

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 3550] Magnetic properties of $T = 0$ electrons (Pauli)

N electrons are in a box as follows: (I) two-dimensional with area A ; (II) three dimensional with volume V . The temperature is zero. We create a magnetic field B . The electrons behave like an ideal fermi gas. The one particle hamiltonian is

$$H_1 = \frac{\vec{p}^2}{2m} - rB\sigma_z$$

- (a) Show a schematic drawing of the uniparticle states density function. Distinguish between a spin up conditions and a spin down ones.
- (b) Determine which of the following graphs describes the magnetization $M(B)$ in each one of the cases (I) (II) and complete the missing details ($M_s = ?$, $B_c = ?$, $\chi = ?$).

Use only γ, m, V, A, N .

