

Laser safety

Marcus Malmquist, marmalm, 941022

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1 Answers: laser safety

1.1 1

It is OK to put your hand in the laser beam for two reasons:

1. The beam is not focused on your hand, but it will be ($> 10^5$ times higher) on the retina.
2. You can easily cope with a damaged hand but not with a damaged eye...

1.2 2

According to the lecture notes it take about one fourth of a second.

1.3 3

The laser beam has a diameter of approximately 2 mm, which is less than the diameter of a pupil, so all of the incident power (2.5 mW) will hit the retina. The pupil can be approximated to be a circular disk with a diameter of approximately 7 mm so the incident irradiance is therefor $I = 65 \text{ Wm}^{-2}$.

The laser is assumed to be (nearly) a point source so the solid angle is very small. The maximum premissible exposure time can be calculated from 1, where $C_6 = 1$ since the solid angle is small.

$$It = 18t^{0.75}C_6 \Leftrightarrow t = (18/I)^{\frac{1}{0.25}} = 5.9 \text{ ms} \quad (1)$$

1.4 4

No because $5.9 \text{ ms} < 250 \text{ ms}$.

1.5 5

The exposure time would be roughly 40 times higher than the maximum allowed so it would be likely to cause permanent damage to the retina.

1.6 6

This 2.5 mW laser should be labeled as **Class 3R** as it allows up to 5 mW and the more restrictive Class 2(M) allows up to 1 mW.