PHYSICS 105 (Fall 2009)

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PHYSICS FORMULAS

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

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

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

projectile motion $\quad v_x = v_{xo} = |v_o|\cos\theta_o$ $\qquad v_{yo} = |v_o|\sin\theta_o$ $\qquad v_y = |v_o|\sin\theta_o - gt$

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

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

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

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

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

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

$\Delta U_g = -W_g$ $\qquad E = K + U$ $\qquad \Delta E = \Delta K + \Delta U = 0$

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

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

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

elastic: $\quad \mathbf{v}_1' = \frac{\mathbf{m}_1 - \mathbf{m}_2}{\mathbf{m}_1 + \mathbf{m}_2}\mathbf{v}_1 + \frac{2\mathbf{m}_2}{\mathbf{m}_1 + \mathbf{m}_2}\mathbf{v}_2;\ \mathbf{v}_2' = \frac{2\mathbf{m}_1}{\mathbf{m}_1 + \mathbf{m}_2}\mathbf{v}_1 + \frac{\mathbf{m}_2 - \mathbf{m}_1}{\mathbf{m}_1 + \mathbf{m}_2}\mathbf{v}_2$, ;

Inelastic: $\quad m_1\mathbf{v}_{i1} + m_2\mathbf{v}_{i2} = (m_1 + m_2)\mathbf{v}_f$

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