

PHYS 1304, Chp 33 Solutions, 7th Ed. Serway

P33.2 $\Delta V_{rms} = \frac{170 \text{ V}}{\sqrt{2}} = 120 \text{ V}$

(a) $p = \frac{(\Delta V_{rms})^2}{R} \rightarrow R = \frac{(120 \text{ V})^2}{75.0 \text{ W}} = \boxed{193 \Omega}$

(b) $R = \frac{(120 \text{ V})^2}{100 \text{ W}} = \boxed{144 \Omega}$

P33.3 $\Delta V_{rms} = \frac{100}{\sqrt{2}} = \boxed{70.7 \text{ V}}$, $I_{rms} = \frac{\Delta V_{rms}}{R} = \frac{70.7}{24} = \boxed{2.95 \text{ A}}$

P33.8 $X_L^{50} = 2\pi f_{50} L = 2\pi f_{50} \cdot \left(\frac{X_L^{60}}{2\pi f_{60}} \right) = 2\pi(50) \cdot \left(\frac{54}{2\pi \cdot 60} \right) = \boxed{45 \Omega}$

$I_{max} = \frac{\Delta V_{max}}{X_L} = \frac{\sqrt{2}(\Delta V_{rms})}{X_L} = \frac{\sqrt{2} \cdot (100)}{45} = \boxed{3.14 \text{ A}}$

P33.12 (a) $X_C = \frac{1}{2\pi f C} < \frac{1}{2\pi f(22.0 \times 10^{-6})} < 175 \Omega$
 $\frac{1}{2\pi(22.0 \times 10^{-6})(175)} < f \quad \boxed{f > 413 \text{ Hz}}$

(b) $X_C \propto \frac{1}{C}$, so $X(44) = \frac{1}{2} X(22)$: $\boxed{X_C < 87.5 \Omega}$

P33.13 $I_{max} = \sqrt{2} I_{rms} = \frac{\sqrt{2}(\Delta V_{rms})}{X_C} = \sqrt{2}(\Delta V_{rms})2\pi f C$

(a) $I_{max} = \sqrt{2}(120 \text{ V})2\pi(60.0/\text{s})(2.20 \times 10^{-6} \text{ C/V}) = \boxed{141 \text{ mA}}$

(b) $I_{max} = \sqrt{2}(240 \text{ V})2\pi(50.0/\text{s})(2.20 \times 10^{-6} \text{ F}) = \boxed{235 \text{ mA}}$

P33.19 $\omega L = \frac{1}{\omega C} \rightarrow \omega = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{(57.0 \times 10^{-6})(57.0 \times 10^{-6})}} = 1.75 \times 10^4 \text{ rad/s}$

$f = \frac{\omega}{2\pi} = \boxed{2.79 \text{ kHz}}$

P33.19

(a) $X_L = \omega L = 2\pi(50.0 \text{ s}^{-1})(250 \times 10^{-3} \text{ H}) = \boxed{78.5 \Omega}$

(b) $X_C = \frac{1}{\omega C} = \left[2\pi(50.0 \text{ s}^{-1})(2.00 \times 10^{-6} \text{ F})\right]^{-1} = \boxed{1.59 \text{ k}\Omega}$

(c) $Z = \sqrt{R^2 + (X_L - X_C)^2} = \boxed{1.52 \text{ k}\Omega}$

(d) $I_{\text{max}} = \frac{\Delta V_{\text{max}}}{Z} = \frac{210 \text{ V}}{1.52 \times 10^3 \Omega} = \boxed{138 \text{ mA}}$

(e) $\phi = \tan^{-1}\left[\frac{X_L - X_C}{R}\right] = \tan^{-1}(-10.1) = \boxed{-84.3^\circ}$

P33.24

$X_C = \frac{1}{\omega C} = \frac{1}{2\pi(50.0)(65.0 \times 10^{-6})} = 49.0 \Omega$

$X_L = \omega L = 2\pi(50.0)(185 \times 10^{-3}) = 58.1 \Omega$

$Z = \sqrt{R^2 + (X_L - X_C)^2} = \sqrt{(40.0)^2 + (58.1 - 49.0)^2} = 41.0 \Omega$

$I_{\text{max}} = \frac{\Delta V_{\text{max}}}{Z} = \frac{150}{41.0} = 3.66 \text{ A}$

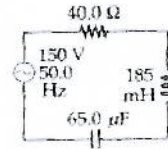


FIG. P33.26

(a) $\Delta V_R = I_{\text{max}} R = (3.66)(40) = \boxed{146 \text{ V}}$

(b) $\Delta V_L = I_{\text{max}} X_L = (3.66)(58.1) = 212.5 = \boxed{212 \text{ V}}$

(c) $\Delta V_C = I_{\text{max}} X_C = (3.66)(49.0) = 179.1 \text{ V} = \boxed{179 \text{ V}}$

(d) $\Delta V_L - \Delta V_C = 212.5 - 179.1 = \boxed{33.4 \text{ V}}$

P33.40

(a) $\Delta V_{2, \text{rms}} = \frac{1}{13}(120 \text{ V}) = \boxed{9.23 \text{ V}}$

(b) $\Delta V_{1, \text{rms}} I_{1, \text{rms}} = \Delta V_{2, \text{rms}} I_{2, \text{rms}}$
 $(120 \text{ V})(0.350 \text{ A}) = (9.23 \text{ V}) I_{2, \text{rms}}$
 $I_{2, \text{rms}} = \frac{42.0 \text{ W}}{9.23 \text{ V}} = \boxed{4.55 \text{ A}}$ for a transformer with no energy loss.

(c) $\mathcal{P} = \boxed{42.0 \text{ W}}$ from part (b).