HW12

31-2 $L = 22.0\,mH = 2.2 \times 10^{-2}\,H$

$X_L = \omega L = 6.60 \times 10^2\,\Omega$

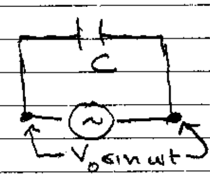
$\omega = \frac{X_L}{L}$

$f = \frac{\omega}{2\pi} = \frac{X_L}{2\pi L} = \frac{6.60 \times 10^2\,\Omega}{(6.28)(2.2 \times 10^{-2}\,H)}$

$= (0.478) \times 10^4\,Hz$

$= 4.78 \times 10^3\,Hz = 4.78\,kHz$

31-9(a) $V = V_0 \sin \omega t$



$V(t) = \frac{Q(t)}{C}$

$Q(t) = C\,V(t) = C V_0 \sin \omega t$

$I(t) = \frac{dQ(t)}{dt} = \omega C V_0 \cos \omega t$

because: $\sin(\omega t + 90^\circ) = \sin \omega t \cos \pi/2 + \cos \omega t \sin \pi/2$ ($\delta = \pi/2$; $\cos \pi/2 = 0$, $\sin \pi/2 = 1$)

also have:

$I(t) = \omega C V_0 \sin(\omega t + 90^\circ)$

31-19 For coil $Z = 335\,\Omega$

$X_L = 45.5\,\Omega$

Can treat the coil as part of an LRC circuit with $X_C = 0$.

In general

$Z = \sqrt{R^2 + (X_L - X_C)^2}$ ($X_C = 0$)

So now

$Z = \sqrt{R^2 + X_L^2}$

$R = \sqrt{Z^2 - X_L^2}$

$= \sqrt{(3.35 \times 10^2)^2 - (4.55 \times 10^1)^2}\,\Omega$

$= 332\,\Omega$

31-23 LRC circuit

$L = 32.0\ mH$

$R = 8.70\ k\Omega$

$C = 5000\ pF$

$V_{rms} = 800\ V$

$f = 10.0\ kHz$

$\omega = 2\pi f = 62.8\ kHz$

$X_L = \omega L = (62.8\times10^3)(32.0\times10^{-3})\ \Omega$

$= 2.01\times10^3\ \Omega$

$X_C = \dfrac{1}{\omega C} = \dfrac{1}{(62.8\times10^3)(5.00\times10^3\times10^{-12})}\ \Omega$

$= 3.18\times10^{-3}\times10^6\ \Omega$

Eq (31-9a) $= 3.18\times10^3\ \Omega$

- Impedance

$Z = \sqrt{(8.70\times10^3)^2 + (2.01\times10^3 - 3.18\times10^3)^2}\ \Omega$

Eq (31-10a) $= 8.78\times10^3\ \Omega = 8.78\ k\Omega$

- Phase angle

$\tan\phi = \dfrac{X_L - X_C}{Z} = \dfrac{-1.17\ k\Omega}{8.78\ k\Omega} = -0.134$

(p. 779) $\rightarrow \phi = -7.63°$

- $I_{rms} = \dfrac{V_{rms}}{Z} = \dfrac{8\times10^2\ V}{8.78\times10^3\ \Omega} = 9.11\times10^{-2}\ A$

31-25 LRC circuit of Example 31-3

$L = 30.0\ mH$

$C = 12.0\ \mu F$

resonant frequency

$f_0 = \dfrac{\omega}{2\pi} = \dfrac{1}{2\pi\sqrt{LC}}$

$= \dfrac{1}{(6.28)(30.0\times10^{-3}\ H\times12.0\times10^{-6}\ F)^{1/2}}$

$= (2.65\times10^{-2})\times10^4\ Hz$

$= 2.65\times10^2\ Hz$

$= 265\ Hz$

32-9 $E_0 = 0.43 \times 10^{-4} \frac{V}{m}$

for wave

$B_0 = \frac{E_0}{c}$ (see Ex 32-3)

$= \frac{0.43 \times 10^{-4} \frac{V}{m}}{3.0 \times 10^{8} \frac{m}{s}}$

$= 0.14 \times 10^{-12}$ T

32-11 $E_x = E_0 \cos(kz + \omega t)$

$E_y = E_z = 0$

b) $\cos(kz + \omega t)$

↑ wave is moving in $-z$-direction

a) B must be perp. to $\vec{E}$ and direction of motion

B_y is only non-zero component

$\Rightarrow B_y^{max} = B_0 = \frac{E}{c}$

$B_x = B_z = 0$

direction of propagation is given by

$\vec{E} \times \vec{B}$

direction of wave is $-\hat{k}$

then we have $\vec{E} = \hat{i} E_0 \cos(kz + \omega t)$

$\vec{B} = -\hat{j} B_0 \cos(kz + \omega t)$

because $\hat{i} \times (-\hat{j}) = -\hat{k}$