

Physics 110 Formula Sheet

Vectors

$$v = \sqrt{v_x^2 + v_y^2}$$

$$\phi = \tan^{-1} \left(\frac{v_y}{v_x} \right)$$

Motion Definitions

Displacement: $\Delta x = x_f - x_i$

Average velocity: $v_{avg} = \frac{\Delta x}{\Delta t}$

Average acceleration: $a_{avg} = \frac{\Delta v}{\Delta t}$

Equations of Motion

displacement:
$$\begin{cases} x_f = x_i + v_{ix}t + \frac{1}{2}a_xt^2 \\ y_f = y_i + v_{iy}t + \frac{1}{2}a_yt^2 \end{cases}$$

velocity:
$$\begin{cases} v_{fx} = v_{ix} + a_x t \\ v_{fy} = v_{iy} + a_y t \end{cases}$$

time-independent:
$$\begin{cases} v_{fx}^2 = v_{ix}^2 + 2a_x \Delta x \\ v_{fy}^2 = v_{iy}^2 + 2a_y \Delta y \end{cases}$$

Rotational Motion Definitions

Angular displacement: $\Delta\theta = R\Delta\theta$

Angular velocity: $\omega = \frac{\Delta\theta}{\Delta t} \rightarrow \nu = R\omega$

Angular acceleration: $\alpha = \frac{\Delta\omega}{\Delta t} \rightarrow \begin{cases} a_t = r\alpha \\ a_c = r\omega^2 \end{cases}$

Rotational Equations of Motion

$$\theta_f = \theta_i + \omega_i t + \frac{1}{2}\alpha t^2$$

$$\omega_f = \omega_i + \alpha t$$

$$\omega_f^2 = \omega_i^2 + 2\alpha\Delta\theta$$

Fluids

$$\rho = \frac{m}{V} \quad P = \frac{F}{A}$$

$$P_y = P_{air} + \rho gy$$

$$F_B = \rho g V$$

$\rho_1 A_1 v_1 = \rho_2 A_2 v_2$; compressible

$A_1 v_1 = A_2 v_2$; incompressible

$$P_1 + \frac{1}{2}\rho v_1^2 + \rho g y_1 = P_2 + \frac{1}{2}\rho v_2^2 + \rho g y_2$$

Momentum & Force

$$\vec{p} = m\vec{v} \rightarrow p_x = mv_x; p_y = mv_y$$

$$\Delta\vec{p} = \vec{F}\Delta t \rightarrow \vec{p}_f = \vec{p}_i + \vec{F}\Delta t$$

$$\vec{F} = \frac{d\vec{p}}{dt} = m\vec{a} \rightarrow F_x = ma_x; F_y = ma_y$$

$$F_{fr} = \mu F_N$$

$$F_w = mg$$

$$\text{stress} = E \times \text{strain} \rightarrow \frac{F}{A} = E \frac{\Delta l}{l} \rightarrow F_s = -kx$$

$$F_G = G \frac{M_1 M_2}{r^2}$$

$$F_c = ma_c = m \frac{v^2}{R}$$

Work & Energy

$$\begin{cases} W_T = \int \vec{F} \cdot d\vec{r} = F\Delta r \cos\theta = \Delta K_T \\ W_R = \int \vec{\tau} \cdot d\vec{\theta} = \tau\Delta\theta = \Delta K_R \end{cases}$$

$$W_{net} = W_T + W_R = \Delta K_T + \Delta K_R = -\Delta U$$

$$K_T = \frac{1}{2}mv^2$$

$$K_R = \frac{1}{2}I\omega^2$$

$$U_g = mgy$$

$$U_s = \frac{1}{2}kx^2$$

$$\Delta E = \Delta E_R + \Delta E_T$$

$$\Delta E = \Delta K_R + \Delta K_T + \Delta U_g + \Delta U_s = \begin{cases} 0 \\ W_{fr} \end{cases}$$

Rotational Momentum & Force

$$\vec{\tau} = \vec{r} \times \vec{F}; \tau = r_\perp F = rF_\perp = rF \sin\theta$$

$$\tau = \frac{\Delta L}{\Delta t} = I\alpha$$

$$L = I\omega$$

$$\Delta\vec{L} = \vec{\tau}\Delta t \rightarrow \vec{L}_f = \vec{L}_i + \vec{\tau}\Delta t$$

