66.25: Fundamental Physical Constants — Extensive Listing

From NIST

Table 66.25.1: Universal Fundamental Constants

Quantity	Symbol	Value	Unit	Relative std. uncert. u_{\mathrm{r}}
speed of light in vacuum	c	299 792 458	$\mathbf{m\ s^{-1}}$	exact
vacuum magnetic permeability $4\pi\alpha\hbar/e^2c$	μ_0	$1.25663706212(19)\times 10^{-6}$	NA^{-2}	1.5×10^{-10}
$\mu_0/\left(4\pi\times 10^{-7}\right)$		$\mathbf{1.00000000055(15)}$	NA^{-2}	1.5×10^{-10}
vacuum electric permittivity $1/\mu_0c^2$	ϵ_0	$8.8541878128(13)\times 10^{-12}$	$\mathrm{F\ m}^{-1}$	1.5×10^{-10}
characteristic impedance of vacuum μ_0c	Z_0	$\mathbf{376.730313668(57)}$	Ω	1.5×10^{-10}
Newtonian constant of gravitation	G	$6.67430(15)\times 10^{-11}$	$\mathbf{m^3\ kg^{-1}\ s^{-2}}$	2.2×10^{-5}
	$G/\hbar c$	$6.70883(15)\times 10^{-39}$	$\left(\mathrm{GeV}/c^2\right)^{-2}$	2.2×10^{-5}
Planck constant*	h	$6.62607015\times 10^{-34}$	$\mathbf{J\ Hz^{-1}}$	exact
		$4.135667696\ldots\times 10^{-15}$	$\mathbf{eVHz^{-1}}$	exact
	$\hbar$	$1.054571817\ldots\times 10^{-34}$	Js	exact
		$6.582119569\ldots\times 10^{-16}$	eVs	exact
	$\hbar c$	$197.3269804\ldots$	MeVfm	exact
Planck mass $(\hbar c/G)^{1/2}$	m_{P}	$2.176434(24)\times 10^{-8}$	kg	1.1×10^{-5}
energy equivalent	$m_{\mathrm{P}}c^2$	$1.220890(14)\times 10^{19}$	GeV	1.1×10^{-5}
Planck temperature $\left(\hbar c^5/G\right)^{1/2}/k$	$\boldsymbol{T_{\mathrm{P}}}$	$1.416784(16)\times 10^{32}$	K	1.1×10^{-5}
Planck length $\hbar/m_{\mathrm{P}}c=\left(\hbar G/c^3\right)^{1/2}$	l_{P}	$1.616255(18)\times 10^{-35}$	$\mathbf{m}$	1.1×10^{-5}
Planck time $l_{\mathrm{P}}/c=\left(\hbar G/c^5\right)^{1/2}$	t_{P}	$5.391247(60)\times 10^{-44}$	s	1.1×10^{-5}

Table 66.25.2: Electromagnetic Constants

Quantity	Symbol	Value	Unit	Relative std. uncert. u_{\mathrm{r}}
elementary charge	e	$1.602176634\times 10^{-19}$	C	exact

Quantity	Symbol	Value	Unit	Relative std. uncert. u_{\mathrm{r}}
	$e/\hbar$	$1.519267447\ldots \times 10^{15}$	$\mathbf{A\ J^{-1}}$	exact
magnetic flux quantum $2\pi\hbar/(2e)$	Φ_0	$2.067833848\ldots \times 10^{-15}$	Wb	exact
conductance quantum $2e^2/2\pi\hbar$	G_0	$7.748091729\ldots \times 10^{-5}$	S	exact
inverse of conductance quantum	G_0^{-1}	$12906.40372\ldots$	Ω	exact
Josephson constant $2e/h$	K_{J}	$483597.8484\ldots \times 10^9$	$\mathrm{Hz\ V^{-1}}$	exact
von Klitzing constant $\mu_0 c/2\alpha = 2\pi\hbar/e^2$	R_{K}	$25812.80745\ldots$	Ω	exact
Bohr magneton $e\hbar/2m_{\mathrm{e}}$	$\boldsymbol{\mu}_{\mathbf{B}}$	$9.2740100783(28) \times 10^{-24}$	$\mathrm{J\ T^{-1}}$	3.0×10^{-10}
		$5.7883818060(17) \times 10^{-5}$	$\mathrm{eV\ T^{-1}}$	3.0×10^{-10}
	μ_{B}/h	$1.39962449361(42) \times 10^{10}$	$\mathrm{Hz\ T^{-1}}$	3.0×10^{-10}
	μ_{B}/hc	$\mathbf{46.686447783(14)}$	$\left[\mathrm{m^{-1}\ T^{-1}}\right]^{\dagger}$	3.0×10^{-10}
	μ_{B}/k	$\mathbf{0.67171381563(20)}$	$\mathrm{K\ T^{-1}}$	3.0×10^{-10}
nuclear magneton $e\hbar/2m_{\mathrm{p}}$	$\boldsymbol{\mu}_{\mathbf{N}}$	$5.0507837461(15) \times 10^{-27}$	$\mathrm{J\ T^{-1}}$	3.1×10^{-10}
		$3.15245125844(96) \times 10^{-8}$	$\mathrm{eV\ T^{-1}}$	3.1×10^{-10}
	μ_{N}/h	$\mathbf{7.6225932291(23)}$	$\mathrm{MHz\ T^{-1}}$	3.1×10^{-10}
	μ_{N}/hc	$2.54262341353(78) \times 10^{-2}$	$\left[\mathrm{m^{-1}\ T^{-1}}\right]^{\dagger}$	3.1×10^{-10}
	μ_{N}/k	$3.6582677756(11) \times 10^{-4}$	$\mathrm{K\ T^{-1}}$	3.1×10^{-10}

