66. (a) We denote the upper level as level 1 and the lower one as level 2. From $N_1/N_2 = e^{-(E_1-E_2)/kT}$ we get (using the result of problem 3 in Chapter 39)

$$\begin{aligned} N_1 &= N_2 e^{-(E_1-E_2)/kT} = N_2 e^{-hc/\lambda kT} \\ &= (4.0\times 10^{20}) e^{-(1240\,\text{eV}\cdot\text{nm})/[(580\,\text{nm})(8.62\times 10^{-5}\,\text{eV/K})(300\,\text{K})]} \\ &= 5.0\times 10^{-16} \ll 1 \ , \end{aligned}$$

so practically no electron occupies the upper level.

(b) With $N_1 = 3.0\times 10^{20}$ atoms emitting photons and $N_2 = 1.0\times 10^{20}$ atoms absorbing photons, then the net energy output is

$$\begin{aligned} E &= (N_1 - N_2)\, E_{\text{photon}} = (N_1 - N_2)\, \frac{hc}{\lambda} \\ &= \left(2.0\times 10^{20}\right) \frac{(6.63\times 10^{-34}\,\text{J}\cdot\text{s})(2.998\times 10^{8}\,\text{m/s})}{580\times 10^{-9}\,\text{m}} \\ &= 68\ \text{J} \ . \end{aligned}$$