



# On-Level Physics Equation Sheet

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<u>Fall Semester</u>		<u>Spring Semester</u>	
<p><b><u>Constant Motion</u></b> <math>\Delta d = v_c t</math></p> <p><b><u>Changing Motion</u></b> <math>\Delta d = v_{avg} t</math> <math>v_f = v_i + at</math> <math>\Delta d = v_i t + \frac{1}{2} at^2</math> <math>v_f^2 = v_i^2 + 2a\Delta d</math></p> <p><b><u>Newton's Laws</u></b> <math>\Sigma F = F_{net} = ma</math> <math>F_g = mg</math> (weight)</p> <p><b><u>2D Motion</u></b> <math>d_y = \frac{1}{2} gt^2</math> <math>d_x = v_x t</math></p>	<p><b><u>UCM and Gravity</u></b> (Uniform Circular Motion) <math>F_{net} = F_{centripetal} = \frac{mv^2}{r}</math> <math>F_g = \frac{Gm_1 m_2}{r^2}</math> or <math>\frac{Gm_1 m_2}{d^2}</math> <math>T = \frac{1}{f}</math> <math>v = \frac{2\pi r}{T}</math> <math>a_c = \frac{v^2}{r}</math></p> <p><b><u>Work and Energy</u></b> <math>W = F\Delta d</math> <math>W_{net} = \Delta KE</math> <math>W = \Delta E</math> <math>PE_{gravity} = mgh</math> <math>KE = \frac{1}{2} mv^2</math> <math>PE_i + KE_i = PE_f + KE_f</math> <math>P = \frac{W}{t} = \frac{E}{t}</math> <math>Q = mc\Delta T</math> <math>F = \frac{9}{5} C + 32</math> <math>K = 273.15 + C</math></p>	<p><b><u>Impulse &amp; Momentum</u></b> <math>p = mv</math> <math>m_1 v_1 + m_2 v_2 = m_1 v_1' + m_2 v_2'</math> <math>J = F_{net} \Delta t = \Delta p = m\Delta v</math></p> <p><b><u>Mechanical Waves</u></b> <math>v = \lambda f</math></p> <p><b><u>Electromagnetic Waves</u></b> <math>c = \lambda f</math> <math>n = \frac{c}{v}</math> <math>n_i \sin \theta_i = n_r \sin \theta_r</math> <math>\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}</math></p> <p><b><u>Electrostatics</u></b> <math>Q = Ne</math> <math>F_E = \frac{kq_1 q_2}{r^2}</math> or <math>\frac{kq_1 q_2}{d^2}</math> <math>E = \frac{F_E}{q}</math> <math>V = \frac{W}{q}</math></p>	<p><b><u>Circuits</u></b> <math>V = iR</math> <math>P = iV = i^2 R = \frac{V^2}{R}</math> <math>i = \frac{Q}{t}</math> <math>R_{series} = R_1 + R_2 + \dots</math> <math>\frac{1}{R_{parallel}} = \frac{1}{R_1} + \frac{1}{R_2} + \dots</math></p> <p><b><u>Magnetism</u></b> <math>F_B = qvB</math> <math>F_B = BiL</math> <i>F<sub>B</sub> = palm; B = fingers i or v = thumb x = Into; • = out of right hand is positive</i> <math>\frac{V_P}{V_S} = \frac{i_S}{i_P}</math></p> <p><b><u>Modern</u></b> <math>E = Pt</math> <math>E = hf</math> <math>W = hf_t</math> <math>KE = E - W</math> <math>KE = hf - hf_t</math> <math>E_n = \frac{E_1}{n^2}</math> (Hydrogen ONLY) <math>\lambda = \frac{h}{p} = \frac{h}{mv}</math> <math>E = mc^2</math></p>

**Working Equation** - Algebraically manipulate your equation(s) solving for the unknown variable. The working equation may only have variables identified in the given.

