A Table showing Key Physical Constants

Issue 6

Key Constants		SI system	value	units	dimensions	cgs - esu	value	units	dimensions	cgs - emu	value	units	dimensions	esu/emu
speed of light	c	defined	2.9979E+08	metres/sec	LT^{-1}	$c_{SI} \times 10^2$	2.9979E+10	cm/sec	LT^{-1}	$c_{SI} \times 10^2$	2.9979E+10	cm/sec	LT^{-1}	1
permeability free space - $^{\text{flux density}}/_{\text{field strength}}$	μ_0	$4\pi \times 10^{-7}$	1.2566E-06	henry/metre	$MLI^{-2}T^{-2}$	$1 \times c_{cgs}^{-2}$	1.1127E-21	stathenry/cm	T^2L^{-2}	1	1.0000E+00	dimensionless	$M^0L^0T^0$	c_{cgs}^{-2}
Plank's constant - unit of action	h	measured	6.6261E-34	joule-sec	ML^2T^{-1}	$h_{SI} \times 10^7$	6.6261E-27	erg-sec	ML^2T^{-1}	$h_{SI} \times 10^7$	6.6261E-27	erg-sec	ML^2T^{-1}	1
haitch bar - absorbs 2π	ħ	$^{h}/_{2\pi}$	1.0546E-34	joule-sec	ML^2T^{-1}	$h_{cgs}/2\pi$	1.0546E-27	erg-sec	ML^2T^{-1}	$h_{cgs}/2\pi$	1.0546E-27	erg-sec	ML^2T^{-1}	1
gravitational constant - F = Gm_1m_2/r^2	G	measured	6.6743E-11	N-m^2/kg^2	$L^3M^{-1}T^{-2}$	$G_{SI} \times 10^3$	6.6743E-08	dyne-cm^2/g^2	$L^3M^{-1}T^{-2}$	$G_{SI} \times 10^3$	6.6743E-08	dyne-cm^2/g^2	$L^3M^{-1}T^{-2}$	1
Avogadro's Constant - exact if we redefine kg	N_A	defined	6.0221E+23	mol^{-1}	$M^0L^0T^0$	N_A	6.0221E+23	mol^{-1}	$M^0L^0T^0$	N_A	6.0221E+23	mol^{-1}	$M^0L^0T^0$	1
Ryberg constant (measured) - photon wavenumber	$^{Rc}/_{c}$	measured	1.0974E+07	$metres^{-1}$	L^{-1}	$2\pi^2 (m_e e^4/ch^3)$	1.0974E+05	cm^{-1}	L^{-1}	$c_{SI} \times 10^{-2}$	1.0974E+05	cm^{-1}	L^{-1}	1
Faraday's constant - charge on one mole	F	measured	9.6485E+04	coulomb	IT	measured	2.8926E+14	franklin	$M^{½}L^{1½}T^{-1}$	measured	9.6485E+03	abcoulomb	$M^{½}L^{½}$	c_{cgs}
proton rest mass	m_p	measured	1.6726E-27	kilogram	M	$m_{p\,si} \times 10^3$	1.6726E-24	grams	M	$m_{p\,si} \times 10^3$	1.6726E-24	grams	M	1
neutron rest mass	m_n	measured	1.6749E-27	kilogram	M	$m_{n\,si} \times 10^3$	1.6749E-24	grams	M	$m_{n\,si} \times 10^3$	1.6749E-24	grams	M	1
Hubble's constant - rate recession per unit distance	H_0	measured	7.0800E+01	km/sec/megaparsec	T^{-1}	measured	7.0800E+01	cm/sec/megaparsec	T^{-1}	measured	7.0800E+01	cm/sec/megaparsec	T^{-1}	1