Table 66.25.3: General Atomic and Nuclear Constants

Quantity	Symbol	Value	Unit	Relative std. uncert. u_{\mathrm{r}}
fine-structure constant $e^2/4\pi\epsilon_0\hbar c$	α	$7.2973525693(11) \times 10^{-3}$		1.5×10^{-10}
inverse fine-structure constant	α^{-1}	$137.035999084(21)$		1.5×10^{-10}
Rydberg frequency $\alpha^2 m_{\mathrm{e}} c^2/2h = E_{\mathrm{h}}/2h$	cR_∞	$3.2898419602508(64) \times 10^{15}$	Hz	1.9×10^{-12}
energy equivalent	hcR_∞	$2.1798723611035(42) \times 10^{-18}$	J	1.9×10^{-12}
		$13.605693122994(26)$	eV	1.9×10^{-12}

Rydberg constant	R_∞	10973731.568160(21)	$[\mathrm{m}^{-1}]^\dagger$	1.9×10^{-12}
Bohr radius $\hbar/\alpha m_e c = 4\pi\epsilon_0\hbar^2/m_e e^2$	a_0	$5.29177210903(80)\times10^{-11}$	m	1.5×10^{-10}
Hartree energy $\alpha^2 m_e c^2 = e^2/4\pi\epsilon_0 a_0 = 2hcR_\infty$	E_h	$4.3597447222071(85)\times10^{-18}$	J	1.9×10^{-12}
		27.211386245988(53)	eV	1.9×10^{-12}
quantum of circulation	$\pi\hbar/m_e$	$3.6369475516(11)\times10^{-4}$	$\mathbf{m^2\ s^{-1}}$	3.0×10^{-10}
	$2\pi\hbar/m_e$	$7.2738951032(22)\times10^{-4}$	$\mathbf{m^2\ s^{-1}}$	3.0×10^{-10}

Table 66.25.4: Electroweak Constants

Quantity	Symbol	Value	Unit	Relative std. uncert. u_{\mathrm{r}}
Fermi coupling constant ‡	$G_F/(\hbar c)^3$	$1.1663787(6)\times10^{-5}$	$\mathbf{GeV^{-2}}$	5.1×10^{-7}
$\sin^2\theta_W = s_W^2 \equiv 1-(m_W/m_Z)^2$	$\sin^2\theta_W$	0.22290(30)		1.3×10^{-3}

Quantity	Symbol	Value	Unit	Relative std. uncert. u_{\mathrm{r}}
electron mass	m_e	$9.1093837015(28)\times10^{-31}$	kg	3.0×10^{-10}
		$5.48579909065(16)\times10^{-4}$	u	2.9×10^{-11}
energy equivalent	$m_e c^2$	$8.1871057769(25)\times10^{-14}$	J	3.0×10^{-10}
		0.51099895000(15)	MeV	3.0×10^{-10}
electron-muon mass ratio	m_e/m_μ	$4.83633169(11)\times10^{-3}$		2.2×10^{-8}
electron-tau mass ratio	m_e/m_τ	$2.87585(19)\times10^{-4}$		6.8×10^{-5}
electron-proton mass ratio	m_e/m_p	$5.44617021487(33)\times10^{-4}$		6.0×10^{-11}
electron-neutron mass ratio	m_e/m_n	$5.4386734424(26)\times10^{-4}$		4.8×10^{-10}
electron-deuteron mass ratio	m_e/m_d	$2.724437107462(96)\times10^{-4}$		3.5×10^{-11}
electron-triton mass ratio	m_e/m_t	$1.819200062251(90)\times10^{-4}$		5.0×10^{-11}
electron-helion mass ratio	m_e/m_h	$1.819543074573(79)\times10^{-4}$		4.3×10^{-11}
electron to alpha particle mass ratio	m_e/m_α	$1.370933554787(45)\times10^{-4}$		3.3×10^{-11}
electron charge to mass quotient	$-e/m_e$	$-1.75882001076(53)\times10^{11}$	C kg^{-1}	3.0×10^{-10}

