

## 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 3515]

#### Ideal Fermi gas in 1D space

Consider  $N$  electrons that are kept between the plates of a capacitor.

$$V(x, y, z) = \begin{cases} \frac{1}{2}m\omega^2(x^2 + y^2) & 0 \leq z \leq L \\ \infty & \text{else} \end{cases}$$

The system is in thermal equilibrium at zero temperature. Find the force that the gas exerts of the plates assuming that it can be treated as one-dimensional.

Write the condition on  $N$  for having this assumption valid.

Tip: Find first the one particle states, and illustrate them using a schematic drawing. Express your results using  $N, L, m, \omega$  only.