

31-29. Note that $\omega = 2\pi f = 2\pi \cdot 400 = 2513 \text{ rad/s}$.

(a) Eq. 31.24:

$$\tan \phi = \frac{\omega L - 1/\omega C}{R} = \frac{2513 \cdot .12 - (2513 \cdot 7.3 \times 10^{-6})^{-1}}{240} = 1.03$$

So $\phi = 45.8^\circ$ and $\cos \phi = 0.697$.

(b) $X_L = \omega L = 301.6 \Omega$; $X_C = 1/\omega C = 54.5 \Omega$. Eq. 31.23:

$$Z = \sqrt{R^2 + (X_L - X_C)^2} = \sqrt{240^2 + (301.6 - 54.5)^2} = 344.4 \Omega$$

(c)

$$V_{\text{rms}} = ZI_{\text{rms}} = 344.4 \cdot .45 = 155 \text{ V}$$

(d) According to the paragraph opposite Fig. 31.17 on page 1076, we can calculate the average power either by $P_{\text{av}} = V_{\text{rms}}I_{\text{rms}} \cos \phi$ or $P_{\text{av}} = I_{\text{rms}}^2 R$, I select the latter (since all the required quantities are given in the problem):

$$P_{\text{av}} = I_{\text{rms}}^2 R = .45^2 \cdot 240 = 48.6 \text{ W}$$

(e) Obviously same as above.

(f) 0 (See previously cited paragraph.)

(g) 0

31-33. (a) At resonance $X_L = X_C$ so $\phi = 0$, and $\cos 0 = 1$

(b) At resonance the voltage across the resistor equals the source voltage, so

$$P_{\text{av}} = I_{\text{rms}}^2 R = V_{\text{rms}}^2/R = \frac{1}{2}V_{\text{max}}^2/R = \frac{150^2}{2 \cdot 150} = 75 \text{ W}$$

(c) Still 75 W as the previous discussion still holds.

31-37. (a) Eq. 31.35:

$$\frac{N_2}{N_1} = \frac{V_2}{V_1} = \frac{12}{120} = \frac{1}{10}$$

So: $N_1/N_2 = 10$, i.e., primary has 10× the turns of the secondary.

(b)

$$I_{\text{rms}} = V_{\text{rms}}/R = 12/5 = 2.4 \text{ A}$$

(c)

$$P_{\text{av}} = V_{\text{rms}}^2/R = 12^2/5 = 28.8 \text{ W}$$

(d)

$$R = V_{\text{rms}}^2/P_{\text{av}} = 500 \Omega$$

$$5 \cdot 10^2 = 500$$

31-42. (a) $X_L = \omega L = 80 \Omega$; $X_C = 1/\omega C = 833.3 \Omega$; $V_{\text{rms}} = V/\sqrt{2} = 21.21 \text{ V}$.

$$Z = \sqrt{R^2 + (X_L - X_C)^2} = \sqrt{200^2 + (80 - 833.3)^2} = 779.4 \Omega$$

$$I_{\text{rms}} = V_{\text{rms}}/Z = 21.21/779.4 = 0.02722 \text{ A}$$

$$V_5 = V_{\text{rms}} = 21.2 \text{ V}$$

$$V_1 = RI_{\text{rms}} = 200 \cdot 0.02722 = 5.44 \text{ V}$$

$$V_2 = X_L I_{\text{rms}} = 80 \cdot 0.02722 = 2.18 \text{ V}$$

$$V_3 = X_C I_{\text{rms}} = 833.3 \cdot 0.02722 = 22.7 \text{ V}$$

$$V_4 = |X_C - X_L| I_{\text{rms}} = (833.3 - 80) \cdot 0.02722 = 20.5 \text{ V}$$

(b) $X_L = \omega L = 400 \Omega$; $X_C = 1/\omega C = 166.7 \Omega$; $V_{\text{rms}} = V/\sqrt{2} = 21.21 \text{ V}$.

$$Z = \sqrt{R^2 + (X_L - X_C)^2} = \sqrt{200^2 + (400 - 166.7)^2} = 307.3 \Omega$$

$$I_{\text{rms}} = V_{\text{rms}}/Z = 21.21/307.3 = 0.06902 \text{ A}$$

$$V_5 = V_{\text{rms}} = 21.2 \text{ V}$$

$$V_1 = RI_{\text{rms}} = 200 \cdot 0.06902 = 13.8 \text{ V}$$

$$V_2 = X_L I_{\text{rms}} = 400 \cdot 0.06902 = 27.6 \text{ V}$$

$$V_3 = X_C I_{\text{rms}} = 166.7 \cdot 0.06902 = 11.5 \text{ V}$$

$$V_4 = |X_C - X_L| I_{\text{rms}} = (400 - 166.7) \cdot 0.06902 = 16.1 \text{ V}$$