NCERT 12.8 8

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Question 8

Suppose that the electric field amplitude of an electromagnetic wave is $E_0 = 120$N/C and that its frequency is $f = 50.0$ MHz.
(a) Determine, B_0, ω, k and λ
(b) Find expressions for **E** and **B**

Solution:

$$c = \frac{\omega}{k} \tag{1}$$

$$c = f\lambda \tag{2}$$

$$\lambda = \frac{c}{f} \tag{3}$$

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 x 10^8 m/s
$\mathbf{e_2}, \mathbf{e_3}$	Standard Basis vectors	N/A

TABLE II
FORMULAE

Symbol	Description	Formula
E	Electric field vector	$E_0 \sin(kx - 2\pi ft)\mathbf{e_2}$
B	Magnetic field vector	$B_0 \sin(kx - 2\pi ft)\mathbf{e_3}$
B_0	Magnetic field strength	$B_0 = \frac{E_0}{c}$
ω	Angular frequency	$\omega = 2\pi f$
k	Propagation constant	$k = \frac{2\pi f}{c}$
λ	Wavelength	$\lambda = \frac{c}{f}$

TABLE III
OUTPUT PARAMETERS

Symbol	Value
E	$120\sin[1.05x - 3.14\text{x}10^8 t]\mathbf{e_2}$
B	$(4x10^{-7})\sin[1.05x - 3.14\text{x}10^8 t]\mathbf{e_3}$
B_0	400nT
ω	3.14 x 10^8m/s
k	1.05rad/s
λ	6.0m

Fig. 1. Graph of **E**

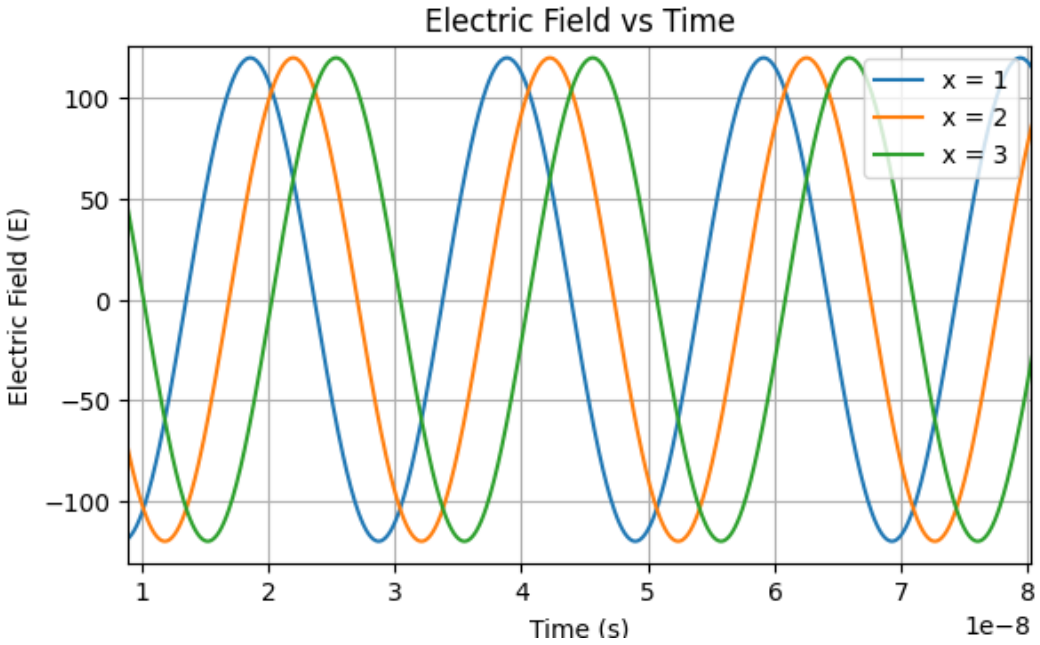

Fig. 2. Graph of **B**