Physics 101: How the "world" works I
Fall 2008

Formula Sheet

$\Delta\vec{\mathbf{x}} = \vec{\mathbf{x}}_f - \vec{\mathbf{x}}_i$
$\vec{\mathbf{v}}_{av} = \frac{\Delta\vec{\mathbf{x}}}{\Delta t}$
$\vec{\mathbf{v}} = \lim_{\Delta t\to 0} \frac{\Delta\vec{\mathbf{x}}}{\Delta t}$
$\vec{\mathbf{a}}_{av} = \frac{\Delta\vec{\mathbf{v}}}{\Delta t}$
$\vec{\mathbf{a}} = \lim_{\Delta t\to 0} \frac{\Delta\vec{\mathbf{v}}}{\Delta t}$
$\Delta v_x = a_x \Delta t$
$\Delta x = \frac{1}{2}(v_{fx} + v_{ix})\Delta t$
$\Delta x = v_{ix}\Delta t + \frac{1}{2}a_x(\Delta t)^2$
$v_{fx}^2 - v_{ix}^2 = 2a_x\Delta x$
$\Delta v_y = a_y \Delta t$
$\Delta y = \frac{1}{2}(v_{fy} + v_{iy})\Delta t$
$\Delta y = v_{iy}\Delta t + \frac{1}{2}a_y(\Delta t)^2$
$v_{fy}^2 - v_{iy}^2 = 2a_y\Delta y$
$R = v_i^2 \sin(2\theta)/g$ where θ is the angle defined from the horizontal
$\vec{\mathbf{F}}_{net} = \sum \vec{\mathbf{F}} = \vec{\mathbf{F}}_1 + \vec{\mathbf{F}}_2 + \cdots + \vec{\mathbf{F}}_n$
$\vec{\mathbf{F}}_{net} = m\vec{\mathbf{a}} \rightarrow \sum F_x = ma_x$ and $\sum F_y = ma_y$
$F_g = G\frac{m_1 m_2}{r^2} = G\frac{m_1 m_2}{d^2}$, $F_g = mg$ near the surface of the Earth
$W = F\Delta x\cos(\theta)$
$KE = \frac{1}{2}mv^2$
$W_{total} = W_{cons} + W_{nc} = \Delta KE$
$\Delta PE = -W_{cons}$
$W_{nc} = \Delta KE + \Delta PE$
$F = k\Delta x$
$PE_{elastic} = \frac{1}{2}kx^2$
$P = \frac{W_{done}}{\Delta t} = \frac{\Delta E}{\Delta t}$
Efficiency=Useful Energy output/Energy input
$\vec{\mathbf{p}} = m\vec{\mathbf{v}}$
$\Delta\vec{\mathbf{p}}_2 = -\Delta\vec{\mathbf{p}}_1$
$\Delta\vec{\mathbf{p}} = \sum \vec{\mathbf{F}}\Delta t$
$\sin(\theta)$ =opposite/hypotenuse
$\cos(\theta)$ =adjacent/hypotenuse
$\tan(\theta)$ =opposite/adjacent
$F_E = \frac{k_e q_1 q_2}{r^2} = \frac{k_e q_1 q_2}{d^2}$
$\vec{\mathbf{E}} = \vec{\mathbf{F}}_E/q$
$V = \frac{ElecPE}{q}$

$Q = C\,V$
$C = \frac{\epsilon_0 A}{d}$
$I = \frac{\Delta q}{\Delta t}$
$V = I\ R$
$\sum I_{in} - \sum I_{out} = 0$
$\sum V_i = 0$
$R_{tot} = \sum R_i$
$\frac{1}{R_{tot}} = \sum \frac{1}{R_i}$
$P = V\ I$
$F_B = qvB\sin(\theta)$
$F_B = ILB\sin(\theta)$
$\Phi_B = NBA\cos(\theta)$
$V_{ind} = -\frac{\Delta\Phi_B}{\Delta t}$
$V_1/V_2 = N_1/N_2$
$\omega_{av} = \frac{\Delta\theta}{\Delta t}$
$2\pi radians = 360$ degrees
$s = \theta r$
$v = r|\omega|$
$a_r = \frac{v^2}{r}$
$\Delta E = Q + W$
$Q = mc\Delta T$
$p = F/A$
$p\mathtt{V} = nRT$
$p\mathtt{V} = Nk_BT$
$W = p\Delta\mathtt{V}$
$W = Q_{power} - Q_{compress}$
$\epsilon = W_{net}/Q_{power} = 1 - \frac{T_l}{T_h}$
$\Delta L = L\alpha\Delta T$
g =10 m/s^2
G =6.674$\times 10^{-11}$ N m^2/kg^2
$\epsilon_0 = 8.854 \times 10^{-12}$ C^2/N m^2
$k_e = 1/(4\pi\epsilon_0) = 8.988 \times 10^9$ N m^2/C^2
R = 8.31 J/mole-K
$k_B = 1.38 \times 10^{-23}$ J/K
$N_A = 6.022 \times 10^{23}$
1 Cal=4184 J