Derived Constants														
permittivity free space - $^{\text{charge density}}/_{\text{field strength}}$	ε_o	$1 \div \mu_0 c^2$	8.8542E-12	farad/metre	$I^2T^4M^{-1}L^{-3}$	1	1.0000E+00	dimensionless	$M^0L^0T^0$	$1 \times c_{cgs}^{-2}$	1.1127E-21	abfarad/cm	T^2L^{-2}	c_{cgs}^2
charge of electron - fundamental	e	F/N_A	1.6022E-19	coulomb	IT	F/N_A	4.8032E-10	franklins	$M^{½}L^{1½}T^{-1}$	F/N_A	1.6022E-20	abcoulomb	$M^{½}L^{½}$	c_{cgs}
but actually measured by this ratio	e	$2/K_JR_K$	1.6022E-19	coulomb	IT	$2/K_JR_K$	4.8032E-10	franklins	$M^{½}L^{1½}T^{-1}$	$2/K_JR_K$	1.6022E-20	abcoulomb	$M^{½}L^{½}$	c_{cgs}
and now defined as	e	$\sqrt{(2h\alpha / \mu_0 c)}$	1.6022E-19	coulomb	IT	$\sqrt{(h \alpha c)}$	4.8032E-10	franklins	$M^{½}L^{1½}T^{-1}$	$\sqrt{(h \alpha / c)}$	1.6022E-20	abcoulomb	$M^{½}L^{½}$	c_{cgs}
substituting $\mu_0 = 1/\varepsilon_0 c^2 \rightarrow$	e	$\sqrt{(2h\alpha\varepsilon_0 c)}$	1.6022E-19	coulomb	IT	*there is no equivalent substitution here*				*there is no equivalent substitution here*				
Coulomb's constant - from $f_e = k_eQ_1Q_2/r^2$	k_e	$1/4\pi\varepsilon_0$	8.9876E+09	newton-$metre^2/coulomb^2$	$ML^3I^{-2}T^{-4}$	1	1.0000E+00	dimensionless	$M^0L^0T^0$	c_{cgs}^2	8.9876E+20	cm/abfarad	L^2T^{-2}	c_{cgs}^{-2}
Ampere's constant - from $f_m = k_mI_1I_2L/r$	k_m	$\mu_0/2\pi$	2.0000E-07	newton/$ampere^2$	$MLI^{-2}T^{-2}$	$2 \times c_{cgs}^{-2}$	2.2253E-21	dynes/$statampere^2$	T^2L^{-2}	2	2.0000E+00	dimensionless	$M^0L^0T^0$	c_{cgs}^{-2}
electron rest mass - fundamental but now derived	m_e	$2Rh/c\alpha^2$	9.1094E-31	kilogram	M	$m_{e\,si} \times 10^3$	9.1094E-28	grams	M	$m_{e\,si} \times 10^3$	9.1094E-28	grams	M	1
reduced (intracule) mass	m_r	$m_pm_e/(m_p+m_e)$	9.1044E-31	kilogram	M	$m_pm_e/(m_p+m_e)$	9.1044E-28	grams	M	$m_pm_e/(m_p+m_e)$	9.1044E-28	grams	M	1
Ryberg's constant - measured directly	R	$m_ee^4/(ch^38\varepsilon_0^2)$	1.0974E+07	$metres^{-1}$	L^{-1}	$2\pi^2 (m_ee^4/ch^3)$	1.0974E+05	cm^{-1}	L^{-1}	$2\pi^2 (m_ec^3e^4/ch^3)$	1.0974E+05	cm^{-1}	L^{-1}	1
Ryberg's constant - measured directly	R	$\alpha^2/2\lambda_{ce}$	1.0974E+07	$metres^{-1}$	L^{-1}	$\alpha^2/2\lambda_{ce}$	1.0974E+05	cm^{-1}	L^{-1}	$\alpha^2/2\lambda_{ce}$	1.0974E+05	cm^{-1}	L^{-1}	1
