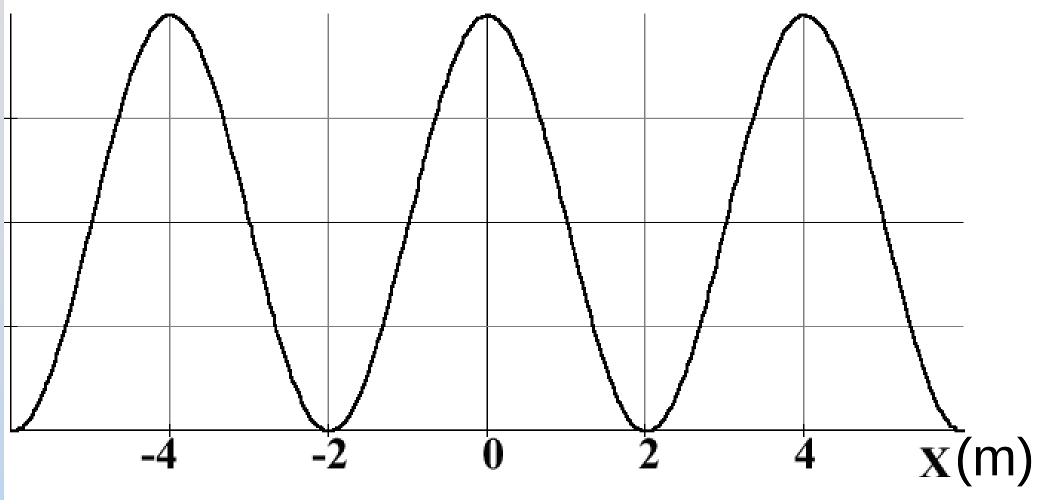
Concept Question: Wave

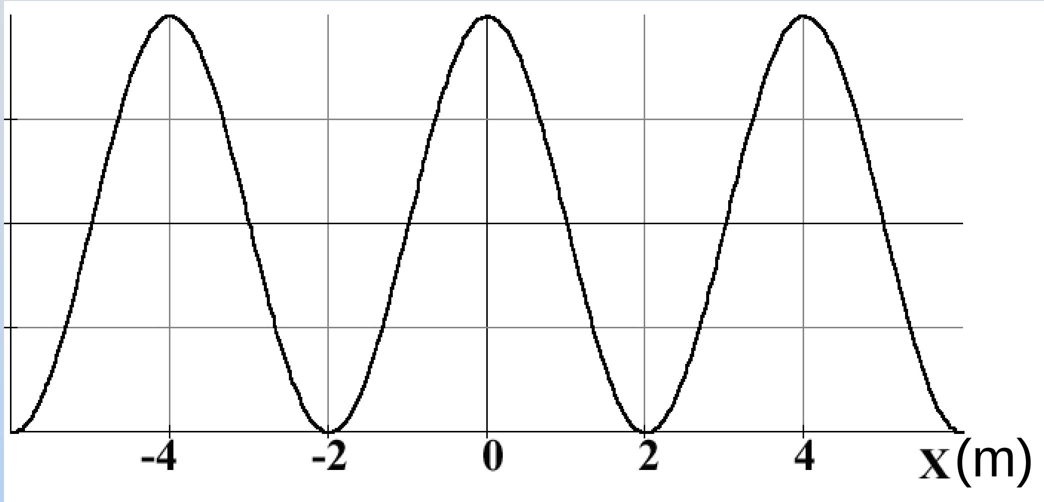


The graph shows a plot of the function
$y = \cos(k x)$. The value of k is

1. ½ m^{-1}
2. ¼ m^{-1}
3. π m^{-1}
4. $\pi/2$ m^{-1}
5. I don't know

Concept Question Answer: Wave

Answer: 4. $k = \pi/2\ m^{-1}$

