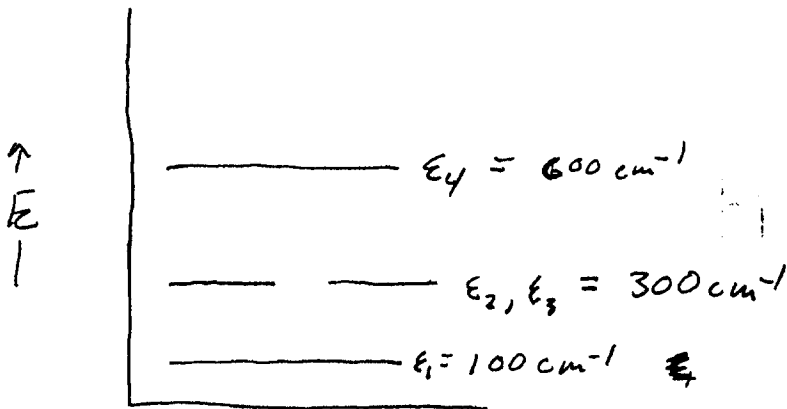


Practice Quiz

① Some crazy system has the following four energy levels



② Write out the partition function for this system

$$Q = e^{-\epsilon_1/\beta} + e^{-\epsilon_2/\beta} + e^{-\epsilon_3/\beta} + e^{-\epsilon_4/\beta}$$

$$= e^{-\frac{100}{kT}} + 2e^{-\frac{300}{kT}} + e^{-\frac{600}{kT}}$$

③ What is the probability of finding a particle in states 1, 2, 3 or 4 at room temp (298K). That is calculate P_1, P_2, P_3 and P_4

Q at room temp \neq $Q = 1.14$

$$P_1 = \frac{e^{-\frac{100}{207}}}{1.14} = 0.54 \quad P_2 = P_3 = 0.21 \quad P_4 = 0.05$$

④ At what temperature does the chance of finding a particle in either state 2 or 3 equal the chance of finding it in the ground state?

$$\frac{P_2 + P_3}{P_1} = 1 \Rightarrow \frac{2e^{-\frac{300}{kT}}}{e^{-\frac{100}{kT}}} = 1 \Rightarrow e^{-\frac{200}{kT}} = \frac{1}{2}$$

$$-\frac{200}{kT} = \ln(1/2)$$

$$kT = \frac{-200}{\ln(1/2)} = 288 \text{ cm}^{-1} \Rightarrow T = 415 \text{ K}$$