

QUESTION 14

After using a diode laser pointer in lectures, a university professor received questions from students who are concerned about the safety of such devices. The professor decides to consult with you, the Radiation Safety Officer of the University. You have collected the relevant data and performed an analysis according to ANSI Z136.1-1993.

GIVEN The laser pointer: Wavelength (λ) = 660-680 nm
 Output power (Φ) = 4.5 mW
 Aperture diameter (a) = 0.2 cm
 Beam divergence (ϕ) = 0.2 milliradians

Distance from the professor to students = 3 to 50 m
 Time for human blinking (aversion time) = 0.25s
 Maximum Permissible Exposure, MPE

$$MPE = \frac{1.8t^{3/4} \times 10^{-3} \text{ Jcm}^{-2}}{t(s)}$$

(for exposure time t : $18 \times 10^{-6} < t < 10 \text{ s}$)

$$\text{NOHD} = \left[\frac{1}{f} \right] \left\{ \frac{4\Phi}{P(MPE)} - a^2 \right\}^{1/2}$$

POINTS

- 20 A. Calculate the emerging irradiance in mW/cm^2 . **Show all work. State the answer which is most appropriate.**
- a) 24 mW/cm^2
 b) 36 mW/cm^2
 c) 95 mW/cm^2
 d) 143 mW/cm^2
 e) 450 mW/cm^2
- 15 B. Calculate the MPE, in mW/cm^2 , for intrabeam viewing. **Show all work. state the answer which is most appropriate.**
- a) 0.64 mW/cm^2
 b) 1.9 mW/cm^2
 c) 2.5 mW/cm^2
 d) 3.6 mW/cm^2
 e) 2500 mW/cm^2

- 10 C. Define nominal ocular hazard distance (NOHD).
- 20 D. Assuming a MPE value of 3.0 mW/cm^2 . Calculate the NOHD for the laser pointer. **Show all work.** Does it include the lecture audience and why?
- 10 E. To which class of laser does this laser pointer belong? Justify your answer.
- 10 F. List two of the ANSI recommended safety precautions to the professor for this class of laser. **Number your responses. Only the first two will be graded.**
- 15 G. During your investigation you discovered that some professors are using older HeNe laser pointers. These are Class II devices operating with a power output of 0.5 mW. What is the basis for the difference in the hazard between the two lasers (diode and HeNe)?