electron molar mass $N_A m_e$	$M(\mathrm{e}), M_e$	$5.4857990888(17) \times 10^{-7}$	$\mathbf{kg\ mol^{-1}}$	3.0×10^{-10}
reduced Compton wavelength $\hbar / m_e c = \alpha a_0$	λ_C	$3.8615926796(12) \times 10^{-13}$	$\mathbf{m}$	3.0×10^{-10}
Compton wavelength	λ_C	$2.42631023867(73) \times 10^{-12}$	$[\mathrm{m}]$	3.0×10^{-10}
classical electron radius $\alpha^2 a_0$	r_e	$2.8179403262(13) \times 10^{-15}$	$\mathbf{m}$	4.5×10^{-10}
Thomson cross section $(8\pi/3) r_e^2$	$\boldsymbol{\sigma_e}$	$6.6524587321(60) \times 10^{-29}$	m^2	9.1×10^{-10}
electron magnetic moment	μ_e	$-9.2847647043(28) \times 10^{-24}$	$\mathrm{J\,T^{-1}}$	3.0×10^{-10}
to Bohr magneton ratio	$\boldsymbol{\mu_e / \mu_B}$	$-1.00115965218128(18)$		1.7×10^{-13}
to nuclear magneton ratio	$\boldsymbol{\mu_e / \mu_N}$	$-1838.28197188(11)$		6.0×10^{-11}
electron magnetic moment				
anomaly $\lvert \boldsymbol{\mu_e} \rvert / \boldsymbol{\mu_B} - \mathbf{1}$	a_e	$1.15965218128(18) \times 10^{-3}$		1.5×10^{-10}
electron g-factor $(-2(1+a_e))$	g_e	$-2.00231930436256(35)$		1.7×10^{-13}
electron-muon magnetic moment ratio	μ_e / μ_μ	$206.7669883(46)$		2.2×10^{-8}
electron-proton magnetic moment ratio electron to shielded proton magnetic	μ_e / μ_p	$-658.21068789(20)$		3.0×10^{-10}
moment ratio $(\mathrm{H_2O}, sphere, 25^\circ\mathrm{C})$	μ_e / μ_p'	$-658.2275971(72)$\)		1.1×10^{-8}
electron-neutron magnetic moment ratio	μ_e / μ_n	$960.92050(23)$		2.4×10^{-7}
electron-deuteron magnetic moment ratio electron to shielded helion magnetic	μ_e / μ_d	$-2143.9234915(56)$		2.6×10^{-9}
moment ratio (gas, sphere, $25^\circ\mathrm{C}$)	μ_e / μ_h'	$864.058257(10)$		1.2×10^{-8}

electron gyromagnetic ratio $2\left\|\mu_{\mathrm{e}}\right\|/\hbar$	γ_{e}	$1.76085963023(53) \times 10^{11}$	$\mathrm{s}^{-1}\ \mathrm{T}^{-1}$	3.0×10^{-10}
		$\mathbf{28024.9514242(85)}$	$\mathrm{MHz\,T}^{-1}$	3.0×10^{-10}

Table **66.25.6**: Muon, *mu_*

Quantity	Symbol	Value	Unit	Relative std. uncert. u_{\mathrm{r}}
muon mass	m_{μ}	$1.883531627(42) \times 10^{-28}$	kg	2.2×10^{-8}
		$\mathbf{0.1134289259(25)}$	u	2.2×10^{-8}
energy equivalent		$1.692833804(38) \times 10^{-11}$	J	2.2×10^{-8}
	$m_{\mu}c^2$	$\mathbf{105.6583755(23)}$	MeV	2.2×10^{-8}
muon-electron mass ratio	m_{μ}/m_{e}	$\mathbf{206.7682830(46)}$		2.2×10^{-8}
muon-tau mass ratio	m_{μ}/m_{τ}	$5.94635(40) \times 10^{-2}$		6.8×10^{-5}
muon-proton mass ratio	m_{μ}/m_{p}	$0.1126095264(25)$		2.2×10^{-8}
muon-neutron mass ratio	m_{μ}/m_{n}	$\mathbf{0.1124545170(25)}$		2.2×10^{-8}
muon molar mass $N_{\mathrm{A}}m_{\mu}$	$M(\mu), M_{\mu}$	$1.134289259(25) \times 10^{-4}$	$\mathbf{kg\ mol^{-1}}$	2.2×10^{-8}
reduced muon Compton wavelength $\hbar/m_{\mu}c$	$\lambda_{\mathrm{C},\mu}$	$1.867594306(42) \times 10^{-15}$	m	2.2×10^{-8}
muon Compton wavelength	$\lambda_{\mathrm{C},\mu}$	$1.173444110(26) \times 10^{-14}$	$[\mathrm{m}]^{\dagger}$	2.2×10^{-8}
muon magnetic moment	μ_{μ}	$-4.49044830(10) \times 10^{-26}$	$\mathrm{J\ T}^{-1}$	2.2×10^{-8}
to Bohr magneton ratio	$\boldsymbol{\mu_{\mu}/\mu_{\mathrm{B}}}$	$-4.84197047(11) \times 10^{-3}$		2.2×10^{-8}
to nuclear magneton ratio	$\boldsymbol{\mu_{\mu}/\mu_{\mathrm{N}}}$	$-8.89059703(20)$		2.2×10^{-8}
muon magnetic moment anomaly				5.4×10^{-7}
$\left\|\mu_{\mu}\right\|/(e\hbar/2m_{\mu})-1$	a_{μ}	$1.16592089(63) \times 10^{-3}$		6.3×10^{-10}
muon g-factor $-2\left(1+a_{\mu}\right)$	g_{μ}	$-2.0023318418(13)$		2.2×10^{-8}
muon-proton magnetic moment ratio	$\mu_{\mu}/\mu_{\mathrm{p}}$	$-3.183345142(71)$		