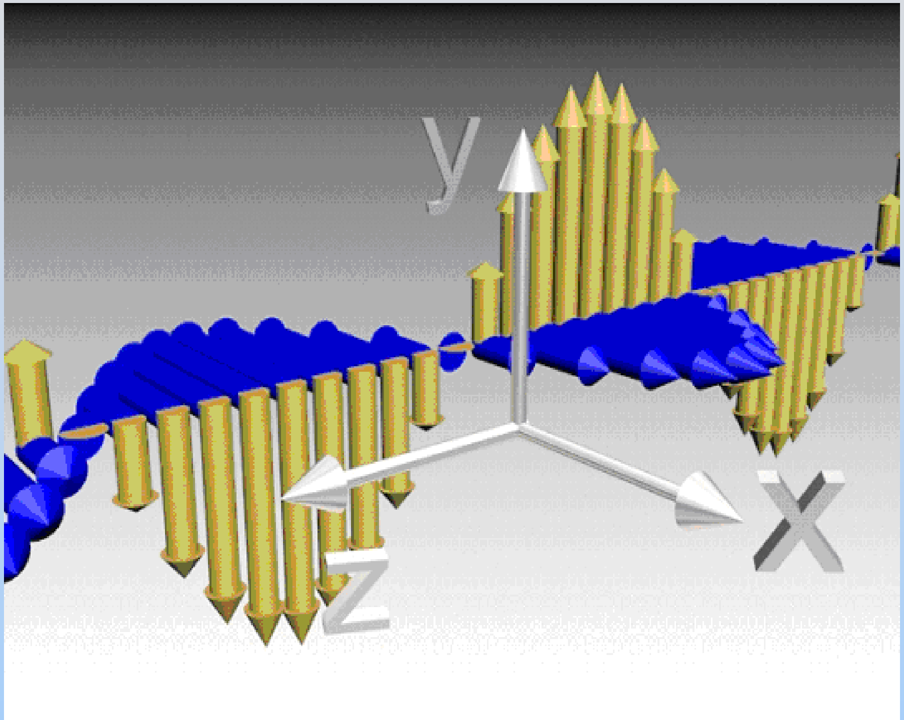


$\lambda = 4\ m \rightarrow k = 2\pi/\lambda = \pi/2\ m^{-1}$

$y = \cos(\pi x/2)$ is 1 at $x = -4$ m, 0 m, 4 m, etc.

Concept Question: Direction of Propagation

The figure shows the E (yellow) and B (blue) fields of a plane wave. This wave is propagating in the

