Physics 121

Trig
$\sin \theta = o/h$
$\cos \theta = a/h$
$\tan \theta = o/a$
area = πr^2 (circle)

Kinematics
$v = \Delta x/\Delta t$
$a = \Delta v/\Delta t$
$\Delta x = v_o t + \frac{1}{2} a t^2$
$v_f^2 = v_o^2 + 2a\Delta x$
$g = 9.8\ m/s^2$

Dynamics
$F_{net} = ma$
$F_g = Gm_1m_2/r^2$
$F_g = mg$ (near surface of earth)
$f_k = \mu_k F_N$
$f_s \leq \mu_s F_N$
$a_c = v^2/r$

Work and Energy
$W = Fd \cos \theta$
$KE = \frac{1}{2} m v^2$
$W_{net} = \Delta KE$
$W_{nc} = \Delta KE + \Delta PE$
$PE = mgh$

Impulse and Momentum
Impulse = $F t = \Delta p$
$p = mv$

$m_1v_1 + m_2v_2 = (m_1+m_2)v_f$ (Inelastic)
$v_{cm} = \Sigma m_i v_i/\Sigma m_i$

Elastic Collisions
1) Find v_{cm}
2) Subtract v_{cm} from each velocity
3) Change sign of each velocity
4) Add v_{cm} to each velocity

Springs
$F = -k\Delta x$
$PE = \frac{1}{2} k \Delta x^2$

Rotations
Rolling without slipping
$x = \theta r$
$v = \omega r$
$a = \alpha r$

Rotations (cont.)
$\Delta\theta = \omega_o t + \frac{1}{2} \alpha t^2$
$\omega_f^2 = \omega_o^2 + 2\alpha\Delta\theta$
$\omega = \Delta\theta/\Delta t$
$\alpha = \Delta\omega/\Delta t$
$KE = 1/2 I\omega^2$
$\tau_{net} = I \alpha$
$\tau = f\ r \sin\theta$
$I = mr^2$
$l = I\omega$ (Angular momentum)

Simple Harmonic Motion
$x(t) = A \cos(\omega t)$
$x(t) = A \sin(\omega t)$
$\omega = \sqrt{k/m}$ (mass and spring)
$\omega = \sqrt{g/L}$ (pendulum)
$T = 2\pi/\omega$

Waves
$l_2 - l_1 = m \lambda$ (Constructive)
$l_2 - l_1 = (m+1/2) \lambda$ (Destructive)
$v = f \lambda$
$T = 1/f$
v = sqrt(T/(m/l)) (string)

Fluids
$\rho = m/V$
$P = F/A$
$F_B = \rho_f V_{dis\ f}\ g$
$P_2 - P_1 = \rho g h$
$Q = v_1A_1 = v_2A_2$
$P_1 + 1/2\rho v_1^2 + \rho g y_1 = P_2 + 1/2\rho v_2^2 + \rho g y_2$

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Expansion
$\Delta L = \alpha L_o \Delta T$
$\Delta V = \beta V \Delta T$

Heat
$^oC = (^oF - 32)5/9$
$Q = mc\Delta T$
$Q = mL$

Heat Transfer

$Q = (k\ A\ \Delta T)t/L$

$Q = e\sigma T^4 At$

Thermodynamics

$\Delta U = Q - W$

$W = P\ \Delta V$ (Isobaric)

$e = W/Q_H = 1 - Q_C/Q_H$

$e_{carnot} = 1 - T_C/T_H$