Mean Free Path vs Pressure and Altitude

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Mean Free Path Equation:

$$\lambda = \frac{R \cdot T}{\sqrt{2} \cdot \pi d_a^{\,2} \cdot L \cdot P}$$

Variables:

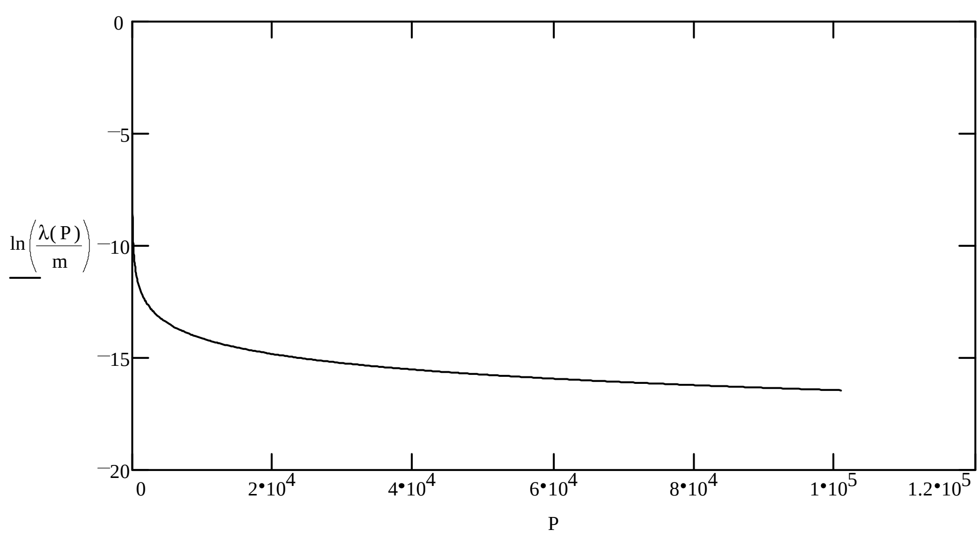
Gas Law Constant	$R := 8.314510 \cdot \mathrm{joule} \cdot K^{-1} \cdot \mathrm{mole}^{-1}$
Avagadro's Number	$L := 6.0221367 \cdot 10^{23} \cdot \mathrm{mole}^{-1}$
Temperature	$T := 298 \cdot K$
Collisional Cross Section	$d_a := 3.57 \cdot 10^{-10} \cdot m$
Pressure	$P := 101325 \cdot Pa$

The Function

$$\lambda(P) := \frac{R \cdot T}{\sqrt{2} \cdot \pi \cdot d_a^{\,2} \cdot L \cdot P} \qquad \lambda(P) = 7.171 \cdot 10^{-8} \cdot m$$

Graph of Function

$$P := 1 \cdot Pa, 10 \cdot Pa .. 101000 \cdot Pa$$



Mean Free Path vs Altitude:

Equations:

$$P_{ht} = P_o \cdot e^{\frac{-M \cdot g \cdot ht}{R \cdot T_{sea}}} \qquad \lambda = \frac{R \cdot T}{\sqrt{2} \cdot \pi d_a^{\,2} \cdot L \cdot P} \qquad \lambda = \frac{R \cdot T}{\sqrt{2} \cdot \pi \cdot d_a^{\,2} \cdot L \cdot P_o \cdot e^{\frac{-M \cdot g \cdot ht}{R \cdot T_{sea}}}}$$

The variables:

The atmospheric pressure at sea level $P_o := 101325 \cdot Pa$

The average molecular mass of the atmosphere: $M := 0.02897 \cdot kg \cdot mole^{-1}$

The altitude of interest (given as a matrix) $ht := 0 \cdot m, 20 \cdot m .. 100 \cdot 10^3 \cdot m$

The average temperature at seal level $T_{sea} := 288 \cdot K$

The function:

$$\lambda(ht) := \frac{R \cdot T}{\sqrt{2} \cdot \pi \cdot d_a^{\,2} \cdot L \cdot P_o \cdot e^{\frac{-M \cdot g \cdot ht}{R \cdot T_{sea}}}}$$