

[tex74] Array of classical harmonic oscillators (microcanonical ensemble)

Consider an array of N 3-dimensional classical harmonic oscillators, representing a system of $3N$ uncoupled degrees of freedom:

$$H = \sum_{i=1}^{3N} \left(\frac{p_i^2}{2m} + \frac{1}{2} m \omega^2 q_i^2 \right).$$

- (a) Calculate the entropy $S(U, V, N)$ of this system in the *microcanonical* ensemble.
- (b) Derive the internal energy $U(T, V, N)$, and the heat capacity $C = (\partial U / \partial T)_{VN}$.

Solution: