$$
\begin{aligned}
g &= 9.80 m/s^2 \\
G &= 6.67 \times 10^{-11} \ N \cdot m^2/kg^2 \\
c &= 3.00 \times 10^8 m/s \\
R_{\text{Earth}} &= 6.38 \times 10^6 m \\
M_{\text{Earth}} &= 5.97 \times 10^{24} kg \\
\rho_{\text{air}} &= 1.225 kg/m^3 \\
\rho_{\text{ice}} &= 0.92 \times 10^3 kg/m^3 \\
\rho_{\text{water}} &= 1.00 \times 10^3 kg/m^3 \\
\rho_{\text{blood}} &= 1.06 \times 10^3 kg/m^3 \\
\rho_{\text{lead}} &= 11.3 \times 10^3 kg/m^3 \\
N_{\text{A}} &= 6.02 \times 10^{23} \ \text{mol}^{-1} \\
m_{\text{e}} &= 9.11 \times 10^{-31} \ kg \\
m_{\text{p}} &= 1.67 \times 10^{-27} \ kg \\
1 \text{ m} &= 3.28 \text{ ft} \\
1 \text{ inch} &= 2.54 \text{ cm} \\
1 \text{ mi} &= 5280 \text{ ft} \\
1 \text{ lb} &= 4.45 \ N \\
1\text{atm} &= 1.013 \times 10^5 Pa \\
C = 2\pi r \quad A &= \pi r^2 \quad \text{SA} = 4\pi r^2 \qquad V = \frac{4}{3}\pi r^3 \\
\frac{d}{dx}(au) &= a\frac{du}{dx} \\
\frac{d}{dx}(u+v) &= \frac{du}{dx} + \frac{dv}{dx} \\
\frac{d}{dx}(uv) &= u\frac{dv}{dx} + v\frac{du}{dx} \\
\int dx &= x \\
\int au \ dx &= a\int u \ dx \\
\int x^m \ dx &= \frac{x^{m+1}}{m+1} \quad (m \neq -1) \\
x &= \frac{-b \pm \sqrt{b^2-4ac}}{2a} \\
\Delta x &= x_2 - x_1 \\
\bar{v} &= \frac{\Delta x}{\Delta t} = \frac{x_2 - x_1}{t_2 - t_1} \\
\bar{s} &= \frac{\text{total distance}}{\Delta t} \\
v &= \frac{dx}{dt} \\
\bar{a} &= \frac{\Delta v}{\Delta t} = \frac{v_2 - v_1}{t_2 - t_1} \\
a &= \frac{dv}{dt} \\
v &= v_0 + at \\
x - x_0 &= v_0 t + \frac{1}{2}at^2 \\
v^2 &= v_0^2 + 2a(x - x_0) \\
x - x_0 &= \frac{1}{2}(v_0 + v)t
\end{aligned}
$$

$$
\begin{aligned}
x - x_0 &= vt - \frac{1}{2}at^2 \\
a_x &= a\cos\theta \\
a_y &= a\sin\theta \\
a &= \sqrt{a_x^2 + a_y^2} \\
\theta_A &= \tan^{-1}\frac{A_y}{A_x} \ [\text{if} A_x < 0 : +180^o] \\
\vec{a}\cdot\vec{b} &= ab\cos\phi \\
\vec{a}\cdot\vec{b} &= A_xB_x + A_yB_y + A_zB_z \\
\vec{a}\times\vec{b} &= \vec{c} \\
c &= ab\sin\phi \\
\vec{v} &= \frac{d\vec{r}}{dt} \\
\vec{a} &= \frac{d\vec{v}}{dt} \\
y &= (\tan\theta_0)x - \frac{gx^2}{2(v_0\cos\theta_0)^2} \\
R &= \frac{v_0^2}{g}\sin(2\theta_0) \\
a &= \frac{v^2}{r} \\
a &= \frac{4\pi^2 r}{T^2} \\
T &= \frac{2\pi r}{v} \\
\Sigma\vec{F} &= m\vec{a} \\
W &= mg \\
\vec{F}_{\text{AB}} &= -\vec{F}_{\text{BA}} \\
f &= \mu N \\
F &= \frac{mv^2}{r} \\
K &= \frac{1}{2}mv^2 \\
\Delta K &= K_f - K_i = W \\
W &= Fd\cos\phi \\
W &= \vec{F}\cdot\vec{d} \\
W_g &= mgd\cos\phi \\
\Delta K &= W_a + W_g \\
W &= \int_{x_i}^{x_f} F(x) \ dx \\
F &= -kx \\
W_s &= -\frac{1}{2}kx^2 \\
\bar{P} &= \frac{W}{\Delta t} \\
P &= \frac{dW}{dt} \\
P &= \vec{F}\cdot\vec{v} \\
U &= mgy \\
U(x) &= \frac{1}{2}kx^2 \\
E &= K + U
\end{aligned}
$$

