

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 5022]

Pressure via the virial theorem

A gas of N particles is confined in a box of volume V at temperature of T . The two-body interaction between the particles is $u(r) \propto r^{-\gamma}$. Write the virial theorem and deduce that the mean kinetic energy is

$$K = \frac{1}{\gamma + 2} (3PV + \gamma E)$$

where $E = K + U$ is the total energy. What happens for $\gamma = -2$?