Sound

$$v_s = f\lambda = (331 + 0.6T)\frac{m}{s}$$

$$\beta = 10 \log \frac{I}{I_0}$$

$$f_n = n f_1 = n \frac{v}{2L}; n = 1, 2, 3, \dots \text{ open pipes}$$

$$f_n = n f_1 = n \frac{v}{4L}; n = 1, 3, 5, \dots \text{ closed pipes}$$

Waves

$$v = f\lambda = \sqrt{\frac{F_T}{\mu}}$$

$$f_n = n f_1 = n \frac{v}{\omega_L}; \quad n = 1, 2, 3, \dots$$

$$I = 2\pi^2 f^2 \rho v A^2$$

Common Metric Units

$$nano \ (n) = 10^{-9} \quad centi \ (c) = 10^{-2}$$

$$micro (\mu) = 10^{-6} \quad kilo (k) = 10^3$$

$$milli \ (m) = 10^{-3} \quad mega \ (M) = 10^6$$

Geometry/Algebra

$$\text{Circles: } A = \pi r^2 \quad C = 2\pi r = \pi D$$

$$\text{Spheres: } A = 4\pi r^2 \quad V = \frac{4}{3}\pi r^3$$

Triangles: $A = \frac{1}{2}bh$

$$\text{Quadratics: } ax^2 + bx + c = 0 \rightarrow x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Simple Harmonic Motion

$$\omega = 2\pi f = \frac{2\pi}{T}$$

$$T_s = 2\pi \sqrt{\frac{m}{k}}; \quad \omega = \sqrt{\frac{k}{m}}$$

$$T_p = 2\pi \sqrt{\frac{l}{g}}; \quad \omega = \sqrt{\frac{g}{l}}$$

Equations of Motion for SHM

$$x(t) = \begin{cases} x_{max} \sin\left(\frac{2\pi}{T}t\right) \\ x_{max} \cos\left(\frac{2\pi}{T}t\right) \end{cases}$$

$$v(t) = \begin{cases} v_{max} \cos\left(\frac{2\pi}{T}t\right) \\ -v_{max} \sin\left(\frac{2\pi}{T}t\right) \end{cases}$$

$$a(t) = \begin{cases} -a_{max} \sin\left(\frac{2\pi}{T}t\right) \\ -a_{max} \cos\left(\frac{2\pi}{T}t\right) \end{cases}$$

