

Answer on Question #65051, 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:

$$P=40 \text{ W}$$

$$c=3 \times 10^8 \text{ m/s}$$

$$\epsilon_0=8.85 \times 10^{-12} \text{ F/m}$$

$$\epsilon=1$$

Solution:

Power of electromagnetic radiation:

$$P = wc \text{ (1),}$$

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

Energy density:

$$w = \epsilon_0 \epsilon E^2 \text{ (2),}$$

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

(2) in (1):

$$P = \epsilon_0 \epsilon E^2 c \text{ (3)}$$

$$\text{Of (3)} \Rightarrow E = \sqrt{\frac{P}{\epsilon_0 \epsilon c}} \text{ (4)}$$

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

Answer:

$$123 \text{ V/m}$$

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