

Exercises in Statistical Mechanics

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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 4549]

Consevation law for the number of nucleons

A collection of free nucleons is enclosed in a box of volume V . The energy of a single nucleon of momentum \mathbf{p} is $\epsilon_{\mathbf{p}} = p^2/2m + mc^2$ where $mc^2 = 1000MeV$.

- (a) Pretending that there is no conservation law for the number of nucleons, calculate the partition function at temperature T . (Nucleons are fermions).
- (b) Calculate the average energy density and average particle density.
- (c) In view of (a) and (b), discuss the necessity for a consevation law for the number of nucleons.