Table 66.25.7: Tau, $tau\_$

Quantity	Symbol	Value	Unit	Relative std. uncert. u_{\mathrm{r}}
tau mass	m_τ	$3.16754(21) \times 10^{-27}$	kg	6.8×10^{-5}
		$1.90754(13)$	u	6.8×10^{-5}
energy equivalent	$m_\tau c^2$	$2.84684(19) \times 10^{-10}$	J	6.8×10^{-5}
		$1776.86(12)$	MeV	6.8×10^{-5}
tau-electron mass ratio	m_τ/m_e	$3477.23(23)$		6.8×10^{-5}
tau-muon mass ratio	m_τ/m_μ	$16.8170(11)$		6.8×10^{-5}
tau-proton mass ratio	m_τ/m_p	$1.89376(13)$		6.8×10^{-5}
tau-neutron mass ratio	m_τ/m_n	$1.89115(13)$		6.8×10^{-5}
tau molar mass $N_\mathrm{A} m_\tau$	$M_{\mathrm{C},\tau}$	$1.90754(13) \times 10^{-3}$	$\mathbf{kg\ mol^{-1}}$	6.8×10^{-5}
reduced tau Compton wavelength $\hbar/m_\tau c$	$\lambda_{\mathrm{C},\tau}$	$1.110538(75) \times 10^{-16}$	$[\mathrm{~m}]^\dagger$	6.8×10^{-5}
tau Compton wavelength	$\lambda_{\mathrm{C},\tau}$	$6.97771(47) \times 10^{-16}$	$[m]$	6.8×10^{-5}

Table 66.25.8: Proton, p

Quantity	Symbol	Value	Unit	Relative std. uncert. u_{\mathrm{r}}
proton-tau mass ratio	m_p/m_τ	$0.528051(36)$		6.8×10^{-5}
proton-neutron mass ratio	$m_\mathrm{p}/m_\mathrm{n}$	$\mathbf{0.99862347812(49)}$		4.9×10^{-10}
proton charge to mass quotient	e/m_p	$9.5788331560(29) \times 10^{7}$	$\mathrm{C\ kg^{-1}}$	3.1×10^{-10}
proton molar mass $N_\mathrm{A} m_\mathrm{p}$	$M(\mathrm{p}), M_\mathrm{p}$	$1.00727646627(31) \times 10^{-3}$	$\mathbf{kg\ mol^{-1}}$	3.1×10^{-10}
reduced proton Compton wavelength $\hbar/m_\mathrm{p} c$	$\lambda_{\mathrm{C,p}}$	$2.10308910336(64) \times 10^{-16}$	\(m	3.1×10^{-10}
proton Compton wavelength	$\lambda_{\mathrm{C,p}}$	$1.32140985539(40) \times 10^{-15}$	$[\mathrm{m}]^\dagger$	3.1×10^{-10}
proton rms charge radius	r_p	$8.414(19) \times 10^{-16}$	$\mathbf{m}$	2.2×10^{-3}
proton magnetic moment	μ_p	$1.41060679736(60) \times 10^{-26}$	$\mathrm{J\ T^{-1}}$	4.2×10^{-10}

to Bohr magneton ratio	$\boldsymbol{\mu_{\mathrm{p}}/\mu_{\mathrm{B}}}$	$1.52103220230(46)\times 10^{-3}$		3.0×10^{-10}
to nuclear magneton ratio	$\boldsymbol{\mu_{\mathrm{p}}/\mu_{\mathrm{N}}}$	$\mathbf{2.79284734463(82)}$		2.9×10^{-10}
proton g-factor $\boldsymbol{2\mu_{\mathrm{p}}/\mu_{\mathrm{N}}}$	g_{p}	$\mathbf{5.5856946893(16)}$		2.9×10^{-10}
proton-neutron magnetic moment ratio	$\mu_{\mathrm{p}}/\mu_{\mathrm{n}}$	$-1.45989805(34)$		2.4×10^{-7}
shielded proton magnetic moment	μ'_{p}	$1.410570560(15)\times 10^{-26}$	$\mathrm{J\,T^{-1}}$	1.1×10^{-8}
$(\mathrm{H_2O}$, sphere, $25^\circ\mathrm{C})$				
to Bohr magneton ratio	$\boldsymbol{\mu'_{\mathrm{p}}/\mu_{\mathrm{B}}}$	$1.520993128(17)\times 10^{-3}$		1.1×10^{-8}
to nuclear magneton ratio	$\boldsymbol{\mu'_{\mathrm{p}}/\mu_{\mathrm{N}}}$	$\mathbf{2.792775599(30)}$		1.1×10^{-8}
proton magnetic shielding correction				
$1-\mu'_{\mathrm{p}}/\mu_{\mathrm{p}}\ (\mathrm{H_2O}$, *sphere*, $25^\circ\mathrm{C})$	σ'_{p}	$2.5689(11)\times 10^{-5}$		4.2×10^{-4}
proton gyromagnetic ratio $2\mu_{\mathrm{p}}/\hbar$	γ_{p}	$2.6752218744(11)\times 10^{8}$	$\mathrm{s^{-1}\,T^{-1}}$	4.2×10^{-10}
		$42.577478518(18)$	$\mathrm{MHz T^{-1}}$	4.2×10^{-10}
shielded proton gyromagnetic ratio				
$2\mu'_{\mathrm{p}}/\hbar\ (\mathrm{H_2O}$, *sphere*, $25^\circ\mathrm{C})$	γ'_{p}	$2.675153151(29)\times 10^{8}$	$\mathrm{s^{-1}\,T^{-1}}$	1.1×10^{-8}
		$\mathbf{42.57638474(46)}$	$\mathrm{MHz T^{-1}}$	1.1×10^{-8}

