1 in = 2.54 cm

1 ft = 0.3048 m

1 mile = 1609.34 m

1 kg = 2.205 lb

1 hour = 60 min = 3600 s

g = 9.80 m/s^2

$360^o = 2\pi$ rad

$L = 2\pi R$ (circumference of a circle)

$S = R^2 \pi$ (surface area of a circle)

$v_f = v_i + a\,\Delta t$

$s_f = s_i + v_i\,\Delta t + a\,\Delta t^2/2$

$v_f^2 = v_i^2 + 2\,a\,\Delta s$

$v = R\,\omega$

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

$\theta_f = \theta_i + \omega_i\,\Delta t + \alpha\,\Delta t^2/2$

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

$\omega = 2\pi / T$, $f = 1/T$

$a_c = v^2/R = \omega^2 R$

Quadratic equation: if $a x^2 + b x + c = 0$, then $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$.

$\vec{A} = A_x\,\hat{\imath} + A_y\,\hat{\jmath} + A_z\,\hat{k}$, $A = \sqrt{{A_x}^2 + {A_y}^2 + {A_z}^2}$, $\tan\phi = A_y / A_x$

Cosine law: $c^2 = a^2 + b^2 - 2\,a\,b\cos\theta$, where θ is the angle *between* sides a and b.

Projectile motion (positive y up):

$x_f = x_i + v_{xi}\,\Delta t$, $y_f = y_i + v_{yi}\,\Delta t - g\,\Delta t^2/2$; $v_{xf} = v_{xi}$, $v_{yf} = v_{yi} - g\,\Delta t$

Relative motion: $\vec{v}_{AB} = \vec{v}_{AC} + \vec{v}_{CB}$, $\vec{v}_{AB} = -\vec{v}_{BA}$

Newton's second law: $\vec{F}_{NET} = m\,\vec{a}$, $\vec{F}_{NET} = \vec{F}_1 + \vec{F}_2 + \cdots + \vec{F}_N$

Weight in non-inertial reference frames: $w = mg\left(1 + a_y/g\right)$

Kinetic friction: $f_k = \mu_k$ N, opposite to the direction of motion

Static friction: $f_s^{(\max)} = \mu_s$ N, direction as necessary to prevent motion

Newton's third law: $\vec{F}_{A\to B} = -\vec{F}_{B\to A}$.

Momentum: $\vec{p} = m\,\vec{v}$.

Impulse – momentum theorem: $\Delta\vec{p} = \vec{J}$, where $\vec{J} = \int_{t_i}^{t_f} \vec{F}\,dt$.

Conservation of momentum: $\vec{p}_i = \vec{p}_f$, where $\vec{p} = \sum_k \vec{p}_k = \sum_k m_k\,\vec{v}_k$.

Kinetic energy: $K = \frac{1}{2}\,m\,v^2 = \frac{1}{2\,m}\,p^2$.

Potential energy in gravitational field: $U_G = m\,g\,h$.

Potential energy of a spring: $U_S = \frac{1}{2}k\,(\Delta s)^2$. Hooke's law: $\vec{F} = -k\,\Delta\vec{s}$.

Conservation of mechanical energy: $K_i + U_i = K_f + U_f$.

Work: W = $\int \vec{F}\,d\vec{r}$. Work-kinetic energy theorem: $W = \Delta K$.

$W_{NC} = \Delta E_{MECH}$; $\Delta K + \Delta U + \Delta E_{TH} = W_{EXT}$.

Power: $P = \frac{dE_{SYS}}{dt}$; $P = \vec{F}\vec{v}$

Elastic collision, with mass m_2 initially at rest:

$$v_{1F} = \frac{m_1 - m_2}{m_1 + m_2}\,v_{1i}\,,\quad v_{2F} = \frac{2\,m_1}{m_1 + m_2}\,v_{1i}$$

Moment of inertia of a system of particles: $I = \sum_i m_i r_i^2$.

Parallel axis theorem: $I = I_{CM} + M\,d^2$

Moments of inertia of solid bodies through the center of mass:

Rod of mass M length L	$ML^2/12$	Hollow sphere of mass M, radius R	$2\ MR^2 / 3$
Cylindrical hoop of mass M, radius R	MR^2	Solid sphere of mass M, radius R	$2\ MR^2 / 5$
Solid cylinder of mass M, radius R	$MR^2 / 2$	Solid disk of mass M, radius R	$MR^2 / 2$

Kinetic energy of rotational motion: $K = \frac{1}{2} I \omega^2$

Angular momentum of a solid body: $\vec{L} = I \vec{\omega}, L = I\omega$

Angular momentum of a particle: $\vec{L} = \vec{r} \times \vec{p},\ L = rp\ sin\theta = mrv\ sin\theta$

Torque: $\vec{\tau} = \vec{r} \times \vec{F}$, $\tau = r\ F\ sin\theta, \tau = I\ \alpha$

Conservation of angular momentum: $\frac{d\vec{L}}{dt} = \vec{\tau}$, for isolated system $\vec{L} = const.$

Gravitational force: $= G \frac{m_1 m_2}{d^2}$, where G = 6.67 * 10^{-11} N m^2 / kg^2

Gravitational potential energy (zero at infinity): $U = -G \frac{m_1 m_2}{d}$

Gravitational acceleration: $g = G \frac{M}{d^2}$

Orbiting velocity: $v_o = \sqrt{G\ M/d}$, Escape velocity: $v_e = \sqrt{2\ G\ M/d}$

Kepler's third law: $\frac{d^3}{T^2} = \frac{G\ M}{4\ \pi^2}$

Linear harmonic motion: $x(t) = A\cos(\omega\ t + \varphi_0),\ x_{MAX} = A$

$$v(t) = -A\, \omega \sin(\omega\ t + \varphi_0), v_{MAX} = A\ \omega$$

$$a(t) = -A\, \omega^2 \cos(\omega\ t + \varphi_0)\ , a_{MAX} = A\ \omega^2$$

Period of a spring-box oscillator: $T_S = 2\pi \sqrt{m/k}$

Period of a pendulum: $T_P = 2\pi \sqrt{l/g}$

Angular frequency: $\omega = 2\ \pi/T$

Mass of the Earth: M_E = 5.98 * 10^{24} kg, Radius of the Earth: R_E = 6370 km

Mass of the Sun: M_S = 1.99 * 10^{30} kg, Radius of the Sun: R_S = 6.96 * 10^5 km

Earth-Sun distance: d_{ES} = 149.6 *10^6 km