During adiabatic compression, PV^γ and $VT^{f/2}$ are constant, $\gamma = (f+2)/f$.

Entropy of an ideal gas is given by

$$S = Nk\left(\ln\frac{VU^{f/2}}{N^{f/2+1}} + c\right)$$

where c is a constant that depends on the type of gas.

The multiplicity of the paramagnet is given by

$$\binom{N}{q} = \frac{N!}{(N-q)!q!}$$

The multiplicity of the Einstein solid is given by

$$\binom{N+q-1}{q} = \frac{(N+q-1)!}{(N-1)!q!}$$

Stirling approximation (leading order):

$$\ln N! \approx N\ln N - N$$

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Physical Constants

$k = 1.381 \times 10^{-23}$ J/K
$= 8.617 \times 10^{-5}$ eV/K
$N_A = 6.022 \times 10^{23}$
$R = 8.315$ J/mol·K
$h = 6.626 \times 10^{-34}$ J·s
$= 4.136 \times 10^{-15}$ eV·s
$c = 2.998 \times 10^{8}$ m/s
$G = 6.673 \times 10^{-11}$ N·m^2/kg^2
$e = 1.602 \times 10^{-19}$ C
$m_e = 9.109 \times 10^{-31}$ kg
$m_p = 1.673 \times 10^{-27}$ kg

Unit Conversions

1 atm = 1.013×10^5 N/m^2
$= 14.7$ lb/in^2 $= 760$ mm Hg
(T in °C) = (T in K) − 273.15
(T in °F) = $\frac{9}{5}$(T in °C) + 32
1 °R = $\frac{5}{9}$ K
1 cal = 4.186 J
1 Btu = 1054 J
1 eV = 1.602×10^{-19} J
1 u = 1.661×10^{-27} kg