

Review Question 4.1-4.3

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Consider a gas (initial density ρ_0) of N molecules each with mass m and moment of inertia I . Account for translational motion as well as rotational and vibrational excitations, and assume that the vibrational excitations are describable by a two-dimensional harmonic oscillator (two independent 1-D oscillators) with frequency ω . In addition, assume that $\hbar\omega \ll T$ and $\frac{\hbar^2}{2I} \ll T$.

1. Find the energy per particle.
2. Find the entropy per particle in terms of the density.
3. If the gas undergoes an adiabatic expansion from temperature T_0 to T_1 , what is the final density?