The System of Units

We define a new time unit T such that a wave number $\tilde{\nu}$ has the same numerical value as the corresponding angular wave frequency $\omega = \tilde{\nu} 2\pi c$ (c is the speed of light).

	SI	New
ν	$1\,\mathrm{cm}^{-1}$	$1\mathrm{cm}^{-1}$
ω	$1.883\,651\,567\,308\,853\,1 \times 10^{10}\,\mathrm{s}^{-1}$	$1\mathrm{T}^{-1}$
Time Unit(SI)	$1\,\mathrm{s}$	$1.883\,651\,567\,308\,853\,1 \times 10^{10}\,\mathrm{T}$
Time Unit(New)	$5.308\,837\,458\,876\,145 \times 10^{-12}\,\mathrm{s}$	$1\mathrm{T}$

Table 1: The Defining Relationship: $\omega = 2\pi c\nu$. $c = 2.997\,924\,58 \times 10^{10}\,\mathrm{cm\,s}^{-1}$.

With the time unit defined, we further define a new energy unit E such that Planck's constant $\hbar$ is $1\mathrm{E\,T}$. Planck's constant in SI is $1.054\,571\,817 \times 10^{-34}\,\mathrm{J\,s}$. Once E is defined, for $\tilde{\nu} = 1\,\mathrm{cm}$, we will have the corresponding angular frequency $\omega = 1\mathrm{cm}^{-1}$ and the energy $\mathcal{E} = \hbar\omega = 1\,\mathrm{E\,T} \times 1\,\mathrm{T}^{-1} = 1\,\mathrm{E}$.

	SI	New
$\hbar$	$1.054\,571\,817 \times 10^{-34}\,\mathrm{J\,s}$	$1\mathrm{E} \cdot \mathrm{T}$
Time Unit(SI)	$1\,\mathrm{s}$	$1.883\,651\,567\,308\,853\,1 \times 10^{10}\,\mathrm{T}$
Time Unit(New)	$5.308\,837\,458\,876\,145 \times 10^{-12}\,\mathrm{s}$	$1\mathrm{T}$
Energy Unit(SI)	$1\,\mathrm{J}$	$5.034\,116\,570\,627\,209\,6 \times 10^{22}\,\mathrm{E}$
Energy Unit(New)	$1.986\,445\,855\,931\,795 \times 10^{-23}\,\mathrm{J}$	$1\mathrm{E}$

Table 2: The Defining Relationship: $\hbar = 1.054\,571\,817 \times 10^{-34}\,\mathrm{J\,s} = 1\mathrm{ET}$.

With the two units defined, we calculate the value of Boltzmann's constant in this system of units.

	SI	New
Energy Unit(SI)	$1\,\mathrm{J}$	$5.034\,116\,570\,627\,209\,6 \times 10^{22}\,\mathrm{E}$
Energy Unit(New)	$1.986\,445\,855\,931\,795 \times 10^{-23}\,\mathrm{J}$	$1\mathrm{E}$
k_{B}	$1.380\,649 \times 10^{-23}\,\mathrm{J\,K}^{-1}$	$0.695\,034\,800\,911\,988\,8\,\mathrm{E\,K}^{-1}$

Table 3: The Defining Relationship: $k_{\mathrm{B}} = 1.380\,649 \times 10^{-23}\,\mathrm{J\,K}^{-1} = 1.380\,649 \times 10^{-23}\,\mathrm{J\,K}^{-1} \times 15.034\,116\,570\,627\,209\,6 \times 10^{22}\,\frac{\mathrm{E}}{\mathrm{J}} = 0.695\,034\,800\,911\,988\,8\mathrm{E\,K}^{-1}$.