

Exercises in Statistical Mechanics

Based on course by Doron Cohen, has to be proofed
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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 8020]

Baruch's D21.

Consider the Langevin equation for a particle with mass M and velocity $\mathbf{v}(t)$ in a medium with viscosity γ and a random force $\mathbf{A}(t)$.

- (a) Show that in equilibrium $\langle \mathbf{v}(t)\mathbf{A}(t) \rangle = 3k_B T \gamma / M$.
- (b) Given $\langle \mathbf{v}(t)\mathbf{v}(0) \rangle \sim e^{-\gamma|t|}$ and $\langle \mathbf{v} \rangle = 0$, use $\mathbf{v}(t) = \dot{\mathbf{x}}(t)$ to evaluate $\langle \mathbf{x}^2(t) \rangle$ [do not use Langevin's equation] .