

[tex136] Irreversible decompression

Consider an insulating box with two compartments. Each compartment initially contains N atoms of a monatomic classical ideal gas [$pV = Nk_B T$, $C_V = \frac{3}{2}Nk_B$] in equilibrium at initial pressures $p_1 \neq p_2$ and at the same initial temperature T . Gas atoms are then allowed to leak through a hole in the dividing wall.

- Show that the temperature remains the same in the final equilibrium state.
 - Find the uniform pressure p in the final equilibrium state as a function of p_1 and p_2 .
 - Find the increase in total entropy, ΔS , between the initial and final equilibrium states.
- Hint: Use the result for $S(T, V, N)$ derived in [tex14].

Solution: