PHYS-201 Equation Sheet for Midterm Exam #2

(19 November 2010, STRATTON 113, 8:00-8:50 am)

Chapter 5: Applying Newton's Laws

$$\sum \vec{\mathbf{F}} = 0 \qquad \sum F_x = 0 \qquad \sum F_y = 0$$

$$\sum \vec{\mathbf{F}} = m\vec{\mathbf{a}} \qquad \sum F_x = ma_x \qquad \sum F_y = ma_y$$

$$f_k = \mu_k n \qquad f_s \leq \mu_s n$$

$$f = kv \qquad v_t = \frac{mg}{k}$$

$$f = Dv^2 \qquad v_t = \sqrt{\frac{mg}{D}}$$

$$a_{rad} = \frac{v^2}{R} \qquad T = \frac{2\pi R}{v}$$

$$a_{rad} = \frac{4\pi^2 R}{T^2} \qquad F = m\frac{v^2}{R}$$

Chapter 6: Work and Kinetic Energy

$$W = Fs\cos\Phi \;[1 \text{ J} = 1 \text{ Nm}] \qquad W = \vec{\mathbf{F}} \cdot \vec{\mathbf{s}}$$

$$K = \frac{1}{2}mv^2 \qquad W_{tot} = \frac{1}{2}mv_2^2 - \frac{1}{2}mv_1^2 = \Delta K$$

$$W = \int_{x_1}^{x_2} F_x\,dx \qquad W = F_x\,(x_2 - x_1)\;(F_x = const)$$

$$F_x = kx \qquad W = \int_{x_1}^{x_2} F_x\,dx = \frac{1}{2}kx_2^2 - \frac{1}{2}kx_1^2$$

$$W = \int_{P_1}^{P_2} F\cos\Phi\,dl \quad \Rightarrow \quad W = \int_{P_1}^{P_2} \vec{\mathbf{F}} \cdot d\vec{\mathbf{l}}$$

$$P_{av} = \frac{\Delta W}{\Delta t}\;[1 \text{ W} = 1 \text{ Js}] \qquad P = \frac{dW}{dt} = \vec{\mathbf{F}} \cdot \vec{\mathbf{v}}$$

Chapter 7: Potential Energy and Energy Conservation

$$W_{grav} = Fs = mgy_1 - mgy_2$$
$$U_{grav} = mgy$$
$$W_{grav} = -\Delta U_{grav}$$
$$K_1 + U_{grav,1} = K_2 + U_{grav,2} \text{ (only gravity)}$$
$$K_1 + U_{grav,1} + W_{other} = K_2 + U_{grav,2} \text{ (other forces)}$$
$$\frac{1}{2}mv_1^2 + mgy_1 + W_{other} = \frac{1}{2}mv_2^2 + mgy_2 \text{ (other forces)}$$
$$U_{el} = \frac{1}{2}kx^2 \text{ (elastic potential energy)}$$
$$W_{el} = -\Delta U_{el}$$
$$K_1 + U_{el,1} = K_2 + U_{el,2} \text{ (only elastic forces)}$$
$$U = U_{grav} + U_{el} = mgy + \frac{1}{2}kx^2$$
$$K_1 + U_1 + W_{other} = K_2 + U_2 \text{ (valid in general)}$$
$$\Delta K + \Delta U + \Delta U_{int} = 0 \text{ (conservation energy law)}$$
$$F_x(x) = -\frac{dU(x)}{dx} \text{ (one dimension)}$$
$$\vec{\mathbf{F}} = -\left(\frac{\partial U}{\partial x}\hat{\mathbf{i}} + \frac{\partial U}{\partial y}\hat{\mathbf{j}} + \frac{\partial U}{\partial z}\hat{\mathbf{k}}\right) = -\vec{\nabla} U \text{ (three dimensions)}$$