Table **66.25.9**: Neutron, n

Quantity	Symbol	Value	Unit	Relative std. uncert. u_{\mathrm{r}}
neutron mass	m_{n}	$1.67492749804(95)\times 10^{-27}$	kg	5.7×10^{-10}
		$1.00866491595(49)$	u	4.8×10^{-10}
energy equivalent	$m_{\mathrm{n}}c^2$	$1.50534976287(86)\times 10^{-10}$	J	5.7×10^{-10}
		$939.56542052(54)$	MeV	5.7×10^{-10}
neutron-electron mass ratio	$m_{\mathrm{n}}/m_{\mathrm{e}}$	$\mathbf{1838.68366173(89)}$		4.8×10^{-10}
neutron-muon mass ratio	m_{n}/m_{μ}	$8.89248406(20)$		2.2×10^{-8}

neutron-tau mass ratio	m_{n}/m_{τ}	$0.528779(36)$		6.8×10^{-5}
neutron-proton mass ratio	$m_{\mathrm{n}}/m_{\mathrm{p}}$	$\mathbf{1.00137841931(49)}$		4.9×10^{-10}
neutron-proton mass difference	$m_{\mathrm{n}} - m_{\mathrm{p}}$	$2.30557435(82) \times 10^{-30}$	kg	3.5×10^{-7}
		$1.38844933(49) \times 10^{-3}$	u	3.5×10^{-7}
energy equivalent	$(m_{\mathrm{n}} - m_{\mathrm{p}})\, c^2$	$2.07214689(74) \times 10^{-13}$	J	3.5×10^{-7}
		$1.29333236(46)$	MeV	3.5×10^{-7}
neutron molar mass $N_{\mathrm{A}} m_{\mathrm{n}}$	$M(\mathrm{n}), M_{\mathrm{n}}$	$1.00866491560(57) \times 10^{-3}$	$\mathbf{kg\ mol^{-1}}$	5.7×10^{-10}
reduced neutron Compton wavelength $\hbar/m_{\mathrm{n}} c$	\(\lambda_{\mathrm{C}, \mathrm{n}}\)	$2.1001941552(12) \times 10^{-16}$	m	5.7×10^{-10}
neutron Compton wavelength	\(\lambda_{\mathrm{C}, \mathrm{n}}\)	$1.31959090581(75) \times 10^{-15}$	[m]	5.7×10^{-10}
neutron magnetic moment	μ_{n}	$-9.6623651(23) \times 10^{-27}$	$\mathrm{J\,T^{-1}}$	2.4×10^{-7}
to Bohr magneton ratio	$\boldsymbol{\mu_{\mathrm{n}}/\mu_{\mathrm{B}}}$	$-1.04187563(25) \times 10^{-3}$		2.4×10^{-7}
to nuclear magneton ratio	$\boldsymbol{\mu_{\mathrm{n}}/\mu_{\mathrm{N}}}$	$-1.91304273(45)$		2.4×10^{-7}
neutron g-factor $\boldsymbol{2\mu_{\mathrm{n}}/\mu_{\mathrm{N}}}$	g_{n}	$-3.82608545(90)$		2.4×10^{-7}
neutron-electron magnetic moment ratio	$\mu_{\mathrm{n}}/\mu_{\mathrm{e}}$	$1.04066882(25) \times 10^{-3}$		2.4×10^{-7}
neutron-proton magnetic moment ratio	$\mu_{\mathrm{n}}/\mu_{\mathrm{p}}$	$-0.68497934(16)$		2.4×10^{-7}
neutron to shielded proton magnetic				
moment ratio $(\mathrm{H_2O}, \mathit{sphere}, 25^{\circ}\mathrm{C})$	$\mu_{\mathrm{n}}/\mu'_{\mathrm{p}}$	$-0.68499694(16)$		2.4×10^{-7}
neutron gyromagnetic ratio $2\lvert\mu_{\mathrm{n}}\rvert/\hbar$	γ_{n}	$1.83247171(43) \times 10^{8}$	$\mathrm{s^{-1}\ T^{-1}}$	2.4×10^{-7}
		$29.1646931(69)$	$\mathrm{MHz\,T^{-1}}$	2.4×10^{-7}

