

Page 3 Two volumes V_1 and V_2 communicate through a hole containing N molecules without interaction. Find the probability of finding n molecules in V_1 . Let $\gamma = V_1/V_2$

$$\begin{aligned}
 p_n &= \binom{N}{n} \left(\frac{V_1}{V_1 + V_2} \right)^n \left(\frac{V_2}{V_1 + V_2} \right)^{N-n} \\
 &= \binom{N}{n} \left(\frac{V_1}{V_1 + V_2} \right)^n \left(\frac{V_1 + V_2}{V_2} \right)^{n-N} \\
 &= \binom{N}{n} \left(\frac{V_1}{V_1 + V_2} \frac{V_1 + V_2}{V_2} \right)^n \left(\frac{V_1 + V_2}{V_2} \right)^{-N} \\
 &= \binom{N}{n} \left(\frac{V_1}{V_2} \right)^n \left(\frac{V_1}{V_2} + 1 \right)^{-N} \\
 &= \binom{N}{n} (\gamma)^n (\gamma + 1)^{-N}
 \end{aligned}$$