

SN2: Electricity & Magnetism Data Sheet

Constants	Prefixes Used with SI Units	Particles																																																												
Acceleration Due to Gravity Near Earth $ \vec{a}_g = 9.81 \text{ m/s}^2$	<table> <tr> <th>Prefix</th><th>Symbol</th><th>Exponential Value</th></tr> <tr><td>atto</td><td><i>a</i></td><td>10^{-18}</td></tr> <tr><td>femto</td><td><i>f</i></td><td>10^{-15}</td></tr> <tr><td>pico</td><td><i>p</i></td><td>10^{-12}</td></tr> <tr><td>nano</td><td><i>n</i></td><td>10^{-9}</td></tr> <tr><td>micro</td><td>μ</td><td>10^{-6}</td></tr> <tr><td>milli</td><td><i>m</i></td><td>10^{-3}</td></tr> <tr><td>centi</td><td><i>c</i></td><td>10^{-2}</td></tr> <tr><td>deci</td><td><i>d</i></td><td>10^{-1}</td></tr> <tr><td>deka</td><td><i>da</i></td><td>10^1</td></tr> <tr><td>hecto</td><td><i>h</i></td><td>10^2</td></tr> <tr><td>kilo</td><td><i>k</i></td><td>10^3</td></tr> <tr><td>mega</td><td><i>M</i></td><td>10^6</td></tr> <tr><td>giga</td><td><i>G</i></td><td>10^9</td></tr> <tr><td>tera</td><td><i>T</i></td><td>10^{12}</td></tr> </table>	Prefix	Symbol	Exponential Value	atto	<i>a</i>	10^{-18}	femto	<i>f</i>	10^{-15}	pico	<i>p</i>	10^{-12}	nano	<i>n</i>	10^{-9}	micro	μ	10^{-6}	milli	<i>m</i>	10^{-3}	centi	<i>c</i>	10^{-2}	deci	<i>d</i>	10^{-1}	deka	<i>da</i>	10^1	hecto	<i>h</i>	10^2	kilo	<i>k</i>	10^3	mega	<i>M</i>	10^6	giga	<i>G</i>	10^9	tera	<i>T</i>	10^{12}	<table> <tr> <th></th><th>Charge</th><th>Mass</th></tr> <tr> <td>Alpha Particle</td><td>$+2e$</td><td>$6.65 \times 10^{-27} \text{ kg}$</td></tr> <tr> <td>Electron</td><td>$-1e$</td><td>$9.11 \times 10^{-31} \text{ kg}$</td></tr> <tr> <td>Proton</td><td>$+1e$</td><td>$1.67 \times 10^{-27} \text{ kg}$</td></tr> <tr> <td>Neutron</td><td>0</td><td>$1.67 \times 10^{-27} \text{ kg}$</td></tr> </table>		Charge	Mass	Alpha Particle	$+2e$	$6.65 \times 10^{-27} \text{ kg}$	Electron	$-1e$	$9.11 \times 10^{-31} \text{ kg}$	Proton	$+1e$	$1.67 \times 10^{-27} \text{ kg}$	Neutron	0	$1.67 \times 10^{-27} \text{ kg}$
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Gravitational Constant ... $G = 6.67 \times 10^{-11} \text{ N} \cdot \text{m}^2/\text{kg}^2$																																																														
Radius of Earth $r_E = 6.37 \times 10^6 \text{ m}$																																																														
Mass of Earth..... $M_E = 5.97 \times 10^{24} \text{ kg}$																																																														
Elementary charge..... $e = 1.60 \times 10^{-19} \text{ C}$																																																														
Coulomb's Law Constant $k = \frac{1}{4\pi\epsilon_0} = 8.99 \times 10^9 \text{ N} \cdot \text{m}^2/\text{C}^2$																																																														
Electron Volt..... $1 \text{ eV} = 1.60 \times 10^{-19} \text{ J}$																																																														
Atomic Mass Unit..... $u = 1.66 \times 10^{-27} \text{ kg}$																																																														
Permittivity of free space $\epsilon_0 = 8.85 \times 10^{-12} \frac{\text{C}^2}{\text{N} \cdot \text{m}^2}$																																																														
Permeability of free space $\mu_0 = 4\pi \cdot 10^{-7} \frac{\text{N}}{\text{A}^2} \text{ or } \frac{\text{Wb}}{\text{A} \cdot \text{m}}$																																																														
Avogadro's Number..... $N_A = 6.022 \times 10^{23} \text{ atoms/mol}$																																																														
Kinematics & Dynamics	Momentum & Energy	Useful Equations																																																												
$x = x_o + v_o t + \frac{1}{2} a t^2$	$\vec{p} = m\vec{v}$	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$																																																												
$v = v_o + at$	$K_1 + U_1 + W_{nc} = K_2 + U_2$	$\frac{d(t^n)}{dt} = nt^{n-1}$																																																												
$v^2 = v_o^2 + 2a(x - x_o)$	$\vec{F}\Delta t = m\Delta\vec{v}$	$\frac{d}{dt} \sin(\omega t) = \omega \cos(\omega t)$																																																												
$\vec{F} = m\vec{a}$	$W = \vec{F} \cdot \vec{d}$	$\frac{d}{dt} \cos(\omega t) = -\omega \sin(\omega t)$																																																												
$\vec{F} = \frac{Gm_1m_2}{r_{12}^2} \hat{r}_{12}$	$P = \frac{W}{t} = \vec{F} \cdot \vec{v}$	$\ln(e^{ab}) = ab$																																																												

