Fundamental Physical Constants — Physico-chemical constants

Quantity	Symbol	Value	Unit	Relative std. uncert. $u_{\rm r}$
		PHYSICOCHEMICAL		
Avogadro constant	$N_{\rm A}$	$6.022\,140\,76 \times 10^{23}$	$\rm mol^{-1}$	exact
Boltzmann constant	k	$1.380\,649 \times 10^{-23}$	$\rm J\ K^{-1}$	exact
		$8.617\,333\,262\ldots \times 10^{-5}$	$\rm eV\ K^{-1}$	exact
	k/h	$2.083\,661\,912\ldots \times 10^{10}$	$\rm Hz\ K^{-1}$	exact
	k/hc	$69.503\,480\,04\ldots$	$[\rm m^{-1}\ K^{-1}]^*$	exact
atomic mass constant†				
$m_{\rm u} = \frac{1}{12}m(^{12}{\rm C}) = 2hc\,R_\infty/\alpha^2c^2A_{\rm r}({\rm e})$	$m_{\rm u}$	$1.660\,539\,066\,60(50) \times 10^{-27}$	kg	3.0×10^{-10}
energy equivalent	$m_{\rm u}c^2$	$1.492\,418\,085\,60(45) \times 10^{-10}$	J	3.0×10^{-10}
		$931.494\,102\,42(28)$	MeV	3.0×10^{-10}
molar mass constant†	$M_{\rm u}$	$0.999\,999\,999\,65(30) \times 10^{-3}$	$\rm kg\ mol^{-1}$	3.0×10^{-10}
molar mass† of carbon-12 $A_{\rm r}(^{12}{\rm C})M_{\rm u}$	$M(^{12}{\rm C})$	$11.999\,999\,9958(36) \times 10^{-3}$	$\rm kg\ mol^{-1}$	3.0×10^{-10}
molar Planck constant	$N_{\rm A}h$	$3.990\,312\,712\ldots \times 10^{-10}$	$\rm J\ Hz^{-1}\ mol^{-1}$	exact
molar gas constant $N_{\rm A}k$	R	$8.314\,462\,618\ldots$	$\rm J\ mol^{-1}\ K^{-1}$	exact
Faraday constant $N_{\rm A}e$	F	$96\,485.332\,12\ldots$	$\rm C\ mol^{-1}$	exact
standard-state pressure		$100\,000$	Pa	exact
standard atmosphere		$101\,325$	Pa	exact
molar volume of ideal gas RT/p				
$T = 273.15$ K, $p = 100$ kPa or standard-state pressure	$V_{\rm m}$	$22.710\,954\,64\ldots \times 10^{-3}$	$\rm m^3\ mol^{-1}$	exact
Loschmidt constant $N_{\rm A}/V_{\rm m}$	n_0	$2.651\,645\,804\ldots \times 10^{25}$	$\rm m^{-3}$	exact
molar volume of ideal gas RT/p				
$T = 273.15$ K, $p = 101.325$ kPa or standard atmosphere	$V_{\rm m}$	$22.413\,969\,54\ldots \times 10^{-3}$	$\rm m^3\ mol^{-1}$	exact
Loschmidt constant $N_{\rm A}/V_{\rm m}$	n_0	$2.686\,780\,111\ldots \times 10^{25}$	$\rm m^{-3}$	exact
Sackur-Tetrode (absolute entropy) constant‡				
$\frac{5}{2} + \ln[(m_{\rm u}kT_1/2\pi\hbar^2)^{3/2}kT_1/p_0]$				
$T_1 = 1$ K, $p_0 = 100$ kPa or standard-state pressure	S_0/R	$-1.151\,707\,537\,06(45)$		3.9×10^{-10}
$T_1 = 1$ K, $p_0 = 101.325$ kPa or standard atmosphere		$-1.164\,870\,523\,58(45)$		3.9×10^{-10}
Stefan-Boltzmann constant				
$(\pi^2/60)k^4/\hbar^3c^2$	σ	$5.670\,374\,419\ldots \times 10^{-8}$	$\rm W\ m^{-2}\ K^{-4}$	exact
first radiation constant for spectral				
radiance $2hc^2\,{\rm sr}^{-1}$	$c_{\rm 1L}$	$1.191\,042\,972\ldots \times 10^{-16}$	$[\rm W\ m^2\ sr^{-1}]^§$	exact
first radiation constant $2\pi hc^2 = \pi\,{\rm sr}\,c_{\rm 1L}$	c_1	$3.741\,771\,852\ldots \times 10^{-16}$	$[\rm W\ m^2]^§$	exact
second radiation constant hc/k	c_2	$1.438\,776\,877\ldots \times 10^{-2}$	$[\rm m\ K]^*$	exact
Wien displacement law constants				
$b = \lambda_{\rm max}T = c_2/4.965\,114\,231...$	b	$2.897\,771\,955\ldots \times 10^{-3}$	$[\rm m\ K]^*$	exact
$b' = \nu_{\rm max}/T = 2.821\,439\,372...\,c/c_2$	b'	$5.878\,925\,757\ldots \times 10^{10}$	$\rm Hz\ K^{-1}$	exact

* The full description of $\rm m^{-1}$ is cycles or periods per meter and that of m is meter per cycle (m/cycle). The scientific community is aware of the implied use of these units. It traces back to the conventions for phase and angle and the use of unit Hz versus cycles/s. No solution has been agreed upon.

† The relative atomic mass $A_{\rm r}(X)$ of particle X with mass $m(X)$ is defined by $A_{\rm r}(X) = m(X)/m_{\rm u}$, where $m_{\rm u} = m(^{12}{\rm C})/12 = 1$ u is the atomic mass constant and u is the unified atomic mass unit. Moreover, the mass of particle X is $m(X) = A_{\rm r}(X)$ u and the molar mass of X is $M(X) = A_{\rm r}(X)M_{\rm u}$, where $M_{\rm u} = N_{\rm A}$ u is the molar mass constant and $N_{\rm A}$ is the Avogadro constant.

‡ The entropy of an ideal monoatomic gas of relative atomic mass $A_{\rm r}$ is given by $S = S_0 + \frac{3}{2}R\ \ln A_{\rm r} - R\ \ln(p/p_0) + \frac{5}{2}R\ \ln(T/{\rm K})$.

§ The full description of $\rm m^2$ is $\rm m^{-2} \times (m/cycle)^4$. See also footnote for $\rm m^{-1}$.