

Answer on Question#61007 – Physics – Electric Circuits

An LC circuit includes a capacitor of $25\mu F$. The circuit has a period of 5.0ms. The peak current (the amplitude) is 25mA. Determine: a) the inductance; b) the peak voltage.

Solution. According to the condition of the problem

$C = 25\mu F$ – capacitance of capacitor;

$T = 0.005s$ – period;

$I_0 = 0.025A$ – amplitude of current.

a) Using formula for period LC circuit get

$$T = 2\pi\sqrt{LC} \rightarrow L = \frac{T^2}{4\pi^2 C}$$
$$L = \frac{(5 \cdot 10^{-3})^2}{4\pi^2 \cdot 25 \cdot 10^{-6}} \approx 0.025H = 25mH$$

b) Relationship between peak current and voltage get using law conservation of energy $\frac{CU_0^2}{2} = \frac{LI_0^2}{2}$.

$\frac{CU_0^2}{2}$ – energy of capacitor, $\frac{LI_0^2}{2}$ – energy of inductance.

$$\text{Hence } CU_0^2 = LI_0^2 \rightarrow \frac{I_0}{U_0} = \sqrt{\frac{C}{L}} \rightarrow U_0 = I_0 \sqrt{\frac{L}{C}}$$

$$U_0 = 0.025 \sqrt{\frac{0.025}{25 \cdot 10^{-6}}} \approx 0.79V.$$

Answer: a) $L = 25mH$ b) $U_0 = 0.79V$.