

Physics 215 – Elementary Modern Physics

## 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	N·m
Power	Watt	W	J/s
Frequency	Hertz	Hz	$\text{s}^{-1}$
Pressure	Pascal	Pa	$\text{N}/\text{m}^2$
Current	Ampere	A	C/s
Elec. Potential	Volt	V	J/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	$3.1558\times 10^7$ s
Light year	ly = c·y	$9.4607\times 10^{15}$ m
Electron volt	eV	$1.6022\times 10^{-19}$ J
Unified mass unit	u	$1.6605\times 10^{-27}$ kg $= 931.494 \text{ MeV}/c^2$

### Physical Constants

<u>Name</u>	<u>Symbol</u>	<u>Value</u>
Speed of light	$c$	$2.9979\times 10^8$ m/s
Fundamental 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 $= 511.00 \text{ keV}/c^2$
Proton mass	$m_p$	$1.6726\times 10^{-27}$ kg $= 938.27 \text{ MeV}/c^2$
Neutron mass	$m_n$	$1.6749\times 10^{-27}$ kg $= 939.56 \text{ MeV}/c^2$
Boltzmann's Constant	$k_B$	$1.3807\times 10^{-23}$ J/K $= 8.6173\times 10^{-5} \text{ eV}/\text{K}$
Planck's Constant	$h$	$6.6261\times 10^{-34}$ J·s $= 4.1357\times 10^{-15} \text{ eV}\cdot\text{s}$
Planck's Reduced Constant	$\hbar$	$1.0546\times 10^{-34}$ J·s $= 6.5821\times 10^{-16} \text{ eV}\cdot\text{s}$
Coulomb's Constant	$k$	$8.9876\times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$

### Useful Combinations

<u>Combination</u>	<u>Value</u>
$hc$	$1.9864\times 10^{-25}$ J·m $= 1239.8 \text{ eV}\cdot\text{nm}$
$\hbar c$	$3.1615\times 10^{-26}$ J·m $= 197.33 \text{ eV}\cdot\text{nm}$
$\lambda_c \equiv \frac{h}{m_e c}$	2.4263 pm
$a_0 \equiv \frac{\hbar^2}{k m_e e^2}$	0.052918 nm
$\alpha \equiv \frac{ke^2}{\hbar c}$	$0.0072974 = \frac{1}{137.04}$
MeV/c	$5.344\times 10^{-22}$ kg·m/s
MeV/c <sup>2</sup>	$1.78266\times 10^{-30}$ kg