

HW 4-2 Soln)

First, $k_B T = (8.62 \times 10^{-5})(10,000) = 0.862$ eV. Then for each state, the Boltzmann factor is:

$$\text{Level 1: } e^{-E_1/k_B T} = e^{-1/0.862} = 0.313 \quad ;$$

$$\text{Level 2: } e^{-E_2/k_B T} = e^{-2/0.00862} = 0.098 \quad ;$$

$$\text{Level 3: } e^{-E_3/k_B T} = e^{-3/0.00862} = 0.031 \quad .$$

$$P(E_1) = \frac{e^{-E_1/k_B T}}{\sum_m e^{-E_m/k_B T}} = \frac{0.313}{0.313 + 0.098 + 0.031} = 0.708 \quad .$$

$$P(E_2) = \frac{e^{-E_2/k_B T}}{\sum_m e^{-E_m/k_B T}} = \frac{0.098}{0.313 + 0.098 + 0.031} = 0.222 \quad .$$

$$P(E_3) = \frac{e^{-E_3/k_B T}}{\sum_m e^{-E_m/k_B T}} = \frac{0.031}{0.313 + 0.098 + 0.031} = 0.070 \quad .$$