$$v = \pm v_{max} \sqrt{1 - \left(\frac{x}{x_{max}}\right)^2}$$

$$v = \pm \omega x_{max} \sqrt{1 - \left(\frac{x}{x_{max}}\right)^2}$$

PERIODIC TABLE OF ELEMENTS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	H Hydrogen Atomic # 1 Symbol H Relative Weight 1.008	C Solid	Metals	Nonmetals	Metalloids	Metals	Nonmetals	Metalloids	Metals	Nonmetals	Other	Noble gases	Pnictogens	Chalcogens	Halogens			
2	Li Lithium Atomic # 3 Symbol Li Relative Weight 6.94	Hg Liquid	Alkaline earth metals	Lanthanoids (Lanthanides)	Transition metals	Post-transition metals	Actinoids (Actinides)	Transition metals	Post-transition metals	Nonmetals	Other	Noble gases	N Nitrogen Atomic # 7 Symbol N Relative Weight 14.01	O Oxygen Atomic # 8 Symbol O Relative Weight 15.999	F Fluorine Atomic # 9 Symbol F Relative Weight 18.998	Ne Neon Atomic # 10 Symbol Ne Relative Weight 20.180		
3	Be Beryllium Atomic # 4 Symbol Be Relative Weight 9.012	H Gas											B Boron Atomic # 5 Symbol B Relative Weight 10.81	C Carbon Atomic # 6 Symbol C Relative Weight 12.011	N Nitrogen Atomic # 7 Symbol N Relative Weight 14.007	O Oxygen Atomic # 8 Symbol O Relative Weight 15.999	F Fluorine Atomic # 9 Symbol F Relative Weight 18.998	Ne Neon Atomic # 10 Symbol Ne Relative Weight 20.180
4	Mg Magnesium Atomic # 12 Symbol Mg Relative Weight 24.305	Rf Unknown	Alkali metals	Actinoids (Actinides)	Transition metals	Post-transition metals	Metals	Nonmetals	Metalloids	Metals	Nonmetals	Other	Ga Gallium Atomic # 31 Symbol Ga Relative Weight 69.723	As Arsenic Atomic # 33 Symbol As Relative Weight 72.630	Ge Germanium Atomic # 34 Symbol Ge Relative Weight 72.630	S Sulfur Atomic # 16 Symbol S Relative Weight 32.06	Cl Chlorine Atomic # 17 Symbol Cl Relative Weight 35.45	Ar Argon Atomic # 18 Symbol Ar Relative Weight 39.948
5	K Potassium Atomic # 19 Symbol K Relative Weight 39.098	Sc Scandium Atomic # 21 Symbol Sc Relative Weight 44.956	Ti Titanium Atomic # 22 Symbol Ti Relative Weight 47.987	V Vanadium Atomic # 23 Symbol V Relative Weight 50.942	Cr Chromium Atomic # 24 Symbol Cr Relative Weight 51.996	Mn Manganese Atomic # 25 Symbol Mn Relative Weight 54.938	Fe Iron Atomic # 26 Symbol Fe Relative Weight 55.845	Co Cobalt Atomic # 27 Symbol Co Relative Weight 58.933	Ni Nickel Atomic # 28 Symbol Ni Relative Weight 58.693	Cu Copper Atomic # 29 Symbol Cu Relative Weight 63.546	Zn Zinc Atomic # 30 Symbol Zn Relative Weight 65.38	Ga Gallium Atomic # 31 Symbol Ga Relative Weight 69.723	As Arsenic Atomic # 33 Symbol As Relative Weight 72.630	Ge Germanium Atomic # 34 Symbol Ge Relative Weight 72.630	P Phosphorus Atomic # 15 Symbol P Relative Weight 30.974	S Sulfur Atomic # 16 Symbol S Relative Weight 32.06	Cl Chlorine Atomic # 17 Symbol Cl Relative Weight 35.45	Ar Argon Atomic # 18 Symbol Ar Relative Weight 39.948
6	Rb Rubidium Atomic # 37 Symbol Rb Relative Weight 85.468	Sc Strontium Atomic # 38 Symbol Sr Relative Weight 87.62	Ti Yttrium Atomic # 39 Symbol Y Relative Weight 88.906	V Zirconium Atomic # 40 Symbol Zr Relative Weight 91.224	Cr Niobium Atomic # 41 Symbol Nb Relative Weight 92.906	Mn Molybdenum Atomic # 42 Symbol Mo Relative Weight 95.95	Fe Technetium Atomic # 43 Symbol Tc Relative Weight 96.07	Co Ruthenium Atomic # 44 Symbol Ru Relative Weight 101.07	Ni Rhodium Atomic # 45 Symbol Rh Relative Weight 102.91	Cu Palladium Atomic # 46 Symbol Pd Relative Weight 106.42	Zn Silver Atomic # 47 Symbol Ag Relative Weight 107.87	Ga Antimony Atomic # 48 Symbol Cd Relative Weight 112.41	As Tellurium Atomic # 49 Symbol In Relative Weight 114.82	Ge Iodine Atomic # 50 Symbol Sn Relative Weight 118.71	P Bismuth Atomic # 52 Symbol Sb Relative Weight 121.76	S Te Atomic # 51 Symbol Te Relative Weight 127.60	Cl Xenon Atomic # 53 Symbol I Relative Weight 126.90	Ar Krypton Atomic # 54 Symbol Xe Relative Weight 131.29
7	Cs Barium Atomic # 55 Symbol Cs Relative Weight 132.91	Ba Barium Atomic # 56 Symbol Ba Relative Weight 137.33	Hf Tantalum Atomic # 72 Symbol Hf Relative Weight 178.49	T Tungsten Atomic # 73 Symbol T Relative Weight 180.95	W Rhenium Atomic # 74 Symbol W Relative Weight 183.84	Tc Osmium Atomic # 75 Symbol Os Relative Weight 190.23	Ru Iridium Atomic # 76 Symbol Ru Relative Weight 192.22	Pt Platinum Atomic # 77 Symbol Pt Relative Weight 195.08	Ir Platinum Atomic # 78 Symbol Ir Relative Weight 196.97	Os Gold Atomic # 79 Symbol Au Relative Weight 200.59	Ir Mercury Atomic # 80 Symbol Hg Relative Weight 204.38	Sn Lead Atomic # 81 Symbol Pb Relative Weight 207.2	Bi Thallium Atomic # 82 Symbol Tl Relative Weight 208.98	Te Lead Atomic # 83 Symbol Bi Relative Weight 209	Br Polonium Atomic # 84 Symbol Po Relative Weight 208.98	I Astatine Atomic # 85 Symbol At Relative Weight 210	At Radon Atomic # 86 Symbol Rn Relative Weight 222	
8	Fr Francium Atomic # 87 Symbol Fr Relative Weight 223	Rf Rutherfordium Atomic # 89-103 Symbol Rf Relative Weight 257	Db Dubnium Atomic # 104 Symbol Db Relative Weight 268	Sg Seaborgium Atomic # 105 Symbol Sg Relative Weight 269	Bh Bohrium Atomic # 107 Symbol Bh Relative Weight 270	Mt Hassium Atomic # 109 Symbol Mt Relative Weight 277	Ds Minkowski Atomic # 110 Symbol Ds Relative Weight 278	Cn Darmstadtium Atomic # 111 Symbol Cn Relative Weight 281	Rg Roerichium Atomic # 112 Symbol Rg Relative Weight 282	Nh Nhuri Atomic # 113 Symbol Nh Relative Weight 286	Fl Copernicium Atomic # 114 Symbol Fl Relative Weight 289	Mv Moscovium Atomic # 115 Symbol Mv Relative Weight 290	Lv Livermorium Atomic # 116 Symbol Lv Relative Weight 293	Ts Tennessee Atomic # 117 Symbol Ts Relative Weight 294	Og Oganesson Atomic # 118 Symbol Og Relative Weight 294			