Table 66.25.10: Deuteron, d

Quantity	Symbol	Value	Unit	Relative std. uncert. u_{\mathrm{r}}
deuteron mass	m_{d}	$3.3435837768(10) \times 10^{-27}$	kg	3.1×10^{-10}
		$2.013553212544(15)$	u	7.4×10^{-12}
iivalent	$m_{\mathrm{d}} c^2$	$3.00506323491(94) \times 10^{-10}$	J	3.1×10^{-10}
deuteron-electron mass ratio	$m_{\mathrm{d}} / m_{\mathrm{e}}$	$3670.4829676555(63)$	MeV	3.1×10^{-10}
deuteron-proton mass ratio	$m_{\mathrm{d}} / m_{\mathrm{p}}$	$1.9990075012699(84)$		1.7×10^{-11}
deuteron molar mass $N_{\mathrm{A}} m_{\mathrm{d}}$	$M(\mathrm{~d}), M_{\mathrm{d}}$	$2.01355321466(63) \times 10^{-3}$		4.2×10^{-12}
deuteron rms charge radius	r_{d}	$2.12778(27) \times 10^{-15}$	\(\mathrm{~kg} \mathrm{~mol}^{-1 }	3.1×10^{-10}
deuteron magnetic moment	μ_{d}	$4.330735087(11) \times 10^{-27}$	\mathrm{~m}^{-1}	1.3×10^{-4}
to Bohr magneton ratio	$\mu_{\mathrm{d}} / \mu_{\mathrm{B}}$	$4.669754568(12) \times 10^{-4}$		2.6×10^{-9}
to nuclear magneton ratio	$\mu_{\mathrm{d}} / \mu_{\mathrm{N}}$	$\mathbf{0.8574382335(22)}$		2.6×10^{-9}
deuteron g-factor $\boldsymbol{\mu}_{\mathbf{d}} / \boldsymbol{\mu}_{\mathbf{N}}$	g_{d}	$\mathbf{0.8574382335(22)}$		2.6×10^{-9}
deuteron-electron magnetic moment ratio	$\mu_{\mathrm{d}} / \mu_{\mathrm{e}}$	$-4.664345550(12) \times 10^{-4}$		2.6×10^{-9}
deuteron-proton magnetic moment ratio	$\mu_{\mathrm{d}} / \mu_{\mathrm{p}}$	$\mathbf{0.30701220930(79)}$		2.6×10^{-9}
deuteron-neutron magnetic moment ratio	$\mu_{\mathrm{d}} / \mu_{\mathrm{n}}$	$-0.44820652(11)$		2.6×10^{-9}

Table 66.25.11: Triton, t

Quantity	Symbol	Value	Unit	Relative std. uncert. u_{\mathrm{r}}
triton mass	m_{t}	$5.0073567512(16) \times 10^{-27}$	kg	3.1×10^{-10}
		$\mathbf{3.01550071597(10)}$	u	3.4×10^{-11}
energy equivalent	$m_{\mathrm{t}} c^2$	$4.5003878119(14) \times 10^{-10}$	J	3.1×10^{-10}
		$\mathbf{2808.92113668(88)}$	MeV	3.1×10^{-10}

triton-electron mass ratio	$m_{\mathrm{t}}/m_{\mathrm{e}}$	$5496.92153551(21)$		3.8×10^{-11}
triton-proton mass ratio	$m_{\mathrm{t}}/m_{\mathrm{p}}$			3.4×10^{-11}
triton molar mass $N_{\mathrm{A}}m_{\mathrm{t}}$	$M(\mathrm{t}), M_{\mathrm{t}}$	$3.01550071913(94)\times10^{-3}$	$\mathbf{kg\ mol^{-1}}$	3.1×10^{-10}
triton magnetic moment	μ_{t}	$1.5046095178(30)\times10^{-26}$	$\mathrm{J\ T^{-1}}$	2.0×10^{-9}
to Bohr magneton ratio	$\boldsymbol{\mu_{\mathrm{t}}/\mu_{\mathrm{B}}}$	$1.6223936648(32)\times10^{-3}$		2.0×10^{-9}
to nuclear magneton ratio	$\boldsymbol{\mu_{\mathrm{t}}/\mu_{\mathrm{N}}}$	$\mathbf{2.9789624650(59)}$		2.0×10^{-9}
triton g-factor $\boldsymbol{2\mu_{\mathrm{t}}/\mu_{\mathrm{N}}}$	g_{t}			2.0×10^{-9}

Table 66.25.12: Helion, h

Quantity	Symbol	Value	Unit	Relative std. uncert. u_{\mathrm{r}}
helion mass	m_{h}	$5.0064127862(16)\times10^{-27}$	kg	3.1×10^{-10} 25×10^{-11}
		$3.014932246932(74)$		2.5×10^{-11}
energy equivalent	$m_{\mathrm{h}}c^2$	$4.4995394185(14)\times10^{-10}$	J	3.1×10^{-10}
		$\mathbf{2808.39161112(88)}$	MeV	3.1×10^{-10}
helion-electron mass ratio	$m_{\mathrm{h}}/m_{\mathrm{e}}$	$\mathbf{5495.88527984(16)}$		2.9×10^{-11}
helion-proton mass ratio	$m_{\mathrm{h}}/m_{\mathrm{p}}$	$2.993152671552(70)$		2.4×10^{-11}
helion molar mass $N_{\mathrm{A}}m_{\mathrm{h}}$	$M(\mathrm{h}), M_{\mathrm{h}}$	$3.01493225010(94)\times10^{-3}$	$\mathbf{kg\ mol^{-1}}$	3.1×10^{-10}
helion magnetic moment	μ_{h}	$-1.07461755198(93)\times10^{-26}$	J T	8.7×10^{-10}
to Bohr magneton ratio	$\boldsymbol{\mu_{\mathrm{h}}/\mu_{\mathrm{B}}}$	$-1.15874098083(94)\times10^{-3}$		8.1×10^{-10}
to nuclear magneton ratio	$\boldsymbol{\mu_{\mathrm{h}}/\mu_{\mathrm{N}}}$	$\mathbf{-2.1276253498(17)}$		8.1×10^{-10}
helion g-factor $\boldsymbol{2\mu_{\mathrm{h}}/\mu_{\mathrm{N}}}$	g_{h}	$\mathbf{-4.2552506995(34)}$		8.1×10^{-10}
shielded helion magnetic moment (gas, sphere, $25^{\circ}\mathrm{C}$)	μ_{h}'	$-1.07455311035(93)\times10^{-26}$	\(\mathrm{~J} \mathrm{~T}^{-1}	8.7×10^{-10}
to Bohr magneton ratio	$\boldsymbol{\mu_{\mathrm{h}}'/\mu_{\mathrm{B}}}$	$-1.15867149457(94)\times10^{-3}$		8.1×10^{-10}