Name	Variable	Unit	Factor	Prefixes	Symbol
Acceleration .....	a .....	m/s <sup>2</sup>	10 <sup>9</sup>	giga	G
Acceleration due to Gravity ..	g .....	m/s <sup>2</sup>	10 <sup>6</sup>	mega	M
Average Velocity .....	v <sub>avg</sub> .....	m/s	10 <sup>3</sup>	kilo	k
Average Speed .....	v <sub>avg</sub> .....	m/s	10 <sup>-2</sup>	centi	c
Charge .....	q or Q .....	C, coulomb	10 <sup>-3</sup>	milli	m
Constant Velocity .....	v <sub>c</sub> .....	m/s	10 <sup>-6</sup>	micro	μ
Current .....	i or I .....	A, ampere	10 <sup>-9</sup>	nano	n
de Broglie Wavelength .....	λ .....	m, meter	10 <sup>-12</sup>	pico	p
Displacement .....	Δd or d .....	m, meter	<p align="center"><b>Useful Conversions</b></p> <p>1 minute = 60 seconds</p> <p>1 hour = 60 minutes</p> <p>1 km = 1000 meters</p> <p>1 m = 100 cm</p> <p>1m = 1000 mm</p> <p>1 kg = 1000 g</p> <p>1 mile = 1600 meters</p> <p>1 newton = 0.225 pounds</p>		
Distance .....	Δd or d .....	m, meter			
Electric Field .....	E .....	N/C			
Electrostatic Force .....	F <sub>E</sub> .....	N			
Elementary Charge .....	e .....	C, coulomb			
Energy .....	E .....	J, joule			
Focal Length .....	f .....	m, meter			
Force .....	F .....	N, newton			
Frequency .....	f .....	1/s or Hz, hertz			
Frictional Force .....	F <sub>f</sub> .....	N, newton			
Gravitational Force .....	F <sub>g</sub> .....	N, newton			
Image Distance .....	d <sub>i</sub> .....	m, meter			
Impulse .....	J .....	Ns			
Instantaneous speed .....	v .....	m/s			
Magnetic Field .....	B .....	T, tesla			
Magnetic Force .....	F <sub>B</sub> .....	N			
Mass .....	m .....	kg, kilogram			
Momentum .....	p .....	kgm/s			
Net Force .....	F <sub>net</sub> or ΣF ..	N, newton			
Normal Force .....	F <sub>N</sub> .....	N, newton			
Number .....	N .....	no unit			
Kinetic Energy .....	KE .....	J, joule			
Object Distance .....	d <sub>o</sub> .....	m, meter			
Period .....	T .....	s, second			
Pitch .....	f .....	1/s or Hz, hertz			
Potential Difference .....	V .....	V, volt			
Potential Energy					
Gravitational .....	PE <sub>g</sub> .....	J, joule			
Elastic .....	PE <sub>E</sub> .....	J, joule			
Power .....	P .....	W, watt			
Radius .....	r .....	m, meter			
Resistance .....	R .....	Ω, ohm			
Speed .....	v .....	m/s			
Spring Constant .....	k .....	N/m			
Summation of Forces .....	F <sub>net</sub> or ΣF ..	N, newton			
Tangential Velocity/Speed .....	v <sub>T</sub> .....	m/s			
Tension Force .....	F <sub>T</sub> .....	N, newton			
Time .....	t .....	s, second			
Velocity .....	v .....	m/s			
Velocity (constant) .....	v <sub>c</sub> .....	m/s			
Velocity (average) .....	v <sub>avg</sub> .....	m/s			
Volts .....	V .....	V, volt			
Voltage .....	V .....	V, volt			
Wavelength .....	λ .....	m, meter			
Wave Speed .....	v .....	m/s			
Weight .....	F <sub>g</sub> .....	N, newton			
Work .....	W .....	J, joule			
Work Function .....	W .....	J, joule			
			<b>Ratio</b>		
			A to B is $\frac{A}{B}$ OR A:B is $\frac{A}{B}$		
			<b>Constants and Conversion Factors</b>		
			Acceleration due to gravity ...g = 9.8 m/s <sup>2</sup>		
			Pi .....π = 3.14		
			Universal gravitational constant ..... G = 6.67 x 10 <sup>-11</sup> Nm <sup>2</sup> /kg <sup>2</sup>		
			Mass of the Earth .....5.97 X 10 <sup>24</sup> kg		
			Radius of the Earth .....6.37 X 10 <sup>6</sup> m		
			Mass of the Moon .....7.36 X 10 <sup>22</sup> kg		
			Radius of the Moon .....1.74 X 10 <sup>6</sup> m		
			Mass of the Sun .....1.99 X 10 <sup>30</sup> kg		
			Distance between:		
			- Earth and Sun 1.5 X 10 <sup>11</sup> m		
			-Earth and Moon 3.82 X 10 <sup>8</sup> m		
			Index of refraction of air .....n = 1		
			Speed of sound in air .....v = 343 m/s		
			Speed of light in a vacuum ...c = 3.00 X 10 <sup>8</sup> m/s		
			Ludicrous speed .....v > 3.00 X 10 <sup>8</sup> m/s		
			Elementary charge .....e = 1.60 X 10 <sup>-19</sup> C		
			Coulomb's law constant .....k= 9.0 X 10 <sup>9</sup> Nm <sup>2</sup> /C <sup>2</sup>		
			Planck's constant .....h = 4.14 X 10 <sup>-15</sup> eVs		
			h = 6.63 X 10 <sup>-34</sup> Js		
			eV to Joule conversion..... 1 eV = 1.6 X 10 <sup>-19</sup> J		
			Proton mass .....m <sub>p</sub> = 1.67 x 10 <sup>-27</sup> kg		
			Neutron mass .....m <sub>n</sub> = 1.67 x 10 <sup>-27</sup> kg		
			Electron mass .....m <sub>e</sub> = 9.11 x 10 <sup>-31</sup> kg		
			Avogadro's number .....N <sub>o</sub> = 6.02 X 10 <sup>23</sup> mol <sup>-1</sup>		