

6. We denote the diameter of the laser beam as d . The cross-sectional area of the beam is $A = \pi d^2/4$. From the formula obtained in problem 5, the rate is given by

$$\begin{aligned}\frac{R}{A} &= \frac{\lambda P}{hc(\pi d^2/4)} \\ &= \frac{4(633 \text{ nm})(5.0 \times 10^{-3} \text{ W})}{\pi(6.63 \times 10^{-34} \text{ J}\cdot\text{s})(2.998 \times 10^8 \text{ m/s})(3.5 \times 10^{-3} \text{ m})^2} \\ &= 1.7 \times 10^{21} \frac{\text{photons}}{\text{m}^2 \cdot \text{s}} .\end{aligned}$$