

In-class problem linked to lecture pages 241-256:

- a) If both have the same molecular radius, which of the following species will undergo collisions most frequently, N_2 or H_2O ?
- b) If samples of a gas are stored in two different vessels at two different temperatures T_{high} and T_{low} , in which vessel will the collision frequency be higher, and by what factor?
- c) Again for T_{high} and T_{low} , in which vessel will the mean free path be higher, and by what factor?

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$$\begin{aligned} a) \quad m(\text{N}_2) &= 28 \text{ mp} = 28 \text{ mp} \\ m(\text{H}_2\text{O}) &= 2 \text{ mp} + 16 \text{ mp} = 18 \text{ mp} \end{aligned}$$

collision frequency $\nu_c \propto \frac{1}{\sqrt{m}}$

$$\text{So } \frac{\nu_c(\text{H}_2\text{O})}{\nu_c(\text{N}_2)} = \frac{\sqrt{28}}{\sqrt{18}} = 1.25$$

$$\begin{aligned} b) \quad \nu_c &\propto \sqrt{T} \\ \frac{\nu_c(T_{\text{high}})}{\nu_c(T_{\text{low}})} &= \sqrt{\frac{T_{\text{high}}}{T_{\text{low}}}} \end{aligned}$$

c) $L \neq L(T)$
No effect.