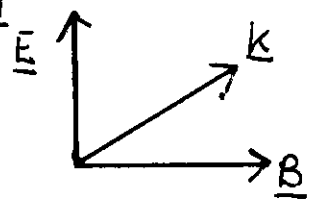
ELECTROMAGNETISM MC2 ANSWERS

MC2.1



$\underline{E}, \underline{B}, \underline{k}$ are mutually orthogonal [$\underline{k}\cdot\underline{E}=0$ etc]

$\underline{B}_0$ is in the direction of $\underline{k}\times\underline{E}_0$

i.e. in direction of $\begin{pmatrix}4\\-2\\-1\end{pmatrix}\times\begin{pmatrix}-1\\-3\\2\end{pmatrix}=\begin{pmatrix}-7\\-7\\-14\end{pmatrix}$ answer c)

MC2.2 $\underline{k}$ is in the direction of $\underline{E}_0\times\underline{B}_0=\begin{pmatrix}-1\\2\\-1\end{pmatrix}\times\begin{pmatrix}1\\0\\-1\end{pmatrix}=\begin{pmatrix}-2\\-2\\-2\end{pmatrix}$

[$\underline{E}_0\cdot\underline{B}_0=0$ etc]

This is equivalent to the $\begin{pmatrix}-1\\-1\\-1\end{pmatrix}$ direction, answer d)

MC2.3 $\underline{E}_0$ is in the direction of $\underline{B}_0\times\underline{k}=\begin{pmatrix}-1\\2\\-1\end{pmatrix}\times\begin{pmatrix}3\\1\\-1\end{pmatrix}=\begin{pmatrix}-1\\-4\\-7\end{pmatrix}$

[Note $\underline{B}_0\cdot\underline{k}=0$ etc]

answer a)

MC2.4 Reference to previous question is irrelevant!

In Free space we always have that $B_0=E_0/c$

Thus $|\underline{B}_0| = B_0 = 4.0/3\times10^8 = 1.3\times10^{-8}$ T (2 s.f.'s)

answer d)

MC2.5 $|\underline{B}_0| = \sqrt{21}$ T, $E_0 = cB_0 = 3\times10^8\times\sqrt{21} = 1.4\times10^9$ V m^{-1} (2 s.f.'s)

answer b)

MC2.6 We require that $\underline{B}_0\cdot\underline{k}=0$ which rules out both a) and c) immediately!

b) and d) are both initially possibilities but we also require that $\frac{\omega}{k}=c$. In this case the angular Frequency is $\omega = 2\pi\times1000$ s^{-1}

so $k=\frac{\omega}{c}=\frac{2\pi\times1000}{3\times10^8}=2.094\times10^{-5}$ m^{-1}

Only answer d) with $|\underline{k}| = 8.55\times10^{-6}\times\sqrt{6}$
$= 2.094\times10^{-5}$ m^{-1}

is consistent with this.