

Name: _____,

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Q1) An oscillating LC circuit consisting of a 1.0 nF capacitor and a 3.0 mH coil has a maximum voltage of 3.0 V. What are (a) the maximum charge on the capacitor, (b) the maximum current through the circuit, and (c) the maximum energy stored in the magnetic field of the coil?

$$(a) Q = C V_{\max} = 10^{-9} \times 3 = 3 \text{ nC}$$

$$(b) U = \frac{1}{2} L I^2 = \frac{1}{2} \frac{Q^2}{C} \Rightarrow I^2 = \frac{Q^2}{LC}$$

$$\text{or } I_{\max} = \frac{Q}{\sqrt{LC}} = \frac{10^{-9}}{\sqrt{10^{-9} \times 3 \times 10^{-3}}} = 1.7 \text{ mA}$$

$$(c) U_{\max} = \frac{1}{2} L I^2 = \frac{1}{2} 3 \times 10^{-3} \times (1.7 \times 10^{-3})^2 = 4.5 \text{ nJ}$$

Q2) For a certain driven series RLC circuit, the maximum generator emf is 125 V and the maximum current is 3.20 A. If the current leads the generator emf by 0.982 rad, what are the (a) impedance and (b) resistance of the circuit? (c) Is the circuit predominantly capacitive or inductive?

$$(a) Z = \frac{E_m}{I} = \frac{125}{3.2} = 39.1 \, \Omega$$

$$(b) V_R = I R = E_m \cos \phi \Rightarrow R = \frac{E_m \cos \phi}{I} = \frac{125 \cos(0.982)}{3.2}$$

$$\Rightarrow R = 21.7 \, \Omega$$

$$(c) \tan \phi = \frac{X_L - X_C}{R} \Rightarrow X_L - X_C = R \tan \phi$$

$$\text{since } I \text{ leads } \mathcal{E} \Rightarrow \phi = -0.982 \text{ rad}$$

$$\Rightarrow X_L - X_C = 21.7 \tan \phi = -32.5 \, \Omega$$

$$\Rightarrow X_L < X_C \text{ or the circuit is capacitive}$$