Josephson constant - measured directly	K_J	2e/h	4.8360E+14	hertz/volt	$IT^3M^{-1}L^{-2}$	2e/h	1.4498E+17	hertz/statvolt	$M^{-½}L^{-½}$	2e/h	4.8360E+06	hertz/abvolt	$TM^{-½}L^{-1½}$	c_{cgs}
von Klitzing constant - measured directly	R_K	h/e^2	2.5813E+04	ohms	$ML^2I^{-2}T^{-3}$	h/e^2	2.8721E-08	statohm	TL^{-1}	h/e^2	2.5813E+13	abohm	LT^{-1}	c_{cgs}^{-2}
Quantum Charge Ratio	$^{h}/_{e}$	$^{h}/_{e}$	4.1357E-15	joule-sec/coulomb	$ML^2I^{-1}T^{-2}$	$^{h}/_{e}$	1.3795E-17	erg-sec/franklin	$M^{½}L^{½}$	$^{h}/_{e}$	4.1357E-07	erg-sec/abcoloumb	$M^{½}L^{1½}T^{-1}$	c_{cgs}^{-1}
electron rest energy	m_ec^2	m_ec^2	8.1871E-14	joules	ML^2T^{-2}	m_ec^2	8.1871E-07	ergs	ML^2T^{-2}	m_ec^2	8.1871E-07	ergs	ML^2T^{-2}	1
electron $^{\text{charge}}/_{\text{mass}}$	e/m_e	e/m_e	1.7588E+11	coulomb/kg	ITM^{-1}	e/m_e	5.2728E+17	franklin/gram	$M^{-½}L^{1½}T^{-1}$	e/m_e	1.7588E+07	abcoulomb/gram	$M^{-½}L^{½}$	c_{cgs}
proton rest energy	m_pc^2	m_pc^2	1.5033E-10	joules	ML^2T^{-2}	m_pc^2	1.5033E-03	ergs	ML^2T^{-2}	m_pc^2	1.5033E-03	ergs	ML^2T^{-2}	1
proton $^{\text{charge}}/_{\text{mass}}$	e/m_p	e/m_p	9.5788E+07	coulomb/kg	ITM^{-1}	e/m_p	2.8717E+14	franklin/gram	$M^{½}L^{1½}T^{-1}$	e/m_p	9.5788E+03	abcoulomb/gram	$M^{½}L^{½}$	c_{cgs}
neutron rest energy	m_nc^2	m_nc^2	1.5053E-10	joules	ML^2T^{-2}	m_nc^2	1.5053E-03	ergs	ML^2T^{-2}	m_nc^2	1.5053E-03	ergs	ML^2T^{-2}	1
Bohr radius	a_0	$4\pi\varepsilon_0\hbar^2/m_ee^2$	5.2918E-11	metres	L	$\hbar^2/m_ee^2$	5.2918E-09	cm	L	$\hbar^2/m_ee^2c^2$	5.2918E-09	cm	L	1
Bohr radius	a_0	$\alpha /4\pi R$	5.2918E-11	metres	L	$\alpha /4\pi R$	5.2918E-09	cm	L	$\alpha /4\pi R$	5.2918E-09	cm	L	1
Compton wavelength electron	λ_{ce}	h/m_ec	2.4263E-12	metres	L	h/m_ec	2.4263E-10	cm	L	h/m_ec	2.4263E-10	cm	L	1
Compton wavelength proton	λ_{cp}	h/m_pc	1.3214E-15	metres	L	h/m_pc	1.3214E-13	cm	L	h/m_pc	1.3214E-13	cm	L	1
Compton (classical) radius	r_e	$e^2/4\pi\varepsilon_0m_ec^2$	2.8179E-15	metres	L	e^2/m_ec^2	2.8179E-13	cm	L	e^2/m_e	2.8179E-13	cm	L	1
Compton (classical) radius	r_e	α^2a_0	2.8179E-15	metres	L	α^2a_0	2.8179E-13	cm	L	α^2a_0	2.8179E-13	cm	L	1
