

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 6070]

Landauer formula for a 1D conductance

Consider 1D conductor that has transmission coefficient g . The conductor is connected to 1D leads that have chemical potentials μ_a and μ_b . Assume $\mu_a = \mu$ and $\mu_b = \mu + eV$, where V is the bias.

- (1) Write the expression for the current I as an integral over the occupation function $f(\epsilon)$.
- (2) For small bias write the relation as $I = GV$ and obtain an expression for G . Write explicit results for zero temperature Fermi occupation (Landauer formula) and for high temperature Boltzman occupation.
- (3) Find expressions for $I(V)$ in the case of arbitrary (possibly large) bias, for zero temperature Fermi occupation and for high temperature Boltzmann occupation. Assume that g is independent of energy.

