4.13: The Rate of Collisions between Unlike Gas Molecules

We define the collision frequencycollision frequency, $\tilde{\nu}_{12}$, as the number of collision per unit time between a single molecule of type 1 and any of the molecules of type 2 present in the same container. We find $\tilde{\nu}_{12} = N_2 \pi \sigma_{12}^2 \langle v_{12} \rangle$. If there are N_1 molecules of type 1 present in a unit volume of the gas, the total number of collisions between type 1 molecules and type 2 molecules is N_1 times greater. For clarity, let us refer to the total number of such collisions, per unit volume and per unit time, as the ***collision rate***, ρ_{12}. We have

$$\rho_{12} = N_1 \tilde{\nu}_{12} = N_1 N_2 \pi \sigma_{12}^2 \langle v_{12} \rangle = N_1 N_2 \sigma_{12}^2 \left(\frac{8 \pi k T}{\mu} \right)^{1/2}$$