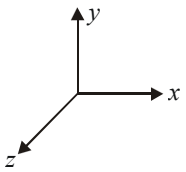
# 22 Electromagnetic Waves

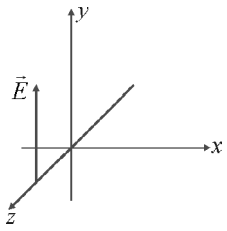
## Diagram Based Questions :

**1.** Light wave is travelling along $y$-direction. If the corresponding $\vec{E}$ vector at any time is along the $x$-axis, the direction of $\vec{B}$ vector at that time is along :



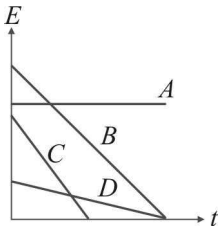

(a) $y$-axis (b) $x$-axis
(c) $+z$-axis (d) $-z$-axis

**2.** The figure here gives the electric field of an electromagnetic wave at a certain point and a certain instant. The wave is transporting energy in the negative $z$-direction. The direction of the magnetic field of the wave at that point and instant is



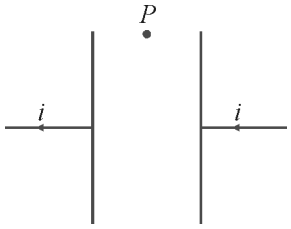

(a) + ve $x$-direction
(b) –ve $x$-direction
(c) +ve $z$-direction
(d) –ve $y$-direction

**3.** The figure shows graphs of the electric field magnitude $E$ versus time $t$ for four uniform electric fields, all contained within identical circular regions. Which of them is according to the magnitudes of the magnetic field?




(a) $A$ (b) $B$
(c) $C$ (d) $D$

**4.** Figure shows a parallel plate capacitor and the current in the connecting wires that is discharging the capacitor.




(a) The displacement current is leftward.
(b) The displacement current is rightward
(c) The electric field $\vec{E}$ is rightward
(d) The magnetic field at point $P$ is out the page.

# Solution

**1.** **(c)** Light wave is an electromagnetic wave in which $\vec{E}$ and $\vec{B}$ are at right angles to each other as well as at right angles to the direction of wave propagation.

**2.** **(a)** Direction of energy progration of EM-waves is given by

$\vec{D} = K(\vec{E} \times \vec{B})$ or $-\hat{k} = K(E\,\hat{j} \times \vec{B})$

Clearly direction of magnetic field is along positive $x$-axis.

**3.** **(c)** $\oint \vec{B}.d\vec{\ell}\sqrt{b^2 - 4ac} = \mu_0 \in_0 \frac{d\phi}{dt}$

or $B \times 2\pi r = \mu_0 \in_0 A\left(\frac{dE}{dt}\right) \quad \therefore \; B \propto \left(\frac{dE}{dt}\right)$

**4.** **(a)** According to conservation of charge, the displacement current must be leftward.