

Phy 410
Quiz #3, Feb 5, 2010

A system has 4 microstates with energies 0, 0, ϵ , 2ϵ respectively.

a) What is the partition function at temperature τ ? (3 points)

$$Z = 1 + 1 + e^{-\epsilon/\tau} + e^{-2\epsilon/\tau} = 2 + e^{-\epsilon/\tau} + e^{-2\epsilon/\tau}$$

b) What is the average energy of the system as function of τ ? (3 points)

$$U = \frac{0 \cdot 1 + 0 \cdot 1 + \epsilon e^{-\epsilon/\tau} + 2\epsilon e^{-2\epsilon/\tau}}{Z} = \frac{\epsilon e^{-\epsilon/\tau} + 2\epsilon e^{-2\epsilon/\tau}}{2 + e^{-\epsilon/\tau} + e^{-2\epsilon/\tau}}$$

c) What is the average energy as $\tau \rightarrow 0$? (2 points)

$$U = 0$$

d) What is the average energy as $\tau \rightarrow \infty$? (2 points)

$$U = \frac{3\epsilon}{4}$$