

In this quiz, we assume that the number of states available to a gas atom is proportional to the volume of its container: $M=bV$, for some constant b .

- 1) [4 points] N distinguishable gas atoms are placed in a container of volume V . Calculate the number of microstates available, assuming that the gas is dilute, in terms of b , V , and N .

- 2) [4 points] Now consider a cylinder of volume V , broken into two spaces V_L and V_R by a frictionless piston, containing N_L and N_R gas atoms respectively. Write the total multiplicity $\Omega=\Omega_L\Omega_R$ in terms of the parameters given.

- 3) [8 points] The system will reach equilibrium when the multiplicity is highest. By maximizing Ω , find the equilibrium relation between N_L , N_R , V_L , and V_R . *Hint: Substituting $V_R=V-V_L$ may help! Remember, maximizing Ω has the same effect as maximizing the entropy, $\ln \Omega$, which is sometimes easier to do.*

- 4) [4 points] Is this the same result we would predict from the Ideal Gas Law? You must justify your answer!!