Answer on Question #69268, Physics / Optics

The sodium lamp used in a physics laboratory gives out light uniformly. Suppose that the lamp uses 40 W. Calculate the magnitude of electric field.

Find: E - ?

Given:

P=40 W

$c=3\times10^8$ m/s

$\varepsilon_0=8.85\times10^{-12}$ F/m

$\varepsilon=1$

Solution:

Power of electromagnetic radiation:

$P = wc$ (1),

where w is energy density, c is speed of light in vacuum.

Energy density:

$w = \varepsilon_0 \varepsilon E^2$ (2),

where ε_0 is electric constant, ε is dielectric constant of the medium, E is magnitude of electric field.

(2) in (1):

$P = \varepsilon_0 \varepsilon E^2 c$ (3)

Of (3) $\Rightarrow$ $E = \sqrt{\frac{P}{\varepsilon_0 \varepsilon c}}$ (4)

Of (4) $\Rightarrow$ E=123 V/m

Answer:

123 V/m