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 1032]

The extensive property of the grand energy

Explain why F, Ω are extensive functions in the thermodynamic limit, so that

$$F(\beta; \lambda V, \lambda N) = \lambda F(\beta; V, N)$$

$$\Omega(\beta\mu; \lambda V) = \lambda \Omega(\beta\mu; V)$$

Guideline: Note that if you split the system, then in neglecting "surface" interaction, the functions Z, Z will be factorized.

$$Z \approx Z^A + Z^B, F \approx F^A + F^B$$

Result: therefore,

$$\Omega(\beta\mu; V) = V\Omega(\beta\mu; 1)$$

Prove that from here, we can conclude that

$$\Omega(\beta\mu; V) = -V * p(\beta\mu)$$

remark: Generalization of considerations such these were written by Euler.