SN2: Electricity & Magnetism Equation Sheet

Electricity		Circuits		Magnetism
$\vec{F} = Q\vec{E}$ $\vec{E}_p = \frac{kQ}{r^2}\hat{r}_p$ $U(r) = k\frac{qQ}{r}$ $V = \frac{U}{q} = -\int_R^P \vec{E} \cdot d\vec{l}$ $V_p = \frac{kQ}{r}$ $\vec{E} = -\left(\frac{\partial V}{\partial x}\hat{i} + \frac{\partial V}{\partial y}\hat{j} + \frac{\partial V}{\partial z}\hat{k}\right)$		$I = \frac{dQ}{dt}$ $V = IR$ $R_{eq} = R_1 + R_2 + R_3 \dots$ $R_{eq} = \left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \dots\right)^{-1}$ $P = IV = I^2R = \frac{V^2}{R}$ $C = \frac{Q}{V}$ $C_{eq} = \left(\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} \dots\right)^{-1}$ $C_{eq} = C_1 + C_2 + C_3 \dots$ $U_C = \frac{1}{2}V^2C = \frac{1}{2}\frac{Q^2}{C} = \frac{1}{2}QV$ $\tau = RC$ $X_{\text{increasing}}(t) = X\left(1 - e^{\frac{-t}{\tau}}\right)$ $X_{\text{decreasing}}(t) = Xe^{\frac{-t}{\tau}}$		$\vec{F} = q\vec{v} \times \vec{B}$ $\vec{F} = I\vec{l} \times \vec{B}$ $r = \frac{mv}{qB}$ $\vec{\mu} = NIA\hat{n}$ $\vec{\tau} = \vec{\mu} \times \vec{B}$ $\vec{B} = \frac{\mu_0}{4\pi} \int_{\text{wire}} \frac{Id\vec{l} \times \hat{r}}{r^2}$ $B_{\text{wire}} = \frac{\mu_0 I}{2\pi R}$ $B_{\text{coil}} = \frac{\mu_0 NI}{2R}$ $B_{\text{solenoid}} = \mu_0 nI$ $\phi_m = \vec{B} \cdot \vec{A}$ $\mathcal{E} = -N \frac{d\phi_m}{dt}$