PHYSICS 105 (Spring 2009)
PHYSICS FORMULAS

DO NOT USE THIS SHEET DURING EXAM. A COPY WILL BE PROVIDED.

$\mathbf{A} = A_x\mathbf{i} + A_y\mathbf{j}$ $|\mathbf{A}| = \sqrt{(A_x)^2 + (A_y)^2}$ $\tan^{-1}\left(\frac{A_y}{A_x}\right)$

$\mathbf{A} + \mathbf{B} = (A_x+B_x)\mathbf{i} + (A_y+B_y)\mathbf{j}$ $\mathbf{A} \cdot \mathbf{B} = A_xB_x + A_yB_y + A_zB_z = |A||B| \cos(\mathbf{A},\mathbf{B})$

linear motion $\mathbf{v} = \mathbf{v_0} + \mathbf{a}t$ $x - x_\mathbf{0} = \mathbf{v_0}\, t + ½\, \mathbf{a}t^2$ $2\mathbf{a}(x - x_\mathbf{0}) = v^2 - v_0^2$ $x - x_\mathbf{0} = ½\,(v + v_0)t$

projectile motion $v_x = v_{xo} = |v_o|\cos\theta_o$ $v_{yo} = |v_o|\sin\theta_o$ $v_y = |v_o|\sin\theta_o - gt$
$x - x_\mathbf{0} = v_o\cos\theta_o t$ $y - y_0 = v_o\sin\theta_o t - ½\, gt^2$ $x - x_o = (v_o^2\sin(2\theta))/g$ $(-2g)(x - x_\mathbf{0}) = v_y^{\ 2} - v_{yo}^{\ 2}$

circular motion $a_r = v^2/r$ $a_r = r(2\pi/T)^2$ $T = 1/f$ $F_r = m\, v^2/r$

Newton laws: $\mathbf{F}_{net} = \Sigma\mathbf{F} = m\mathbf{a}$ $\Sigma\mathbf{F_x} = m\mathbf{a_x}$ $\Sigma\mathbf{F_y} = m\mathbf{a_y}$ $\mathbf{w} = m\mathbf{g}$
$\mathbf{F}_{smax} = \mu_s\, \mathbf{N}$ $\mathbf{F}_k = \mu_k\, \mathbf{N}$

Hook's Law $\mathbf{F} = -k\mathbf{x}$

Work $W = \mathbf{F}\cdot\mathbf{d} = |F||d| \cos(\mathbf{F},\mathbf{d}) = F_xd_x + F_yd_y$ $W_s = -½(x_f^2 - x_0^2)$ $W_{net} = (\Sigma\mathbf{F})\cdot\mathbf{d}$
$\Delta Us = -Ws$

Energy $K = ½\, mv^2$ $U_g = mgy$ $U_s = ½kx^2$ $\Delta K = K_f - K_i = W_{net}$

$\Delta Ug = -Wg$ $E = K + U$ $\Delta E = \Delta K + \Delta U = 0$

Power $P = dW/dt = \mathbf{F}\cdot\mathbf{v} = |\mathbf{F}|\, |\mathbf{v}| \cos(\mathbf{F},\mathbf{v})$ $P_{avg} = {}^{\Delta W}/_{\Delta t}$

$U_{gi} + U_{si} + K_I = U_{gf} + U_{sf} + K_f$ $U_{gi} + U_{si} + K_I = U_{gf} + U_{sf} + K_f + \Delta E_{th}$ $\Delta E_{th} = f \cdot d$

momentum: $\mathbf{p} = m\mathbf{v}$; $\mathbf{F_{net}}\, \Delta t = m\mathbf{v_f} - m\mathbf{v_i}$ $\mathbf{P_i} = \mathbf{P_f}$; $m_1\mathbf{v}_{i1} + m_2\mathbf{v}_{i2} = m_1\mathbf{v}_{f1} + m_2\mathbf{v}_{f2}$;

elastic: $\mathbf{v}_1' = \frac{\mathbf{m}_1 - \mathbf{m}_2}{\mathbf{m}_1 + \mathbf{m}_2}\mathbf{v}_1 + \frac{2\mathbf{m}_2}{\mathbf{m}_1 + \mathbf{m}_2}\mathbf{v}_2;\ \mathbf{v}_2' = \frac{2\mathbf{m}_1}{\mathbf{m}_1 + \mathbf{m}_2}\mathbf{v}_1 + \frac{\mathbf{m}_2 - \mathbf{m}_1}{\mathbf{m}_1 + \mathbf{m}_2}\mathbf{v}_2$, perf. Inelastic: $m_1\mathbf{v}_{i1} + m_2\mathbf{v}_{i2} = (m_1 + m_2)\mathbf{v}_f$

$\mathbf{R}_{com} = (m_1\, \mathbf{r_1} + m_2\, \mathbf{r_2} + ... + m_n\, \mathbf{r_n}) / (m_1 + m_2 + ... + m_n)$