

## SIXTH MIDTERM

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**SHOW ALL WORK!!!!**

**REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!**

**Use the conversion constants and data given on the front page.**

A beam of laser light has an electric field described by:

$$E = (2.75 \times 10^{-2} \text{ V/m}) \cos \left[ (2.75 \times 10^6) x - (8.65 \times 10^{14}) t \right]$$

where  $x$  is in meters and  $t$  in seconds.

- Calculate the wavelength of the light wave.
- Find the frequency,  $f$ , for this light wave.
- Determine the velocity of this light wave (not  $c$ , but close).
- What is the energy density at the maximum value of the electric field?
- Using the true velocity of light (c), calculate the maximum value of the magnetic field.

5 a.  $\lambda = \frac{2\pi}{k} = 2.28 \times 10^{-6} \text{ m}$

5 b.  $f = \frac{\omega}{2\pi} = 1.38 \times 10^{14} \text{ Hz}$

5 c.  $v = \lambda f = 3.153 \times 10^8 \text{ m/s}$

5 d.  $u_E = \frac{1}{2} \epsilon_0 E^2 = 3.35 \times 10^{-15} \text{ J/m}^3$

5 e.  $E = cB_p \quad B_p = \frac{E}{c} = 9.17 \times 10^{-11} \text{ T}$