Electromagnetism MC2 2002/3 – Multiple choice.

MC2) All of the following questions relate to plane electromagnetic waves travelling in free space with $\underline{E}$ and $\underline{B} \propto e^{j(\omega t - \underline{k}\cdot\underline{r})}$

MC2.1) If $\underline{E}_0 = \begin{pmatrix} -1 \\ -3 \\ +2 \end{pmatrix}$ Vm^{-1} and $\underline{k}$ is in the $\begin{pmatrix} +4 \\ -2 \\ -1 \end{pmatrix}$ direction what is the direction of $\underline{B}_0$?

a) $\begin{pmatrix} +4 \\ -7 \\ -8 \end{pmatrix}$ b) $\begin{pmatrix} -8 \\ 14 \\ -7 \end{pmatrix}$ c) $\begin{pmatrix} -7 \\ -7 \\ -14 \end{pmatrix}$ d) $\begin{pmatrix} +7 \\ -14 \\ +8 \end{pmatrix}$ e) None of the previous

MC2.2) If $\underline{B}_0 = \begin{pmatrix} +1 \\ 0 \\ -1 \end{pmatrix}$ T and $\underline{E}_0$ is in the $\begin{pmatrix} -1 \\ +2 \\ -1 \end{pmatrix}$ direction what is the direction of $\underline{k}$?

a) $\begin{pmatrix} -2 \\ +2 \\ -2 \end{pmatrix}$ b) $\begin{pmatrix} 2 \\ 1 \\ 2 \end{pmatrix}$ c) $\begin{pmatrix} +1 \\ +2 \\ -2 \end{pmatrix}$ d) $\begin{pmatrix} -1 \\ -1 \\ -1 \end{pmatrix}$ e) None of the previous

MC2.3) If $\underline{k} = \begin{pmatrix} +3 \\ +1 \\ -1 \end{pmatrix}$ m^{-1} and $\underline{B}_0$ is in the $\begin{pmatrix} -1 \\ +2 \\ -1 \end{pmatrix}$ direction what is the direction of $\underline{E}_0$?

a) $\begin{pmatrix} -1 \\ -4 \\ -7 \end{pmatrix}$ b) $\begin{pmatrix} -3 \\ -4 \\ -7 \end{pmatrix}$ c) $\begin{pmatrix} -1 \\ -2 \\ -7 \end{pmatrix}$ d) $\begin{pmatrix} -1 \\ +3 \\ -5 \end{pmatrix}$ e) None of the previous

MC2.4) What (to 2 sig. figs.) is the magnitude of the $\underline{B}$ – field for the situation described in the previous question if $\left|\underline{E}_0\right| = 4.0$ Vm^{-1}?

a) 8.3 x 10^{-10} T
b) 0.75 x 10^{-7} T
c) 1.2 x 10^{9} T
d) 1.3 x 10^{-8} T
e) None of the previous

MC2.5) If $\underline{B}_0 = \begin{pmatrix} 4 \\ 1 \\ 2 \end{pmatrix}$ T what is the value of $\left|\underline{E}_0\right|$ (to 2 sig. figs.)?

    a) 1.5×10^{-8} Vm^{-1}
    b) 1.4×10^{9} Vm^{-1}
    c) 6.5×10^{7} Vm^{-1}
    d) 7.3×10^{-10} Vm^{-1}
    e) None of the previous

MC2.6) If the above wave in MC2.5) has a frequency of 1000 Hz which of the following is a possible value for $\underline{k}$?

a) $9.43 \times 10^{-5} \begin{pmatrix} +1 \\ -1 \\ -1 \end{pmatrix}$ m^{-1} b) $6.52 \times 10^{-6} \begin{pmatrix} +1 \\ 0 \\ -2 \end{pmatrix}$ m^{-1}

c) $4.21 \times 10^{-5} \begin{pmatrix} +1 \\ -2 \\ -2 \end{pmatrix}$ m^{-1} d) $8.55 \times 10^{-6} \begin{pmatrix} +1 \\ -2 \\ -1 \end{pmatrix}$ m^{-1} e) None of the previous