$v_x = v_{0x} + a_x t$

$\Delta x = v_{0x} t + \frac{1}{2} a_x t^2$ g = 9.80 m/s^2 down

$v_x^2 = v_{0x}^2 + 2a_x \Delta x$

$\vec{a} = \frac{\Sigma \vec{F}}{m}$; $\Sigma \vec{F} = m\vec{a}$; $\vec{F}_{12} = -\vec{F}_{21}$; weight $W = mg$;

$W = (F\cos\theta)d$; $K = \frac{1}{2} m\upsilon^2$; $U_g = mgy$

$\overline{P} = \frac{W}{t} = F\overline{\upsilon}$; centrip. $a_{CP} = v^2 / R$; $f_{CP} = mv^2 / R$;

impulse $\vec{I} = \vec{F}_{av}\Delta t = \Delta\vec{p}$; $\vec{p} = m\vec{v}$;

θ(in radians) $= \frac{s}{r}$; $v = \frac{2\pi r}{T}$; $T = \frac{2\pi r}{v}$; $f = 1/T$

$\tau = rF\sin\theta$; $L = I\omega$; $\vec{L} = \vec{r} \times \vec{p} = lp = mrv\sin\theta$;

$I = MR^2$ *thin cylindrical shell* ; $I = \frac{1}{2} MR^2$ *solid disk*

$I = \frac{2}{3} MR^2$ *thin spherical shell* ; $I = \frac{2}{5} MR^2$ *solid sphere* ;

$F_G = \frac{-GM\ m}{r^2}$;G=6.67x10^{-11} N m^2 kg^{-2}; $U = \frac{-GM_E m}{r}$; orbit $\upsilon = \sqrt{\frac{GM_S}{r}}$; $T = \frac{2\pi r^{3/2}}{\sqrt{GM_S}}$;

Kepler : $T^2 = \left(\frac{4\pi^2}{GM_S}\right) r^3$

SHM $2\pi f = \omega = \sqrt{\frac{k}{m}}$; $T = \frac{2\pi}{\omega} = 2\pi\sqrt{\frac{m}{k}}$; $f = \frac{1}{T} = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$; $T = 2\pi\sqrt{\frac{L}{g}}$;

$v = \frac{\lambda}{T} = \lambda f$; $v = \sqrt{\frac{F}{m/L}}$;; $v = 343\, m/s$; $I = \frac{P}{A}$; $I = \frac{P}{4\pi r^2}$;

$T_C = T - 273.15$; $T_F = \frac{9}{5} T_C + 32$; $T_C = \frac{5}{9}(T_F - 32)$; $\Delta L = \alpha L_0 \Delta T$; $L - L_0 = \alpha L_0 (T - T_0)$;

1 cal = 4.186 J; spec. heat $c \equiv \frac{Q}{m\Delta T}$; $Q = kA\frac{\Delta T}{L}t$; $P = \sigma A e T^4$

$W_{env} = |Q_h| - |Q_c|$; $e = \frac{W_{env}}{|Q_h|} = \frac{|Q_h| - |Q_c|}{|Q_h|} = 1 - \frac{|Q_c|}{|Q_h|}$; $S = k_B \ln W$;

$F = k_e \frac{|q_1||q_2|}{r^2}$, $k_e = 8.99 \times 10^9\, N \cdot m^2 / C^2$ $\vec{E} = \vec{F} / q_0$, $E = k_e \frac{|q|}{r^2}$, flux $\Phi_E = E\, A\cos\theta$

$I = \frac{\Delta Q}{\Delta t}$, $R = \frac{\Delta V}{I}$, $\Delta V = IR$, power $\mathcal{P} = I\Delta V = I^2 R = \frac{(\Delta V)^2}{R}$

For spherical mirrors and thin lenses, $M = \frac{h_i}{h_o} = \frac{-d_i}{d_o}$, $\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$.

wave: $c = f\lambda$, $c = 3.00 \times 10^8\, m/s$ energy: $E = mc^2$