

Exercises in Statistical Mechanics

Based on course by Doron Cohen, has to be proofed
Department of Physics, Ben-Gurion University, Beer-Sheva 84105, Israel

This exercises pool is intended for a graduate course in “statistical mechanics”. Some of the problems are original, while other were assembled from various undocumented sources. In particular some problems originate from exams that were written by B. Horovitz (BGU), S. Fishman (Technion), and D. Cohen (BGU).

==== [Exercise 6050] Radiation from 1D balckbody fiber

Given an optic fiber with length L and it's section area is A . The fiber is in thermic equilibrium in temperature T . Assume the fiber is a one dimensional medium for the electromagnetic field (relate to the magnetic radiation as a photon gas).

- (a) What is the condition (on temperature)so the one dimensional proximity will be valid?
- (b) What is the electromagnetic energy density per length unit?
- (c) What is the radiation pressure on the fiber edges?
- (d) Assuming that the radiation can emit from the boundary of the fiber, what is the emitting radiation flow (energy per time unit)?
- (e) What is the spectral distribution $J(w)$ of the emitting radiation flow?
- (f) What is the entropy and what is the heat capacity of the system?

Given:

$$\int_0^{\infty} \frac{x}{e^x - 1} dx = \frac{\pi^2}{6}$$