HW Solution 1

August 24, 2010

32.6.
(a) $f = \frac{c}{\lambda} = \frac{3.00*10^8 m/s}{435*10^{-9} m} = 6.90 * 10^{14} Hz$
(b) $B_{max} = \frac{E_{max}}{c} = \frac{2.70*10^{-3} V/m}{435*10^{-9} m} = 9.00 * 10^{-12} T$
(c) $k = \frac{2\pi}{\lambda} = 1.44 * 10^7 rad/m$, $\omega = 2\pi f = 4.34 * 10^{15} rad/s$
$\vec{E}(z,t) = \hat{i} E_{max} cos(kz + \omega t) = \hat{i}(2.70 * 10^{-3} V/m) cos[(1.44 * 10^7 rad/s)z + (4.34 * 10^{15} rad/s)t]$
$\because \vec{E} \times \vec{B}$ is in the $-\hat{k}$ direction
$\therefore \vec{B}(z,t) = -\hat{j} B_{max} cos(kz+\omega t) = -\hat{j}(9.00*10^{-12} V/m) cos[(1.44*10^7 rad/s)z+(4.34*10^{15} rad/s)t]$

32.8.
(a) $B_{max} = \frac{E_{max}}{c} = 1.25 \mu T$
(b) $f = \frac{\omega}{2\pi} = 9.50 * 10^{14} Hz$
$\lambda = \frac{2\pi}{k} = 3.16 * 10^{-7} m$
$T = \frac{1}{f} = 1.05 * 10^{-15} s$
The wavelength is too short for the light to be visible to humans.
(c) $c = f\lambda = (9.50 * 10^{14} Hz)(3.16 * 10^{-7} m) = 3.00 * 10^8 m/s$.

32.10.
(a) The wave is traveling in the $-x$ direction.
(b) $\because k = \frac{2\pi}{\lambda} = \frac{2\pi f}{c}$
$\therefore f = \frac{kc}{2\pi} = 6.59 * 10^{11} Hz$
(c) For $\vec{B}$ is in the $+y$ direction and wave is traveling in the $-x$ direction, therefore $\vec{E}$ is in the $+z$ direction.
$\vec{E}(x,t) = \hat{k} c B(x,t) = \hat{k}(2.48 V/m) sin[(1.38 * 10^4 rad/m)x + (4.14 * 10^{12} rad/s)t]$