29:011 Exam 3 Formulas and Constants

$g = 9.8\, m/s^2$ 1 radian = $(360/2\pi)$ degrees = 57.3°

$\rho_{water} = 1000\ kg/m^3$ $\rho_{air} = 1.29\ kg/m^3$ $P_{atm} = 1.013\times10^5\, Pa$

$\vec{J} = \vec{\bar{F}}\Delta t$ $\vec{p} = m\vec{v}$ $\sum \vec{\bar{F}}\Delta t = \vec{p}_f - \vec{p}_0 = m\vec{v}_f - m\vec{v}_0$

$m_1 v_{01} + m_2 v_{02} = m_1 v_{f1} + m_2 v_{f2}$ $KE = (1/2)mv^2$ $PE_{gravity} = mgh$

totally inelastic collsion with $v_{02} = 0 \Rightarrow mv_{01} = (m_1 + m_2)v_f$

one-dimensional elastic collision with $v_{02} = 0 \Rightarrow v_{f1} = \left(\frac{m_1 - m_2}{m_1 + m_2}\right)v_{01}$; $v_{f2} = \left(\frac{2m_1}{m_1 + m_2}\right)v_{01}$

$\theta = \frac{s}{r}$ $\omega = \frac{\Delta\theta}{\Delta t}$ $\alpha = \frac{\Delta\omega}{\Delta t}$ $v_{_T} = \omega r$ $a_{_T} = \alpha r$ $a_c = \frac{v_T^2}{r} = r\omega^2$

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

$\tau = F\ell$ RB Equilibrium $\Rightarrow \sum \vec{F} = 0$ *and* $\sum \tau = 0$ $f_s = \mu_s F_N$

$F_s = -kx$ $\omega = 2\pi f = \frac{2\pi}{T}$ $f = \frac{1}{T}$

$x(t) = A\cos(2\pi ft)$

mass-spring system: frequency $f = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$ period $T = 2\pi\sqrt{\frac{m}{k}}$

pendulum: frequency $f = \frac{1}{2\pi}\sqrt{\frac{g}{L}}$ period $T = 2\pi\sqrt{\frac{L}{g}}$

$PE_{\text{elastic}} = (1/2)kx^2$

$\rho = \frac{m}{V}$ $P = \frac{F}{A}$

$P = P_{atm} + \rho gh$

$F_{\text{buoyant}} = W_{\text{displaced fluid}}$

$= m_{\text{displaced fluid}} \times g = \left(\rho_{\text{fluid}} \times \text{V}_{\text{displaced fluid}}\right) \times g$