Chapter 31

31.8 LC oscillators have been used in circuits connected to create some of the sounds of electronic music. What inductance must be used with a $6.7\mu F$ capacitor to produce a frequency of 10 kHz which is near the middle of the audible range of frequencies.

$$2\pi f = \sqrt{\frac{1}{LC}}$$
$$\frac{1}{LC} = (2\pi f)^2$$
$$L = \frac{1}{(2\pi f)^2 C} = 3.78\times10^{-5}$$

31.28 A $50\,\Omega$ capacitor is connected as in Fig 31-10 to an ac generator with an $\varepsilon_m = 30.0\,V$. What is the amplitude of the resulting alternating current if the frequency of the emf is (a) 1 kHz, and (b) 8 kHz.

The current through just a resistor is not dependent on the frequency.

$$\varepsilon_m = 30.0\,V$$
$$\varepsilon_m = i_m R$$
$$i_m = \frac{\varepsilon_m}{R} = 0.6A$$

31.30 A $1.5\mu F$ capacitor is connected as in Fig 31-10 to an ac generator with an $\varepsilon_m = 30.0\,V$. What is the amplitude of the resulting alternating current if the frequency of the emf is (a) 1 kHz, and (b) 8 kHz.

$$\varepsilon_m = 30.0\,V$$
$$\varepsilon_m = i_m X_C$$
$$i_m = \frac{\varepsilon_m}{X_C}$$
$$X_C = \frac{1}{(2\pi f)C}$$
$$f = 1000Hz \Rightarrow X_C = 106.1\Omega \Rightarrow i_m = 0.283\,A$$
$$f = 8000Hz \Rightarrow X_C = 13.3\Omega \Rightarrow i_m = 2.26A$$

31.31 A 50mH inductor is connected as in Fig 31-8a to an ac generator with $\varepsilon_m = 30V$. What is the amplitude of the resulting alternating current if the frequency of the emf is (a)1.00 kHz and (b) 8.00 kHz?

$$\varepsilon_m = i_m X_L$$
$$i_m = \frac{\varepsilon_m}{X_L}$$
$$X_L = (2\pi f) L$$
$$f = 1000Hz \Rightarrow X_L = 314.2\Omega \Rightarrow i_m = 9.55 \times 10^{-2} A$$
$$f = 8000Hz \Rightarrow X_L = 2513.6\Omega \Rightarrow i_m = 1.19 \times 10^{-2} A$$

31.52 What is the maximum value of an ac voltage whose rms value is 100V?

$$V_{RMS} = \frac{V_0}{\sqrt{2}}$$
$$V_0 = \sqrt{2}\, V_{RMS} = 141.4V$$

31.64 A generate supplies 100V to the primary coil of a transformer of 50 turns. If the secondary coil has 500 turns, what is the secondary voltage?

$$\frac{V_1}{N_1} = \frac{V_2}{N_2}$$
$$V_2 = \frac{N_2}{N_1} V_1 = \frac{500\, turns}{50\, turns} \cdot 100V = 1000V$$