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A Simple Derivation of the Equation for Mean Free Path

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A SIMPLE DERIVATION OF THE EQUATION FOR MEAN FREE PATH

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(*ABSTRACT*)

According to simple kinetic theory, in which all the gas molecules but one are considered stationary, the mean free path L is given by $L = \frac{1}{N \pi \sigma^2}$, where N is the number of molecules per cc. and σ is the molecular diameter. Clausius, considering all molecules to be moving with the mean relative velocity, finds $L = \frac{3}{4N \pi \sigma^2}$. Again, Maxwell, applying his law of velocity distribution, obtains the result $L = \frac{1}{\sqrt{2} N \pi \sigma^2}$. This value found by Maxwell is the one most generally accepted. If we consider it to be correct, then the value from simple kinetic theory is 41% too large, while that found by Clausius is 6% too large.

An approximate value of L, much more nearly correct than the first one given, may be derived very simply by considering the gas molecules to be vibrating in sheets. The result obtained is $L = \frac{1}{4 N \sigma^2}$. This value is 11% higher than that found by Maxwell, as compared to 41% for the first value given above. The mathematical difficulties encountered by Clausius and Maxwell in deriving their formulas are entirely avoided in this development.

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A NEW ANALYSIS OF THE ACTION OF AMSLER'S POLAR PLANIMETER

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(*ABSTRACT*)

The theory of Amsler's polar planimeter, as commonly given, leads to the expression $A = L\, h$, where A is the area circumscribed, L is the length of the tracer arm, and h is the net distance of translation of the tracer arm in a direction perpendicular to its length. However, it can be shown that the area may also be given by $A = L^2 \theta$, where θ is the net angle through which the tracer arm has rotated about either of its ends. But as the tracer point passes around the area A, the tracer arm does not, in general,