MOLECULAR FREE PATHS

The System of Study: Let us postulate a system of study consisting of a ***p***-population of gaseous atmospheric molecules in random motion in proximity space. The surface of interest is the intangible surface of an imaginary sphere surrounded by the ***p***-population.

Molecular Free Path: A free path is the distance a molecule travels between interactions. Every free path has an interaction at its initial point and an interaction at its terminal point. These interactions can be imaginary, such as passage through the surface of interest; or they can be real, such as interaction with another molecule during intermolecular collisions.

Mean Molecular Free Path: The mean molecular free path is obtained by dividing the mean molecular impulse speed between interactions by the mean frequency of molecular interactions.

$$\bar{\lambda}_i = \frac{\bar{v}_i}{\bar{f}_\otimes} \qquad \text{MFP01}$$

Here, $\bar{\lambda}_i$ is the mean free path in meters between intermolecular collisions, $\bar{v}_i$ is the mean molecular impulse speed in meters per second between any two subsequent collisions, and $\bar{f}_\otimes$ is the frequency of intermolecular collisions in number per second.

Mean Free Paths in the Free Atmosphere: Since randomness is postulated, the air is still. Consequently, the mean free paths in the free atmosphere are a function of the ambient temperature, the ambient pressure, and the ambient humidity. Temperature and pressure determine the number density, temperature and humidity determine the molecular speeds, and humidity determine the effective mean molecular radius.

Still Air Parameters: The essay Still Air Parameters gives the following values for mean free paths in still air with no net evaporation or condensation. The system temperature is 25° C, and the system pressure is 1,000 hectopascals. The system vapor pressure is 10 hectopascals.

$\bar{\lambda}_i = 2.86 \times 10^{-7}$ meters

REFERENCES

Internal References: References to other essays in this collection are linked in the essay text by hyperlinks. You may follow these hyperlinks or ignore them, as you choose.

External References: These are papers by other authors that contain statements or data that are specifically incorporated into this essay. This paper has no external references.

General References: These are works that I have read carefully and whose views have helped to shape the views presented in this collection. None of these authors are have any responsibility for my many unconventional views and opinions.

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