

NCERT 12.8 8

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Question 8

Suppose that the electric field amplitude of an electromagnetic wave is $E_0 = 120\text{N/C}$ and that its frequency is $f = 50.0\text{ MHz}$.

- (a) Determine, B_0 , ω , k and λ
 (b) Find expressions for \mathbf{E} and \mathbf{B}

Solution:

TABLE I
INPUT PARAMETERS

Symbol	Description	value
f	frequency of source	50.0 MHz
E_0	Electric field amplitude	120 N/C
c	speed of light	$3 \times 10^8\text{ m/s}$
$\mathbf{e}_2, \mathbf{e}_3$	Standard Basis vectors	N/A

TABLE II
FORMULAE AND OUTPUT

Symbol	Description	Formula	Value
\mathbf{E}	Electric field vector	$E_0 \sin(kx - 2\pi ft)\mathbf{e}_2$	$120 \sin[1.05x - 3.14 \times 10^8 t]\mathbf{e}_2$
\mathbf{B}	Magnetic field vector	$B_0 \sin(kx - 2\pi ft)\mathbf{e}_3$	$(4 \times 10^{-7}) \sin[1.05x - 3.14 \times 10^8 t]\mathbf{e}_3$
B_0	Magnetic field strength	$\frac{E_0}{c}$	400nT
ω	Angular frequency	$2\pi f$	$3.14 \times 10^8\text{ m/s}$
k	Propagation constant	$\frac{2\pi f}{c}$	1.05rad/s
λ	Wavelength	$\frac{c}{f}$	6.0m

Fig. 1. Graphs of \mathbf{E} and \mathbf{B}

