

FIFTH MIDTERM

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REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
Use the conversion constants and data given on the front page.

Given the description below for the electric field in a light beam (x is in meters, t in seconds),

$$E = (0.325 \text{ V/m}) \sin ([5.23 \times 10^6]x + [1.20 \times 10^{14}]t)$$

$(E_{\text{MAX}}) \sin (kx + \omega t)$

(a) Calculate the magnitude of the speed of this wave.

$$v = \lambda f = \left(\frac{2\pi}{k}\right) \left(\frac{\omega}{2\pi}\right) = \frac{\omega}{k} = 2.29 \times 10^7 \text{ m/s}$$

(b) Clearly state the direction of the wave.

$$-x, -\hat{i}, \text{ Left}$$

(c) Calculate the maximum value of the B field (use the true velocity of the light in this calculation.)

$$B_{\text{MAX}} = \frac{E_{\text{MAX}}}{c} = 1.08 \times 10^{-9} \text{ T or } 1.08 \text{ nT}$$

(d) Find the wavelength (in meters) of the wave.

$$\lambda = \frac{2\pi}{k} = 1.20 \times 10^{-6} \text{ m}$$

(e) Calculate the frequency of the wave (in Hz).

$$f = \frac{\omega}{2\pi} = 1.90 \times 10^{13} \text{ Hz}$$