

Physics 310 – Cosmology  
Units and Constants

**Fundamental SI Units**

<u>Measures</u>	<u>Name</u>	<u>Abbr.</u>
Length	meter	m
Time	second	s
Mass	kilogram	kg
Temperature	Kelvin	K
Charge	Coulomb	C

**Metric Abbreviations**

<u>Name</u>	<u>Abbr.</u>	<u>Multiple</u>
tera	T	$10^{12}$
giga	G	$10^9$
mega	M	$10^6$
kilo	k	$10^3$
centi	c	$10^{-2}$
milli	m	$10^{-3}$
micro	$\mu$	$10^{-6}$
nano	n	$10^{-9}$
pico	p	$10^{-12}$
femto	f	$10^{-15}$

**Derived SI Units**

<u>Measures</u>	<u>Name</u>	<u>Abbr.</u>	<u>Equiv.</u>
Force	Newton	N	$\text{kg}\cdot\text{m}/\text{s}^2$
Energy	Joule	J	$\text{N}\cdot\text{m}$
Power	Watt	W	$\text{J}/\text{s}$
Frequency	Hertz	Hz	$\text{s}^{-1}$
Pressure	Pascal	Pa	$\text{N}/\text{m}^2$
Elec. Potential	Volt	V	$\text{J}/\text{C}$
Mag. Field	Tesla	T	$\text{N}\cdot\text{s}/\text{m}/\text{C}$

**Non SI Units**

<u>Name</u>	<u>Abbr.</u>	<u>Value</u>
Minute	min	60 s
Hour	h	3600 s
Day	d	86,400 s
Year	y	$3.156\times 10^7$ s
Angstrom	$\text{\AA}$	$10^{-10}$ m
Astronomical Unit	AU	$1.496\times 10^{11}$ m
Parsec	pc	$3.086\times 10^{16}$ m
Electron volt	eV	$1.602\times 10^{-19}$ J

**Physical Constants**

<u>Name</u>	<u>Symbol</u>	<u>Value</u>
Speed of light	$c$	$2.9979\times 10^8$ m/s
Planck's Reduced Constant	$\hbar$	$1.0546\times 10^{-34}$ J·s $= 6.5821\times 10^{-16}$ eV·s
Boltzmann's Constant	$k_B$	$1.3807\times 10^{-23}$ J/K $= 8.6173\times 10^{-5}$ eV/K
Newton's Constant	$G$	$6.674\times 10^{-11}$ $\text{m}^3/\text{kg}/\text{s}^2$
Elementary Charge	$e$	$1.6022\times 10^{-19}$ C
Avogadro's number	$N_A$	$6.0221\times 10^{23}$ /mol
Electron mass	$m_e$	$9.1094\times 10^{-31}$ kg $= 511.00$ keV/ $c^2$
Proton mass	$m_p$	$1.6726\times 10^{-27}$ kg $= 938.27$ MeV/ $c^2$
Neutron mass	$m_n$	$1.6749\times 10^{-27}$ kg $= 939.56$ MeV/ $c^2$
Coulomb's Constant	$k_e$	$8.9876\times 10^9$ $\text{N}\cdot\text{m}^2/\text{C}^2$

**Useful Combinations**

<u>Combination</u>	<u>Value</u>
$\hbar c$	$3.1615\times 10^{-26}$ J·m $= 197.33$ eV·nm
$\alpha \equiv \frac{k_e e^2}{\hbar c}$	$0.0072974 = \frac{1}{137.04}$
$\sigma \equiv \frac{\pi^2 k_B^4}{60 \hbar^3 c^2}$	$5.670\times 10^{-8}$ $\text{W}/\text{m}^2/\text{K}^4$
MeV/ $c$	$5.344\times 10^{-22}$ kg·m/s
MeV/ $c^2$	$1.78266\times 10^{-30}$ kg

**Angles**

1 circle =  $360^\circ = 2\pi$  rad  
 $1^\circ = 60$  arc-min =  $60'$   
 $1' = 60$  arc-sec =  $60''$   
 $1'' = 1000$  milli-arc-sec =  $1000$  mas

<u>Name</u>	<u>Abbr.</u>	<u>Value</u>
Solar Radius	$R_\odot$	$6.957\times 10^8$ m
Solar Mass	$M_\odot$	$1.988\times 10^{30}$ kg
Solar Lum.	$L_\odot$	$3.828\times 10^{26}$ W
Solar Temp.	$T_\odot$	5772 K