781.

Problem 52.25 (RHK)

Lasers have become very small as well as very large. The active volume of a laser constructed of the semiconductor GaAlAs *has a volume of only* $200\ (\mu\text{m})^3$ (*smaller than a grain of sand*) *and yet it can deliver* 5.0 mW *of power at* $0.80-\mu$m *wavelength. We have to calculate the production rate of photons.*

Solution:

As the wavelength of the laser light is $0.80-\mu$m, the energy of the photons emitted will be

$$E=\frac{hc}{\lambda}=\frac{6.63\times10^{-34}\times3\times10^{8}}{0.80\times10^{-6}}\ \text{J}=24.86\times10^{-20}\ \text{J}.$$

As the power of the laser is 5.0 mW, the number of photons emitted per second by this laser will be

$$n=\frac{5.0\times10^{-3}}{24.86\times10^{-20}}\ \text{photons per second}$$

$$=2.01\times10^{16}\ \text{photons per second.}$$