

$$g=9.8 \text{ m/s}^2$$

$$v_{\text{ave}}=\Delta x/\Delta t$$

$$a_{\text{ave}}=\Delta v/\Delta t$$

$$c=3 \times 10^8 \text{ m/s}$$

$$\text{watt}=\text{Nm/s}=\text{J/s}$$

$$v=v_0+at$$

$$x-x_0=(v+v_0)t/2$$

$$v^2=v_0^2+2a(x-x_0)$$

$$x-x_0=v_0t+at^2/2$$

$$a_{\text{rad}}=v^2/R; f=1/T=v/2\pi R$$

$$1\text{hp}=550\text{ftlb}=746\text{W}$$

$$\sin(A\pm B)=\sin A \cos B \pm \cos A \sin B$$

$$\cos(A+B)=\cos A \cos B - \sin A \sin B$$

$$\cos(A-B)=\cos A \cos B + \sin A \sin B$$

$$\cos^2 A + \sin^2 A = 1; \cos 36.9^\circ = 4/5 \text{ (3,4,5 triangle)}$$

$$\cos 30^\circ = \sin 60^\circ = \sqrt{3}/2; \tan 30^\circ = 1/\sqrt{3}$$

$$\cos 60^\circ = \sin 30^\circ = 1/2; \tan 60^\circ = \sqrt{3}$$

$$\cos 45^\circ = \sin 45^\circ = 1/\sqrt{2}; \tan 45^\circ = 1$$

$$\vec{A} = A_x \hat{i} + A_y \hat{j} + A_z \hat{k}$$

$$\vec{B} = B_x \hat{i} + B_y \hat{j} + B_z \hat{k}$$

$$\vec{A} \cdot \vec{B} = AB \cos \theta = A_x B_x + A_y B_y + A_z B_z; \vec{A} \times \vec{B} = (A_y B_z - B_y A_z) \hat{i} + (A_z B_x - B_z A_x) \hat{j} + (A_x B_y - B_x A_y) \hat{k} = AB \sin \theta \hat{n}$$

$$F_{\text{fk}} = \mu_k N; F_{\text{fs}} \leq \mu_s N$$

$$\sum \vec{F} = m\vec{a};$$

$$\sum \vec{F}_x = m\vec{a}_x; \sum \vec{F}_y = m\vec{a}_y; \sum \vec{F}_z = m\vec{a}_z$$

$$dW = \vec{F} \cdot d\vec{s}$$

$$W = \int \vec{F} \cdot d\vec{s}; W = \vec{F} \cdot \vec{s}$$

$$K = (1/2)mv^2; P_{\text{av}} = \Delta W / \Delta t, P = dW/dt, P = \vec{F} \cdot \vec{v}$$

$$F_s = F_{\text{el}} = kx$$

$$U_{\text{gr}} = mgy; U_{\text{el}} = (1/2)kx^2$$

$$K_1 + U_{\text{gr},1} + U_{\text{el},1} + W_{\text{other}} = K_2 + U_{\text{gr},2} + U_{\text{el},2}$$

$$\Delta K + \Delta U + \Delta U_{\text{inter}} = 0$$

$$\vec{F} = -\vec{\nabla} U$$

$$F_x = -\partial U / \partial x; F_y = -\partial U / \partial y; F_z = -\partial U / \partial z$$

$$\vec{p} = m\vec{v}$$

$$\sum \vec{F} = d\vec{p} / dt$$

$$\vec{j} = \sum \vec{F}(t_2 - t_1) = \sum \vec{F} \Delta t = \int_{t_1}^{t_2} \vec{F} dt = \vec{p}_2 - \vec{p}_1$$

$$\sum \vec{p} = m\vec{v}_{\text{cm}}$$

$$v_{A1} - v_{B1} = -(v_{A2} - v_{B2})$$

$$r_{\text{cm}} = (m_1 r_1 + m_2 r_2 + m_3 r_3 + \dots) / (m_1 + m_2 + m_3 + \dots)$$

$$\sum \vec{F} = m\vec{a}_{\text{cm}}$$

$$v - v_0 = v_{\text{ex}} \ln(m_0 / m)$$

$$\vec{F} = -v_{\text{ex}} (dm / dt); a = -(v_{\text{ex}} / m) (dm / dt)$$

$$\sum \vec{F}_{\text{ext}} = M\vec{a}_{\text{cm}}$$

$$I = \sum m_i r_i^2 = \int r^2 dm$$

$$\omega = d\theta / dt = (\theta_2 - \theta_1) / \Delta t; \alpha = d^2\theta / dt^2$$

$$\vec{p} = M\vec{v}_{\text{cm}}$$

$$\alpha_{\text{av}} = (\omega_2 - \omega_1) / (t_2 - t_1)$$

$$\theta = \omega_0 t + (1/2)\alpha t^2 = (\omega_0 + \omega)t / 2$$

$$\omega = \omega_0 + \alpha t$$

$$\omega^2 = \omega_0^2 + 2\alpha t$$

$$a_{\text{rad}} = \omega^2 r = v^2 / r; v = r\omega; a_{\text{tan}} = r\alpha$$

$$K = I\omega^2 / 2$$

$$I_{\text{para}} = I_{\text{cm}} + Md^2$$

$$\vec{\tau} = \vec{r} \times \vec{F}; \tau_z = I\alpha_z; W = \int \tau d\theta; P = \tau_z \omega_z$$

$$\vec{L} = \vec{r} \times \vec{p}$$

$$\vec{L} = \vec{r} \times m\vec{v} = mvr \sin \theta \hat{n}$$

$$d\vec{L} / dt = \vec{\tau}; \Omega = d\phi / dt = \tau_z / L_z$$

$$B = -\Delta p / (\Delta V / V_0)$$

$$Y = (F_{\perp} / A) / (\Delta L / L)$$

$$r_{\text{cg}} = (m_1 r_1 g + m_2 r_2 g + \dots) / (m_1 g + m_2 g + \dots)$$

$$K = 1/B$$

$$S = (F_{11} / A) / (x / h)$$

$$\text{SHM: } x = A \cos(\omega t + \phi) + B \sin(\omega t + \phi)$$

$$\ddot{x} = -\omega^2 x$$

$$\omega = \sqrt{k/m}; \omega = \sqrt{g/l}$$

$$E = (1/2)mv^2 + (1/2)kx^2 = (1/2)kA^2$$

$$v_{\text{max}} = \omega A$$