$$
\begin{aligned}
F(x) &= -\frac{dU(x)}{dx} \\
W_{\text{app}} &= \Delta E \\
\Delta E &= -f_k d \\
P &= \frac{dE}{dt} \\
x_{\text{com}} &= \frac{m_1 x_1 + m_2 x_2}{m_1 + m_2} \\
x_{\text{com}} &= \frac{1}{M} \int x\ dm \\
x_{\text{com}} &= \frac{1}{V} \int x\ dV \\
\Sigma \vec{F}_{\text{ext}} &= M \vec{a}_{\text{cm}} \\
\vec{p} &= m \vec{v} \\
\Sigma \vec{F} &= \frac{d\vec{p}}{dt} \\
\vec{P} &= M \vec{v}_{\text{cm}} \\
\Sigma \vec{F}_{\text{ext}} &= \frac{d\vec{P}}{dt} \\
\vec{P} &= \text{constant} \\
\vec{J} &= \int_{t_i}^{t_f} \vec{F}(t)\ dt \\
\vec{p}_f - \vec{p}_i &= \Delta \vec{p} = \vec{J} \\
v_{1f} &= \frac{m_1 - m_2}{m_1 + m_2} v_{1i} \\
v_{2f} &= \frac{2m_1}{m_1 + m_2} v_{1i} \\
m_1 v_{1i} + m_1 v_{2i} &= (m_1 + m_2)\, V \\
v_{cm} &= \frac{P}{m_1 + m_2} \\
\theta &= \frac{s}{r} \\
\Delta \theta &= \theta_2 - \theta_1 \\
\omega &= \frac{d\theta}{dt} \\
\alpha &= \frac{d\omega}{dt} \\
\omega &= \omega_0 + \alpha t \\
\theta - \theta_0 &= \omega_0 t + \frac{1}{2} \alpha t^2 \\
\omega^2 &= \omega_0^2 + 2\alpha\, (\theta - \theta_0) \\
\theta - \theta_0 &= \frac{1}{2}\, (\omega_0 + \omega)\, t \\
\theta - \theta_0 &= \omega t - \frac{1}{2} \alpha t^2 \\
s &= \theta r \\
v &= \omega r \\
a_t &= \alpha r \\
a_r &= \frac{v^2}{r} = \omega^2 r \\
I &= \Sigma m_i r_i^2 \\
I &= \int r^2 dm
\end{aligned}
$$

$$
\begin{aligned}
K &= \frac{1}{2} I \omega^2 \\
\tau &= r F \sin\phi \\
\tau &= I \alpha \\
\Sigma \tau &= I \alpha \\
v_{cm} &= \omega R \\
K &= \frac{1}{2} I_{cm} \omega^2 + \frac{1}{2} M v_{cm}^2 \\
\vec{\tau} &= \vec{r} \times \vec{F} \\
\vec{l} &= \vec{r} \times \vec{p} = m\, (\vec{r} \times \vec{v}) \\
\Sigma \vec{\tau} &= \frac{d\vec{l}}{dt} \\
L &= I \omega \\
\rho &= \frac{\Delta m}{\Delta V} \\
p &= \frac{\Delta F}{\Delta A} \\
p_2 &= p_1 + \rho g\, (y_1 - y_2) \\
p &= p_0 + \rho g h \\
F_{\text{B}} &= \rho_{\text{fl}} V_{\text{sub}} g \\
A_1 v_1 &= A_2 v_2 \\
p_1 + \frac{1}{2} \rho v_1^2 + \rho g y_1 &= p_2 + \frac{1}{2} \rho v_2^2 + \rho g y_2 \\
F &= G \frac{m_1 m_2}{r^2} \\
U &= -G \frac{m_1 m_2}{r} \\
v_{\text{esc}} &= \sqrt{\frac{2GM}{R}} \\
v_{\text{orb}} &= \sqrt{\frac{GM}{r}} \\
R_S &= \frac{2GM}{c^2} \\
T &= 1/f \\
\omega &= 2\pi f \\
k &= \frac{2\pi}{\lambda} \\
v &= \lambda f \\
y(x,t) &= A \cos\left(\frac{2\pi}{\lambda} x - \omega t\right) \\
f_n &= n \frac{v}{2L} \quad \text{fixed string or open pipe} \\
f_n &= n \frac{v}{4L} \quad \text{stopped pipe} \\
f_{\text{beat}} &= f_a - f_b \\
f_L &= \frac{v + v_L}{v + v_S} f_S
\end{aligned}
$$