

33. (a) The inductive reactance for angular frequency  $\omega_d$  is given by  $X_L = \omega_d L$ , and the capacitive reactance is given by  $X_C = 1/\omega_d C$ . The two reactances are equal if  $\omega_d L = 1/\omega_d C$ , or  $\omega_d = 1/\sqrt{LC}$ . The frequency is

$$f_d = \frac{\omega_d}{2\pi} = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2\pi\sqrt{(6.0 \times 10^{-3} \text{ H})(10 \times 10^{-6} \text{ F})}} = 650 \text{ Hz} .$$

- (b) The inductive reactance is  $X_L = \omega_d L = 2\pi f_d L = 2\pi(650 \text{ Hz})(6.0 \times 10^{-3} \text{ H}) = 24 \Omega$ . The capacitive reactance has the same value at this frequency.
- (c) The natural frequency for free  $LC$  oscillations is  $f = \omega/2\pi = 1/2\pi\sqrt{LC}$ , the same as we found in part (a).