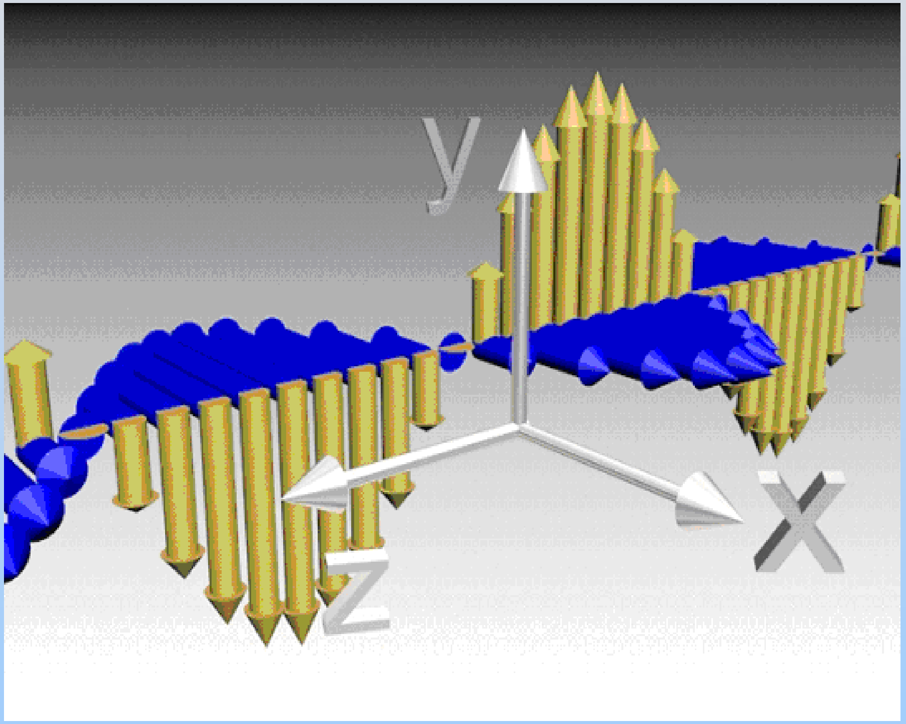


1. +x direction
2. –x direction
3. +z direction
4. –z direction
5. I don't know

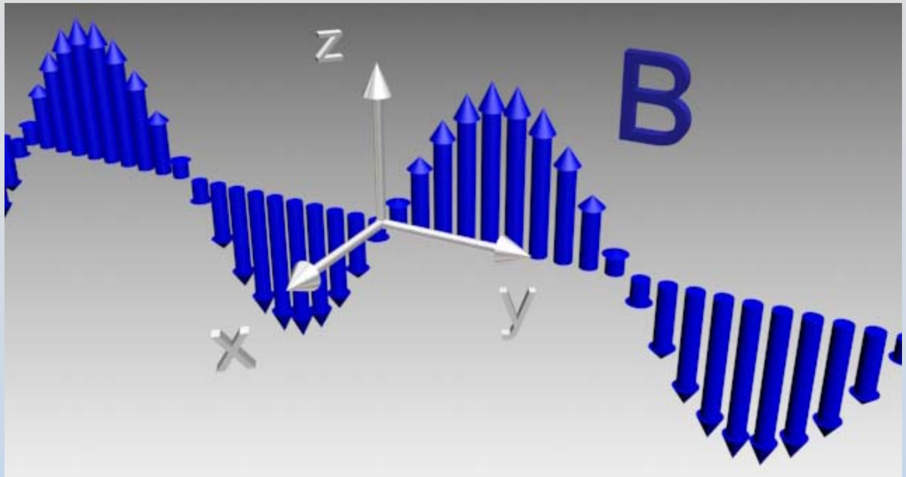
Concept Question Answer: Propagation

Answer: 4. The wave is moving in the –z direction

The propagation direction is given by the direction of **E** x **B** (Yellow x Blue)



Concept Question: Traveling Wave



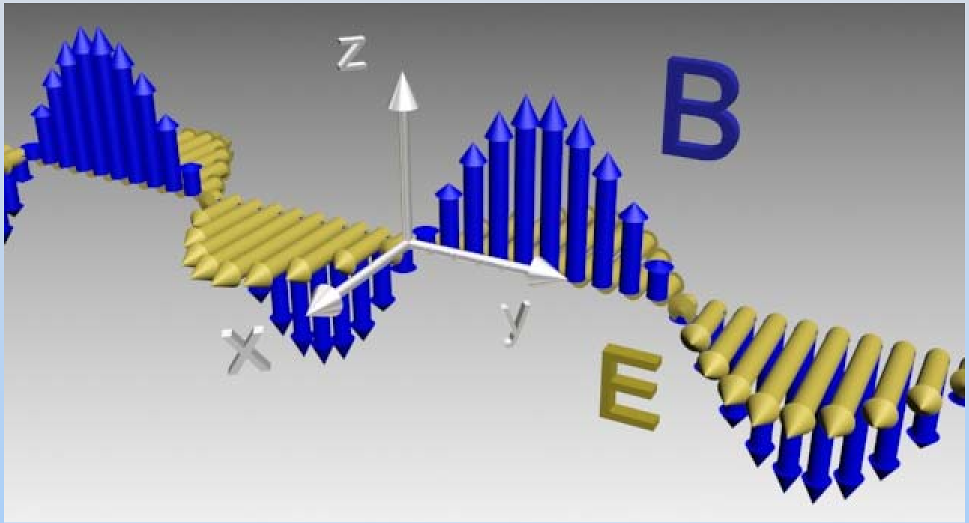
The B field of a plane EM wave is $\vec{\mathbf{B}}(z,t) = \hat{\mathbf{k}}B_0 \sin(ky - \omega t)$

