Practice Problems Section 14 Solutions

1. A sinusoidal (simple harmonic) electromagnetic wave in vacuum has a frequency of 5.0 x 1015 Hz. The wave has magnetic field amplitude equal to T. The wave is traveling in the + direction and the magnetic field initially points in the direction.

Write the equation which describes the electric field (magnitude and direction) of this wave as a function of position and time . **Show your work in finding all constants and make sure to specify the direction of the electric field.**

The wave function magnitude for a simple harmonic electromagnetic wave is

Thus, we must find and the direction of travel to specify the wave. In addition, we must find the direction in which the electric field oscillates.

Let’s find the direction of oscillation first: The wave is traveling in the direction and the magnetic field points in the direction. An electromagnetic wave always propagates in the direction of . For this cross product to point in the direction, **the electric field must point in the direction.**

* Since the wave is propagating in the positive x-direction, we choose the “minus” sign in the wave function.

Thus, our final answer is:

For a wave traveling along the x-axis:

Direction of travel of the wave is the direction of