Plank charge	q_P	$\sqrt{(4\pi\varepsilon_0\hbar c)}$	1.8755E-18	coulombs	IT	$\sqrt{(\hbar c)}$	5.6227E-09	franklins	$M^{½}L^{1½}T^{-1}$	$\sqrt{(\hbar / c)}$	1.8755E-19	abcoulomb	$M^{½}L^{½}$	c_{cgs}
Fine Structure Constant	α^{-1}	q_P^2 / e^2	1.3704E+02	dimensionless	$M^0L^0T^0$	q_P^2 / e^2	1.3704E+02	dimensionless	$M^0L^0T^0$	q_P^2 / e^2	1.3704E+02	dimensionless	$M^0L^0T^0$	1
Fine Structure Constant	α^{-1}	$4\pi\varepsilon_0\hbar c/e^2$	1.3704E+02	dimensionless	$M^0L^0T^0$	$\hbar c / e^2$	1.3704E+02	dimensionless	$M^0L^0T^0$	$\hbar / ce^2$	1.3704E+02	dimensionless	$M^0L^0T^0$	1
Fine Structure Constant	α^{-1}	$(\hbar c/e^2)/k_e$	1.3704E+02	dimensionless	$M^0L^0T^0$	$(\hbar c/e^2)/k_e$	1.3704E+02	dimensionless	$M^0L^0T^0$	$(\hbar c/e^2)/k_e$	1.3704E+02	dimensionless	$M^0L^0T^0$	1
Fine Structure Constant	α^{-1}	$2\pi\, a_0 / \lambda_{ce}$	1.3704E+02	dimensionless	$M^0L^0T^0$	$2\pi\, a_0 / \lambda_{ce}$	1.3704E+02	dimensionless	$M^0L^0T^0$	$2\pi\, a_0 / \lambda_{ce}$	1.3704E+02	dimensionless	$M^0L^0T^0$	1
Fine Structure Constant	α^{-1}	$\lambda_{ce} / 2\pi r_e$	1.3704E+02	dimensionless	$M^0L^0T^0$	$\lambda_{ce} / 2\pi r_e$	1.3704E+02	dimensionless	$M^0L^0T^0$	$\lambda_{ce} / 2\pi r_e$	1.3704E+02	dimensionless	$M^0L^0T^0$	1
Fine Structure Constant	α	*inverse*	7.2974E-03	dimensionless	$M^0L^0T^0$	*inverse*	7.2974E-03	dimensionless	$M^0L^0T^0$	*inverse*	7.2974E-03	dimensionless	$M^0L^0T^0$	1
Gravitational coupling constant	α_G	$(m_e/m_{pk})^2$	1.7518E-45	dimensionless	$M^0L^0T^0$	$(m_e/m_{pk})^2$	1.7518E-45	dimensionless	$M^0L^0T^0$	$(m_e/m_{pk})^2$	1.7518E-45	dimensionless	$M^0L^0T^0$	1
$^{\text{electrostatic}}/_{\text{gravitational force}}$ - pair electons	$\mathcal{N}_{ee}$	k_ee^2 / Gm_e^2	4.1656E+42	dimensionless	$M^0L^0T^0$	k_ee^2 / Gm_e^2	4.1656E+42	dimensionless	$M^0L^0T^0$	k_ee^2 / Gm_e^2	4.1656E+42	dimensionless	$M^0L^0T^0$	1
$^{\text{electrostatic}}/_{\text{gravitational force}}$ - pair protons	$\mathcal{N}_{pe}$	k_ee^2 / Gm_p^2	1.2356E+36	dimensionless	$M^0L^0T^0$	k_ee^2 / Gm_p^2	1.2356E+36	dimensionless	$M^0L^0T^0$	k_ee^2 / Gm_p^2	1.2356E+36	dimensionless	$M^0L^0T^0$	1
