Kinematics: $v = v_0 + at$ $x = x_0 + v_0 t + \frac{1}{2}at^2$ $v^2 = v_0^2 + 2a(x - x_0)$ $a_{rad} = \frac{v^2}{r}$
$T = \frac{2\pi r}{v}$ $\vec{v}_{P/A} = \vec{v}_{P/B} + \vec{v}_{B/A}$

Forces and Potentials: $\vec{F} = m\vec{a}$ $f_s \leq \mu_s F_N$ $f_k = \mu_k F_N$ $F_s = -k(x - x_R)$
$U_s = \frac{1}{2}k(x - x_R)^2$ $\vec{F}_g = -\frac{GM_1M_2}{r^2}\hat{r}$ $U_g = -\frac{GM_1M_2}{r}$ $GMT^2 = 4\pi^2 r^3$

Rotation: $\theta = \theta_0 + \omega_0 t + \frac{1}{2}\alpha t^2$ $\omega = \omega_0 + \alpha t$ $\omega^2 = \omega_0^2 + 2\alpha(\theta - \theta_0)$ $v = \omega r$
$a_{tan} = \alpha r$ $a_{rad} = \omega^2 r$ $\vec{L} = \vec{r} \times \vec{p}$ (particle) $L = I\omega$ (rigid body) $\vec{\tau} = \vec{r} \times \vec{F}$
$I = \sum_i m_i r_i^2$ $K = \frac{1}{2}I\omega^2$ $\sum \vec{\tau}_{ext} = \frac{d\vec{L}}{dt}$ $\sum \tau_{ext} = I\alpha$ $I = I_{cm} + Md^2$
$K = \frac{1}{2}MV_{cm}^2 + \frac{1}{2}I_{cm}\omega^2$

Systems of Particles: $\vec{p} = m\vec{v}$ $\vec{F} = \frac{d\vec{p}}{dt}$ $Mx_{cm} = m_1x_1 + m_2x_2 + \cdots = \sum_i m_i x_i$
$\sum \vec{F}_{ext} = M\vec{a}_{cm}$ $v_{2f} - v_{1f} = -(v_{2i} - v_{i1})$

Work-Energy: $W = \int_{r_1}^{r_2} \vec{F} \cdot d\vec{r}$ $W = \vec{F} \cdot \vec{r}$ $K_i + W_{tot} = K_f$ $P = \vec{F} \cdot \vec{v}$
$\Delta U_{AB} = -\int_A^B \vec{F} \cdot d\vec{r}$ $F_x = -\frac{dU}{dx}$

Oscillations: $F = -kx$ $x = A\cos(\omega t + \phi)$ $\omega = 2\pi f$ $T = \frac{1}{f}$ $\omega = \sqrt{k/m}$
$\omega = \sqrt{g/L}$ $\omega = \sqrt{Mgd/I}$ $E = \frac{1}{2}kA^2$
$x = Ae^{-bt/(2m)}\cos(\omega' t + \phi)$ $\omega' = \sqrt{\frac{k}{m} - \frac{b^2}{4m^2}}$

Waves: $y(x,t) = A\sin(kx - \omega t + \phi)$ $k = \frac{2\pi}{\lambda}$ $v = \lambda f = \frac{\omega}{k}$ $v = \sqrt{\frac{F_T}{\mu}}$
$v = \sqrt{\frac{\gamma RT}{M}}$ $P_{avg} = \frac{1}{2}\mu v \omega^2 A^2$ $I = \frac{P}{A}$ $y(x,t) = 2A\sin(kx)\cos(\omega t)$ $f_n = n\frac{v}{2L}$
$f_n = n_{\text{odd}}\frac{v}{4L}$ $\phi = 2\pi\frac{\Delta r}{\lambda}$ $f_{beat} = |f_2 - f_1|$ $f_L = \left(\frac{v + v_L}{v + v_S}\right) f_S$

Thermodynamics: $T_K = T_C + 273.15$ $\Delta L = \alpha L_0 \Delta T$ $Q = mc\Delta T$
$Q = \pm mL$ $pV = nRT = Nk_BT$ $\bar{K}_{tr} = \frac{3}{2}k_BT$ $W = \int_{V_i}^{V_f} pdV$
$Q = \Delta U + W$ $C_p = C_V + R$ $C_V = \frac{f}{2}R$ $\Delta U = nC_V\Delta T$ $p_1V_1^\gamma = p_2V_2^\gamma$
$\gamma = \frac{C_p}{C_V}$ $e = \frac{|W|}{|Q_H|}$ $e_{Carnot} = 1 - \frac{T_C}{T_H}$ $K = \frac{|Q_C|}{|W|}$
$K_{Carnot} = \frac{T_C}{T_H - T_C}$ $\Delta S = \int_i^f dS = \int_i^f \frac{dQ}{T}$ $S = k_B \ln w$

Vectors: $A_x = A\cos\theta$ $A_y = A\sin\theta$ $A = \sqrt{A_x^2 + A_y^2}$ $\tan\theta = \frac{A_y}{A_x}$
$\vec{A} \cdot \vec{B} = AB\cos\phi_{AB}$ $\vec{A} \cdot \vec{B} = A_xB_x + A_yB_y + A_zB_z$ $\vec{A} \times \vec{B} = \hat{n}AB\sin\phi_{AB}$

Math: $ax^2 + bx + c = 0 \qquad x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad (1+x)^n \approx 1 + nx$ for $x \ll 1$

Constants: $g = 9.8\,\mathrm{m/s^2} \qquad G = 6.67 \times 10^{-11}\,\mathrm{Nm^2/kg^2} \qquad R_{Earth} = 6.37 \times 10^6\,\mathrm{m}$

$M_{Earth} = 5.98 \times 10^{24}\,\mathrm{kg} \qquad M_{Sun} = 1.99 \times 10^{30}\,\mathrm{kg} \qquad c = 2.998 \times 10^8\,\mathrm{m/s}$

$T_z = -273.15\,^\circ\mathrm{C} \qquad 1\mathrm{atm} = 1.013 \times 10^5\,\mathrm{N/m^2} = 101.3\,\mathrm{kPa} \qquad \rho_{water} = 1000\,\mathrm{kg/m^3}$

$k_B = 1.38 \times 10^{-23}\,J/K \qquad N_A = 6.022e23 \qquad R = 8.3145 J/\mathrm{mol} \cdot K$

$v_{sound} = 343\,\mathrm{m/s} \qquad 1\mathrm{eV} = 1.602 \times 10^{-19}\,\mathrm{J}$