Physics 151

Prof. Thomson's Section

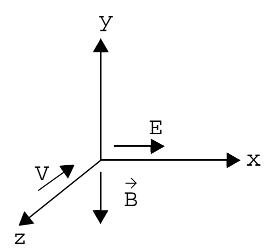
Solutions to Quiz on Ch 32
April 18, 2005

1. (a) $f = \dfrac{c}{\lambda} = \dfrac{3 \times 10^8}{435\times10^{-9}} = 6.90\times10^{14}$ Hz

(b) $B = \dfrac{E}{c} = \dfrac{2.70\times10^{-3}}{3\times10^8} = 9.00\times10^{-12}$ T

(c) $\vec{E}(z,t) = E_{max}\,\hat{i}\cos(kz+\omega t)$

$\vec{B}(z,t) = B_{max}(-\hat{j})\cos(kz+\omega t)$



$k = 2\pi/\lambda$

$k = 1.44\times10^7\,m^{-1}$

$\omega = 2\pi f$

$\omega = 4.34\times10^{15}$ rad/s

B_{max} = B from part (b) = 9.00×10^{-12}T

$E_{max} = 2.70\times10^{-3}$ V/m

Direction of motion given by $\vec{E}\times\vec{B}$

$\therefore$ $\vec{B}$ points in -ve y direction

2. $\lambda = \dfrac{c}{f} = \dfrac{3\times10^8}{750\times10^6} = \underline{\underline{0.4m}}$

Nodes in electric field occur at conducting planes and at $\lambda/2 = 0.2m$ intervals.
$\vec{E}$ is zero here.

Could place particle at 20cm, 40cm, 60cm between planes and it would remain at rest since $\vec{E} = 0$, and particle is not moving, so force from magnetic field $\vec{f} = q\vec{v}\times\vec{B}$ would be zero.