# Inductor and Inductance, LR and LC circuit

1. A coil that has a self-inductance equal to 5.00 mH and a resistance equal to 15.00 $\Omega$ is placed across the terminals of a 12.0-V battery that has a negligible internal resistance. ($a$) What is the final current? ($b$) What is the time constant? ($c$) How many time constants does it take for the current to reach 99.0 percent of its final value? (c) How much energy is stored in this inductor when the final current has been attained?

2. If the total energy in an LC circuit is 5.0 µJ and L=25 mH, then what is the maximum current (in mA)?

3. A 10 µF capacitor with an initial charge $Q_0$ is connected across an 8 mH inductor. If the circuit is completed at time t = 0, how soon (in ms) afterward will the charge on the capacitor reverse sign and become equal to -$Q_0$?

4. A 1 mF capacitor with an initial charge $Q_0$ is connected across a 9 mH inductor to form an LC circuit. If the circuit is completed at time t = 0, how soon (in ms) afterward will the charge on the capacitor decrease to one-half of its initial value? If the maximum current is 3 mA what is $Q_0$ (in µC)?

5. Compare the energy density stored in Earth's electric field near its surface to that stored in Earth's magnetic field near its surface. We'll take Earth's magnetic field to be 0.3 G and its electric field to be 100 V/m.

6. A sinusoidal electromagnetic wave of frequency 40.0 MHz travels in free space in the $x$ direction as in Figure. (a) Determine the wavelength and period of the wave. (B) At some point and at some instant, the electric field has its maximum value of 750 N/C and is directed along the $y$ axis. Calculate the magnitude and direction of the magnetic field at this position and time.
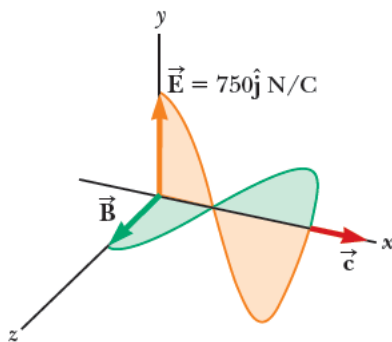


7. The electric field component of an electromagnetic wave traveling in a vacuum is given by $E_y = E_0 \sin (kx - \omega t)$, where $E_0$ = 300 V/m and k=10$^7$/m. What are the frequency of the oscillations (in Hz) and the direction of propagation?

8. The electric field component of an electromagnetic plane wave traveling in a vacuum is given by $\vec{E} = E_0 \sin (kx + \omega t)\hat{y}$, where $E_0$ = 300 V/m and k=10$^7$/m. What is the magnetic field component of the electromagnetic wave? What is the frequency of the electromagnetic wave (in Hz)?