

PHY 2170/2175, Equations, Winter 2009

$$x - x_0 = v_0 t + \frac{at^2}{2} = vt - \frac{at^2}{2} = \frac{(v + v_0)t}{2} \quad (1)$$

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

$$v_{0,x} = v_0 \cos(\theta_0); \quad R = \frac{v_0^2 \sin(2\theta_0)}{g} \quad (3)$$

$$f_{s,max} = \mu_s N; \quad f_k = \mu_k N \quad (4)$$

$$K = \frac{mv^2}{2}; \quad E_{mech} = K + U \quad (5)$$

$$W = \vec{F} \cdot \vec{d}; \quad W = \int_{\vec{r}_i}^{\vec{r}_f} \vec{F} \cdot d\vec{r} \quad (6)$$

$$F_s = -kx, \quad U_s = \frac{kx^2}{2}; \quad F_g = mg, \quad U_g = mgy \quad (7)$$

$$F(x) = -\frac{dU(x)}{dx} \quad (8)$$

$$P = \frac{dW}{dt}; \quad P = \vec{F} \cdot \vec{v} \quad (9)$$

$$\vec{r}_{CM} = \frac{1}{M} \sum_{i=1}^n m_i \vec{r}_i; \quad M = \sum_{i=1}^n m_i \quad (10)$$

$$\vec{p} = m\vec{v}; \quad \vec{F}_{net} = \frac{d\vec{p}}{dt} \quad (11)$$

$$a_c = \frac{v^2}{r} = \omega^2 r; \quad a_\tau = \alpha r \quad (12)$$

$$I = \sum m_i r_i^2 = \int r^2 dm; \quad I = I_{CM} + Md^2 \quad (13)$$

$$K = \frac{I\omega^2}{2}; \quad L = I\omega; \quad \tau_{net} = I\alpha \quad (14)$$

$$\vec{\tau} = \vec{r} \times \vec{F}; \quad \tau = rF \sin \theta = rF_\perp = r_\perp F \quad (15)$$

$$W = \int_{\theta_i}^{\theta_f} \tau d\theta \quad (16)$$

$$\vec{l} = \vec{r} \times \vec{p} = m(\vec{r} \times \vec{v}); \quad \frac{d\vec{l}}{dt} = \vec{\tau}_{net} \quad (17)$$

$$\frac{F}{A} = Y \frac{\Delta L}{L}; \quad \frac{F}{A} = S \frac{\Delta x}{h} \quad (18)$$

$$F_g = G \frac{m_1 m_2}{r_{12}^2}; \quad U_g = -\frac{GMm}{r} \quad (19)$$

$$g = \frac{GM_E}{r^2}; \quad v_{esc} = \sqrt{\frac{2GM}{R}} \quad (20)$$

$$x = x_m \cos(\omega t + \phi); \quad a = -\omega^2 x; \quad T = 2\pi/\omega \quad (21)$$

$$\omega = \sqrt{\frac{k}{m}}; \quad \omega = \sqrt{\frac{\kappa}{I}}; \quad \omega = \sqrt{\frac{g}{L}}; \quad \omega = \sqrt{\frac{mgh}{I}} \quad (22)$$

$$y(x, t) = y_m \sin(kx - \omega t); \quad \lambda = 2\pi/k; \quad (23)$$

$$v = \frac{\lambda}{T} = \lambda f; \quad v = \sqrt{\frac{\tau}{\mu}}; \quad v = \sqrt{\frac{B}{\rho}} \quad (24)$$

$$I = \frac{P_s}{4\pi r^2} \quad (25)$$

$$\beta = (10 \text{ dB}) \log \frac{I}{I_0}; \quad I_0 = 1.0 \cdot 10^{-12} \text{ W/m}^2 \quad (26)$$

$$f' = f \frac{v + v_O}{v - v_S} \quad (27)$$

$$y'(x, t) = [2y_m \sin(kx)] \cos(\omega t); \quad f = \frac{v}{\lambda} = n \frac{v}{2L} \quad (28)$$

$$\Delta L/L = \alpha \Delta T; \quad \Delta V/V = \beta \Delta T; \quad (29)$$

$$PV = nRT = Nk_B T; \quad k_B = R/N_A; \quad (30)$$

$$Q = mc\Delta T; \quad Q = \pm LT; \quad W = -\int_{V_i}^{V_f} PdV \quad (31)$$

$$C_P = C_V + R; \quad PV^\gamma = \text{const}; \quad \gamma = C_P/C_V \quad (32)$$

$$e = \frac{W_{eng}}{Q_{hot}}; \quad e_C = 1 - \frac{T_c}{T_h} \quad (33)$$

$$N_v = 4\pi N \left( \frac{m}{2\pi k_B T} \right)^{3/2} v^2 e^{-mv^2/k_B T} \quad (34)$$

$$P = P_0 + \rho gh; \quad B = \rho_{fluid} gV \quad (35)$$

$$G = 6.67 \times 10^{-11} \text{ N} \cdot \text{m}^2/\text{kg}^2; \quad R_E = 6340 \text{ km} \quad (36)$$

$$I_{cyl} = \frac{MR^2}{2}; \quad I_{sph} = \frac{2MR^2}{5}; \quad I_{sph.shell} = \frac{2MR^2}{3}; \quad (37)$$