$\lambda = 400\,nm$ Phys Final #3 $\varepsilon_0 = 8.85\times10^{-12}\ \frac{C^2}{Nm^2}$ Josh Whitehead v1069343

a) $\vec{E}(z,t) = E_{max}\cos(kz-\omega t)\hat{j}$

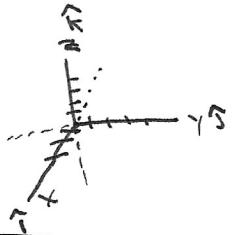
$f = \frac{c}{\lambda} = \frac{3\times10^8\ \frac{m}{s}}{400\,nm} = 7.5\times10^{14}\ Hz$

$\omega = 2\pi\cdot f = 4.71\times10^{15}$

$k = \frac{2\pi}{\lambda} = \frac{\pi}{200} = 0.016$

b) $\vec{B} = B_{max}\cos(kz-\omega t)$ $B_{max} = \frac{E_{max}}{c} = \frac{600\frac{V}{m}}{3\times10^8\ m/s} = 2.00\times10^{-6}\ \frac{V\cdot s}{m^2}$

$\vec{B} = 2.00\times10^{-6}\cos(0.016z - 4.71\times10^{15}t)\hat{i}$



EM wave direction $= \vec{E}\times\vec{B}$ .. $\vec{B}$ oscillates in X-Z Plane

c) $u_{avg} = u_E + u_B = \frac{1}{2}\varepsilon_0 E^2 + \frac{1}{2\mu_0}B^2 = \frac{1}{2}8.85\times10^{-12}\ \frac{C^2}{Nm^2}\cdot\left(600\frac{V}{m}\right)^2 + \frac{1}{2(4\pi\times10^{-7})\frac{N}{A^2}} = 2.56\ T$

$I = u_{avg}\cdot c = 0.796\cdot3\times10^8 = 2.39\times10^8\ \frac{Nm}{s}$

$u_{avg} = 0.796\ N$

D) $P = \frac{I}{c} = u_{avg} = 0.796\ N$