Name KEY
Summer Session

SP212R
Aug 2007

1. The magnetic field part of an electromagnetic wave is given by:

$$B_x = 0.003\sin\left(kz - 6\pi\times10^8 t\right)$$

where B is in Tesla, z is in meters and t is in seconds. The wave is moving in outer space where the speed of light is 3 x 10^8 m/s.

a. What is the direction of propagation? Be as specific as possible. (right or left are not enough) (1)

+ z DIRECTION

b. What is the amplitude of the wave? Include units. (1)

$B_{z0} = 0.003$ T

c. What is the angular frequency? Include units. (1)

$\omega = 6\pi \times 10^8$ RAD/s

d. What is the frequency? Include units. (1)

$f = \frac{\omega}{2\pi} = \frac{6\pi}{2\pi\ \text{RAD}} \times 10^8\ \text{RAD/s} = 3\times10^8\ 1/\text{s} = 3\times10^8\ \text{Hz}$

e. What is the period? Include units. (2)

$T = \frac{1}{f} = \frac{1}{3\times10^8\ \text{Hz}} = 3.3\times10^{-9}\ \text{s}$

f. What is wave number? Again, do not forget units! (2)

$k = \frac{\omega}{c} = \frac{6\pi\times10^8\ \text{rad/s}}{3\times10^8\ \text{m/s}} = 2\pi\ \text{RAD/m}$

g. What is the wavelength? Include units. (2)

$\lambda = \frac{c}{f} = \frac{3\times10^8\ \text{m/s}}{3\times10^8\ \text{Hz}} = 1\ \text{m}$

Useful equations: $v = f\lambda$ $\quad k = \frac{2\pi}{\lambda}$ $\quad \omega = \frac{2\pi}{T}$ $\quad f = \frac{1}{T}$