$^{\text{electrostatic}}/_{\text{gravitational force}}$ - proton and electron	$\mathcal{N}_{pe}$	k_ee^2 / Gm_pm_e	2.2687E+39	dimensionless	$M^0L^0T^0$	k_ee^2 / Gm_pm_e	2.2687E+39	dimensionless	$M^0L^0T^0$	k_ee^2 / Gm_pm_e	2.2687E+39	dimensionless	$M^0L^0T^0$	1
one volt - this line used for conversions below			1.0000E+00	volt	$ML^2I^{-1}T^{-3}$	$1 \times 10^8 / c$	3.3356E-03	statvolt	$M^{½}L^{½}T^{-1}$	1×10^8	1.0000E+08	abvolts	$M^{½}L^{1½}T^{-2}$	c_{cgs}^{-1}
electron-volt - charge × voltage drop	eV	e × 1 volt	1.6022E-19	joules	ML^2T^{-2}	e × statvolts	1.6022E-12	ergs	ML^2T^{-2}	e × abvolts	1.6022E-12	ergs	ML^2T^{-2}	1
electron-volt - charge × voltage drop	eV	e / c^2	1.7827E-36	kilograms	M	e / c^2	1.7827E-33	grams	M	e / c^2	1.7827E-33	grams	M	1
Planck length	L_{pk}	$\sqrt{(G\hbar/c^3)}$	1.6163E-35	metres	L	$\sqrt{(G\hbar/c^3)}$	1.6163E-33	cm	L	$\sqrt{(G\hbar/c^3)}$	1.6163E-33	cm	L	1
Plank time	t_{pk}	$\sqrt{(G\hbar/c^5)}$	5.3912E-44	seconds	T	$\sqrt{(G\hbar/c^5)}$	5.3912E-44	seconds	T	$\sqrt{(G\hbar/c^5)}$	5.3912E-44	seconds	T	1
Plank mass	m_{pk}	$\sqrt{(c\hbar/G)}$	2.1764E-08	kilograms	M	$\sqrt{(c\hbar/G)}$	2.1764E-05	grams	M	$\sqrt{(c\hbar/G)}$	2.1764E-05	grams	M	1
Plank mass (expressed as energy)	$m_{pk(e)}$	$m_{pk}c^2$ / e×10^9	1.2209E+19	giga electron-volts	ML^2T^{-2}	$m_{pk}c^3$ / e×10^{17}	1.2209E+19	giga electron-volts	ML^2T^{-2}	$m_{pk}c^2$ / e×10^{17}	1.2209E+19	giga electron-volts	ML^2T^{-2}	1
Plank mass (expressed as energy)	$m_{pk(e)}$	m_{pk}×joules/eV	1.9561E+00	gigajoules	ML^2T^{-2}	m_{pk}×ergs/eV	1.9561E+07	giga ergs	ML^2T^{-2}	m_{pk}×ergs/eV	1.9561E+07	giga ergs	ML^2T^{-2}	1
Plank mass (expressed as energy)	$m_{pk(e)}$	$m_{pk} \times c^2$	1.9561E+09	joules	ML^2T^{-2}	$m_{pk} \times c^2$	1.9561E+16	ergs	ML^2T^{-2}	$m_{pk} \times c^2$	1.9561E+16	ergs	ML^2T^{-2}	1
One astronomical unit	au		1.49598E+11	metres			1.49598E+13	cm	L		1.49598E+13	cm	L	1
parsec - 360 × 60 × 60 au / 2π	pc		3.08568E+16	metres			3.08568E+18	cm	L		3.08568E+18	cm	L	1
megaparsec	mpc		3.08568E+22	metres			3.08568E+24	cm	L		3.08568E+24	cm	L	1

Strangely Eddington's never directly references this equation. The closest is page 105 FT when he quotes in the text but doesn't number.

These formulae have been derived purely empirically and require justification