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 1060**]

Quasi-Static processes in a mesoscopic system

Write the basic level energy of a particle with mass m, which is in a box with final volume V. (Take boundary conditions zero in the limits of the box). In temperature zero, $\left(\beta^{-1} = 0\right)$, calculate explicitly the pressure caused by the particle. Use the equation

$$p = \sum_r p_r \left(-\frac{\partial E_r}{\partial V} \right)$$

Compare it to the equation developed in class for general temperature

$$P = \frac{1}{V}\beta^{-1}$$

and explain why in the limit $\beta^{-1} \to 0$ we don't get the result you calculated. (Hint - notice the title of this question).