

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

Table 1: The Defining Relationship: $\omega = 2\pi c\nu$. $c = 299\,792\,458 \times 10^{10} \text{ cm s}^{-1}$.

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

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

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

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

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

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