**Phyx 135-2, Fall 2016, Quiz #5** **Name** _____
**Section 02 (1 pm)**

**1)** Suppose you have a 7.5 mH inductor and a 4.5 μF capacitor connected in series. (The resistance of the circuit is zero.) The maximum charge that ever appears on the capacitor is 2.0 μC.

**1a) (4 points)** What is the frequency of oscillation of this circuit, given in Hz?

**Answer:** $\omega = (LC)^{-1/2} = [(7.5 \times 10^{-3})(4.5 \times 10^{-6})]^{-1/2} = 5443$ rad/s. $\omega = 2\pi f$, so $f = 5443/2\pi =$ 866 Hz

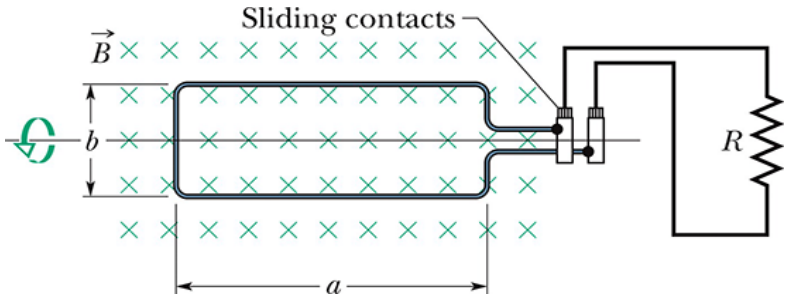
**1b) (4 points)** What is the maximum current that ever flows through the inductor?

**Answer:** $i_{max} = \omega q_{max} = (5443)(2 \times 10^{-6}) =$ 10.9 mA

**1c) (4 points)** What is the total energy contained in this circuit?

**Answer:** We may use either $U = \frac{1}{2} Q^2/C$ or $U = \frac{1}{2} Li^2$. We have:
$U = \frac{1}{2}(2 \times 10^{-6})^2 / (4.5 \times 10^{-6}) =$ 0.44 μJ, or
$U = \frac{1}{2}(7.5 \times 10^{-3})(10.9 \times 10^{-3})^2 =$ 0.44 μJ

**2) (8 points)** You have a rectangular loop of wire with length a = 7 cm and width b = 3 cm. It is in a constant magnetic field of 0.50 T as shown at right. Then, you begin to rotate the wire around its length at a frequency of f = 60 Hz. What is the maximum emf that will appear in the loop?




**Solution**
From Faraday's Law, $\mathcal{E} = d\Phi/dt$. In this case, because the loop is rotating, we have:
$\Phi = BA\cos(\omega t)$. Thus $d\Phi/dt = BA\omega \sin(\omega t)$, so the maximum emf that can appear in the loop is just $BA\omega = B(ab)(2\pi f) = (0.5)(0.07)(0.03)(2\pi)(60) =$ 0.4 volt