 V battery as shown. (a) What is the initial rate of increase of the current in thecircuit after the switch is closed? (b) At what rate is it changing after 1.5s?

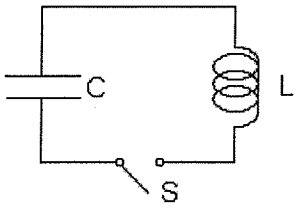



4) At t=0, an emf (500V) is applied to a coil (0.8H) and a resistor (30Ω). (a) Find the energy stored in the B-field when it reaches ½ of its maximum value. (b) How long after the emf is connected does it take for the current to reach this value?
5) On a clear day there is a 100V/m vertical electric field near the surface of the earth. A the same time, the earth's B-field has a magnitude of $0.5 \times 10^{-4}$T. Compare the energy density of the two fields.\
6) A coil of 50 turns is wound on a long solenoid as shown. The solenoid has a cross section of $8.8 \times 10^{-3} m^2$ and is wrapped uniformly with 1000 turns/m. Calculate M.



7) Two single turn loops of wire have radii r and R with R>>r. The loops lie in the same plane and are concentric. (a) Show that $\mathbf{M} = \frac{\mu_0 \pi \mathbf{r}^2}{2\mathbf{R}}$. (b) Evaluate M for r=2cm and R=20cm.

8) An LC circuit has L=82mH and C=17μF. The capacitor initially carries a charge Q=180μC. The switch is thrown at t=0. (a) Find the frequency of the resulting oscillations. (b) At t=1.0s, find the charge on the capacitor and current.




9) An LC circuit carries a current that oscillates with a period T. If $q(t=0) = Q_{max.}$, when will the energy stored in the electric field of the capacitor equal to the energy stored in the magnetic field of the inductor?