The electric field of this wave is given by

1. $\vec{\mathbf{E}}(z,t) = \hat{\mathbf{j}}E_0 \sin(ky - \omega t)$
2. $\vec{\mathbf{E}}(z,t) = -\hat{\mathbf{j}}E_0 \sin(ky - \omega t)$
3. $\vec{\mathbf{E}}(z,t) = \hat{\mathbf{i}}E_0 \sin(ky - \omega t)$
4. $\vec{\mathbf{E}}(z,t) = -\hat{\mathbf{i}}E_0 \sin(ky - \omega t)$
5. I don't know

Concept Question Answer: Traveling Wave

Answer: 4. $\vec{\mathbf{E}}(z,t) = -\hat{\mathbf{i}} E_0 \sin(ky - \omega t)$



From the argument of the sin(ky - ωt), we know the wave propagates in the +y direction.

$$\text{So we have } \hat{\mathbf{E}} \times \hat{\mathbf{B}} = ? \times \hat{\mathbf{k}} = \hat{\mathbf{j}} \Rightarrow \hat{\mathbf{E}} = -\hat{\mathbf{i}}$$

Concept Question EM Wave

The E field of a plane wave is:

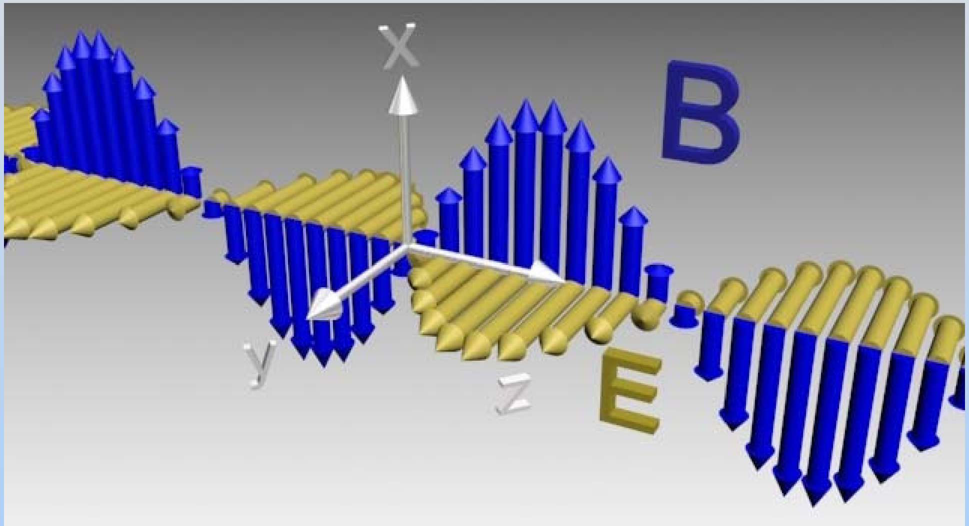
$$\vec{\mathbf{E}}(z,t) = \hat{\mathbf{j}} E_0 \sin(kz + \omega t)$$

The magnetic field of this wave is given by:

1. $\vec{\mathbf{B}}(z,t) = \hat{\mathbf{i}} B_0 \sin(kz + \omega t)$
2. $\vec{\mathbf{B}}(z,t) = -\hat{\mathbf{i}} B_0 \sin(kz + \omega t)$
3. $\vec{\mathbf{B}}(z,t) = \hat{\mathbf{k}} B_0 \sin(kz + \omega t)$
4. $\vec{\mathbf{B}}(z,t) = -\hat{\mathbf{k}} B_0 \sin(kz + \omega t)$
5. I don’t know

Concept Question Answer: EM Wave

Answer: 1. $\vec{\mathbf{B}}(z,t) = \hat{\mathbf{i}} B_0 \sin(kz + \omega t)$



From the argument of the $\sin(kz + \omega t)$, we know the wave propagates in the -z direction.

$$\text{So we have } \hat{\mathbf{E}} \times \hat{\mathbf{B}} = \hat{\mathbf{j}} \times ? = -\hat{\mathbf{k}} \Rightarrow \hat{\mathbf{B}} = \hat{\mathbf{i}}$$

8.02SC Physics II: Electricity and Magnetism
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