

35. (a) From Eq. 41-29, we know that $N_2/N_1 = e^{-\Delta E/kT}$. We solve for ΔE :

$$\begin{aligned}\Delta E &= kT \ln \frac{N_1}{N_2} = (8.62 \times 10^{-5} \text{ eV/K})(2.7 \text{ K}) \ln \left(\frac{1 - 0.25}{0.25} \right) \\ &= 2.56 \times 10^{-4} \text{ eV} = 256 \mu\text{eV} .\end{aligned}$$

(b) Using the result of problem 3 in Chapter 39,

$$\lambda = \frac{hc}{\Delta E} = \frac{1240 \text{ eV}\cdot\text{nm}}{2.56 \times 10^{-4} \text{ eV}} = 4.84 \times 10^6 \text{ nm} = 4.84 \text{ mm} .$$