Ptable
com

Deeplix Copyright © 2017 Michael Davan (michaeldavan.com). For a fully interactive version with orbitals, isotopes, compounds, and free radicals, visit <http://www.purple.com>.

57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
Lanthanum 138.91	Cerium 140.12	Praseodymium 144.24	Ndium 140.91	Promethium 141.93	Samarium 150.36	Europium 151.96	Gadolinium 157.29	Terbium 158.93	Dysprosium 162.50	Holmium 164.93	Erbium 167.26	Thulium 168.93	Ytterbium 173.05	Lutetium 174.97
89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr
Actinium (227)	Thorium 232.04	Potassium 231.04	Uranium 238.03	Neptunium 237.04	Plutonium (244)	Americium (243)	Curium (247)	Berkelium (247)	Californium (251)	Einstenium (258)	Fermium (259)	Mendelevium (258)	Nobelium (259)	Lawrencium (266)

Object	Location of axis	Moment of inertia
Thin hoop, radius R	Through center	 MR^2
Thin hoop, radius R width W	Through central diameter	 $\frac{1}{2}MR^2 + \frac{1}{12}MW^2$
Solid cylinder, radius R	Through center	 $\frac{1}{2}MR^2$
Hollow cylinder, inner radius R_1 outer radius R_2	Through center	 $\frac{1}{2}M(R_1^2 + R_2^2)$
Uniform sphere, radius R	Through center	 $\frac{2}{5}MR^2$
Long uniform rod, length L	Through center	 $\frac{1}{12}ML^2$
Long uniform rod, length L	Through end	 $\frac{1}{3}ML^2$
Rectangular thin plate, length L , width W	Through center	 $\frac{1}{12}M(L^2 + W^2)$

Copyright © 2005 Pearson Prentice Hall, Inc.