to nuclear magneton ratio	$\mu'_{\mathrm{h}}/\mu_{\mathrm{N}}$	$\mathbf{-2.1274977624(17)}$		8.1×10^{-10}
shielded helion to proton magnetic moment ratio (gas, sphere, $25^\circ\mathrm{C}$) shielded helion to shielded proton magnetic	$\mu'_{\mathrm{h}}/\mu_{\mathrm{p}}$	$\mathbf{-0.76176657721(66)}$		8.6×10^{-10}
moment ratio (gas / $\mathrm{H_2O}$, $spheres$, $25^\circ\mathrm{C}$)	$\mu'_{\mathrm{h}}/\mu'_{\mathrm{p}}$	$-0.7617861334(31)$		4.0×10^{-9}
shielded helion gyromagnetic ratio				
$2\lvert\mu'_{\mathrm{h}}\rvert/\hbar$ (gas, sphere, $25^\circ\mathrm{C}$)	γ'_{h}	$2.0378946078(18)\times10^{8}$	$\mathrm{s}^{-1}\ \mathrm{T}^{-1}$	8.7×10^{-10}
		$\mathbf{32.434100033(28)}$	$\mathrm{MHz}\mathrm{T}^{-1}$	8.7×10^{-10}

Table 66.25.13: Alpha particle, α

Quantity	Symbol	Value	Unit	Relative std. uncert. u_{\mathrm{r}}
alpha particle mass	m_α	$6.6446573450(21)\times10^{-27}$	kg	3.1×10^{-10}
energy equivalent		$4.001506179129(62)$	u	1.6×10^{-11}
	$m_\alpha c^2$	$5.9719201997(19)\times10^{-10}$	J	3.1×10^{-10}
alpha particle to electron mass ratio		$\mathbf{3727.3794118(12)}$	MeV	3.1×10^{-10}
alpha particle to proton mass ratio	m_α/m_{e}	$\mathbf{7294.29954171(17)}$		2.4×10^{-11}
alpha particle rms charge radius	m_α/m_{p}	3.972599690252(70)\)		1.8×10^{-11}
alpha particle molar mass $N_{\mathrm{A}}m_\alpha$	r_α	$1.6785(21)\times10^{-15}$	m	1.2×10^{-3}
	$M(\alpha)$, M_α	$4.0015061833(12)\times10^{-3}$	\(\mathrm{~kg} \mathrm{~mol}^{-1 }	3.1×10^{-10}

Table 66.25.14: Physicochemical Constants

Quantity	Symbol	Value	Unit	Relative std. uncert. u_{\mathrm{r}}
Avogadro constant	N_{A}	6.02214076×10^{23}	$\mathbf{mol}^{-1}$	exact
Boltzmann constant	k	1.380649×10^{-23}	$\mathrm{J\ K}^{-1}$	exact
		$8.617333262\ldots\times10^{-5}$	$\mathrm{eV K}^{-1}$	exact
	k / h	$2.083661912\ldots\times10^{10}$	$\mathrm{Hz\ K}^{-1}$	exact

