Worksheet 2: Statistical Mechanics and Molecular Dynamics

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1 Exercise 2.1

We know from our lecture that the entropy of a system is related to the number of microstates Ω using the Boltzmann entropy formula:

$$S = k_B \ln(\Omega) \tag{1}$$

In the first case of N distinguishable particles, each of which can occupy one of two energy states ϵ_1 and ϵ_2, and a system in equilibrium with n_1 particles in state ϵ_1 and n_2 particles in state ϵ_2 such that $n_1 + n_2 = N$, we can express the entropy in terms of Ω: In order to solve this task, we use binomial coefficients to calculate the number of microstates Ω:

$$\Omega = \binom{N}{n_1} = \frac{N!}{n_1! \cdot (N - n_1)!} \tag{2}$$

$$\tag{3}$$