

PHYC - 505: Statistical Mechanics

Homework Assignment 2

Due February 11, 2014

1. Work out fully an expression for the Debye specific heat for a 1-dimensional solid at temperature T . Show all your steps so it will be clear you have understood the Debye derivation. Show what limits the expression you get has at high and low temperatures. What does high and low mean here precisely?
2. Calculate the energy density of states for a 2-dimensional system that is otherwise similar to a free electron of mass m confined to a square of side L but is different in that the energy momentum relationship is $E = Gp^3$ rather than $E \sim p^2$, G being a constant of appropriate dimensions. Calculate the (temperature dependence of the) specific heat of a collection of N such noninteracting electrons in thermal equilibrium at temperature T .
3. Starting from the expression $-kT \ln \mathcal{Z}$ for the free energy, derive an INTERESTING expression for the entropy from what you know about the relation between the entropy, energy and free energy. The emphasis is on the word INTERESTING so be creative.