	k / h c	$69.50348004\ldots$	$\left[\mathrm{m}^{-1}\ \mathrm{K}^{-1}\right]^{\dagger}$	exact
atomic mass constant				
$m_{\mathrm{u}}=\frac{1}{12}m\left({}^{12}\mathrm{C}\right)=2hcR_{\infty}/\alpha^2c^2A_{\mathrm{r}}(\mathrm{e})$	m_{u}	$1.66053906892(52)\times$ 10^{-27}\)	kg	3.1×10^{-10}
equivalent energy	$m_{\mathrm{u}}c^2$	\) $1.49241808768(46)\times 10^{-10}$	J	3.1×10^{-10}
		$\mathbf{931.49410372(29)}$	MeV	3.1×10^{-10}
molar mass constant ‖	M_{u}	$1.00000000105(31)\times 10^{-3}$	$\mathbf{kg\ mol^{-1}}$	3.1×10^{-10}
molar mass" of carbon-12 $A_{\mathrm{r}}\left({}^{12}\mathrm{C}\right)M_{\mathrm{u}}$	$M\left({}^{12}\mathrm{C}\right)$	$12.0000000126(37)\times 10^{-3}$	$\mathbf{kg\ mol^{-1}}$	3.1×10^{-10}
molar Planck constant	$N_{\mathrm{A}}h$	$3.990312712\ldots\times 10^{-10}$	$\mathbf{J\ Hz^{-1}\ mol^{-1}}$	exact
molar gas constant $N_{\mathrm{A}}k$	R	$8.314462618\ldots$	$\mathrm{Jmol}^{-1}\ \mathrm{K}^{-1}$	exact
Faraday constant $N_{\mathrm{A}}e$	F	$96485.33212\ldots$	$\mathbf{Cmol^{-1}}$	exact
standard-state pressure		100000	Pa	exact
standard atmosphere		101325	Pa	exact
molar volume of ideal gas R T / p				
T=273.15 $\mathbf{K}, \boldsymbol{p}=\mathbf{100kPa}$ or standard-state pressure	V_{m}	$22.71095464\ldots\times 10^{-3}$	$\mathbf{m^3\ mol^{-1}}$	exact
Loschmidt constant $N_{\mathrm{A}}/V_{\mathrm{m}}$ molar volume of ideal gas R T / p	n_0	$2.651645804\ldots\times 10^{25}$	m^{-3}	exact
$\boldsymbol{T}=\mathbf{273.15\ K}, \boldsymbol{p}=\mathbf{101.325kPa}$ or standard atmosphere	V_{m}	$22.41396954\ldots\times 10^{-3}$	$\mathbf{m^3\ mol^{-1}}$	exact
Loschmidt constant $N_{\mathrm{A}}/V_{\mathrm{m}}$	n_0	$2.686780111\ldots\times 10^{25}$	m^{-3}	exact
Sackur-Tetrode (absolute entropy) constant**				

$\frac{5}{2}+\ln\left[\left(m_{\mathrm{u}} k T_1 / 2 \pi \hbar^2\right)^{3/2} k T_1 / p_0\right]$ $T_1=1\ \mathrm{K}, p_0=100 \mathrm{kPa}$ or standard-state pressure	S_0/R	$\mathbf{-1.15170753496(47)}$		4.1×10^{-10}
$T_1=1\ \mathrm{K}, p_0=101.325 \mathrm{kPa}$ or standard atmosphere		$\mathbf{-1.16487052149(47)}$		4.0×10^{-10}
Stefan-Boltzmann constant $\left(\pi^2/60\right) k^4/\hbar^3 c^2$	σ	$5.670374419 \ldots \times 10^{-8}$	$\mathrm{W\ m}^{-2}\ \mathrm{K}^{-4}$	exact
first radiation constant for spectral				
radiance $2hc^2\mathrm{sr}^{-1}$	$c_{1\mathrm{L}}$	$1.191042972 \ldots \times 10^{-16}$	$\left[\mathrm{W\ m}^2 \mathrm{sr}^{-1}\right]^{\dagger}$	exact
first radiation constant $2\pi hc^2=\pi \mathrm{sr} c_{1\mathrm{L}}$	c_1	$3.741771852 \ldots \times 10^{-16}$	$\left[\mathrm{W\ m}^2\right]^{\dagger}$	exact
second radiation constant h c / k	c_2	$1.438776877 \ldots \times 10^{-2}$	$[\mathrm{m\ K}]^{\dagger}$	exact
Wien displacement law constants				
$b=\lambda_{\max} T=c_2/4.965114231\ldots$	b	$2.897771955 \ldots \times 10^{-3}$	$[\mathrm{m\ K}]^{\dagger}$	exact
$b^{\prime}=\nu_{\max}/T=2.821439372\ldots c/c_2$	b'	$5.878925757 \ldots \times 10^{10}$	Hz K	exact

* The energy of a photon with frequency ν expressed in unit Hz is $E=h\nu$ in J . Unitary time evolution of the state of this photon is given by $\exp(-iEt/\hbar)|\varphi\rangle$, where $|\varphi\rangle$ is the photon state at time $t=0$ and time is expressed in unit s. The ratio $Et/\hbar$ is a phase.

† The symbol $[\mathrm{m}]$ denotes $\mathrm{m}/(\mathrm{Hz s})$. If angles are dimensionless, as in the current SI , then $\mathrm{Hz s}=1$. If angles have a dimension, then $\mathrm{Hz s}=$ cycle.
‡ Value recommended by the Particle Data Group (Workman, et al., 2022).

§ Based on the ratio of the masses of the W and Z bosons $m_{\mathrm{W}}/m_{\mathrm{Z}}$ recommended by the Particle Data Group (Workman, et al., 2022). The value for $\sin^2\theta_{\mathrm{W}}$ they recommend, which is based on a variant of the modified minimal subtraction $(\overline{\mathrm{MS}})$ scheme, is $\sin^2\hat{\theta}_{\mathrm{W}}\left(M_{\mathrm{Z}}\right)=0.23122(4)$.

II This and other constants involving m_τ are based on $m_\tau c^2$ in MeV recommended by the Particle Data Group (Workman, et al., 2022). atomic mass constant and u is the unified atomic mass unit. Moreover, the mass of particle X is $m(X)=A_{\mathrm{r}}(X)\mathrm{u}$ and the molar mass of X is \

(M(X)=A_{\mathrm{r}}(X) M_{\mathrm{u}}\), where $M_{\mathrm{u}}=N_{\mathrm{A}}\mathrm{u}$ is the molar mass constant and N_{A} is the Avogadro constant.

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