Final Exam Formula Sheet: Chapter 2-11

$$\Delta x \equiv x_f - x_i; \qquad \bar{v}_x = \frac{\Delta x}{\Delta t}; \qquad v_x = \frac{dx}{dt}$$

$$\bar{a}_x \equiv \frac{\Delta v_x}{\Delta t}; \qquad \Delta v = v_f - v_i; \qquad a_x = \frac{dv_x}{dt}$$

$$v_{xf} = v_{xi} + a_x t$$

$$x_f - x_i = \bar{v}_x t = \frac{1}{2}(v_{xi} + v_{xf})t$$

$$x_f = x_i + v_{xi}t + \frac{1}{2} a_x t^2$$

$$v_{xf}^2 = v_{xi}^2 + 2a_x (x_f - x_i)$$

$$\vec{v}_f = \vec{v}_i + \vec{a}t$$

$$\vec{r}_f = \vec{r}_i + \vec{v}_i t + \frac{1}{2}\vec{a}\, t^2$$

$$\vec{a} = \vec{a}_r + \vec{a}_t; \qquad a_r = \frac{v^2}{r}; \qquad a_t = \frac{d|\vec{v}|}{dt}$$

$$\hat{r} = cos\theta\, \hat{i} + sin\theta\, \hat{j}$$

$$\hat{\theta} = -sin\theta\, \hat{i} + cos\theta\, \hat{j}$$

$$\frac{d\theta}{dt} = \omega; \qquad \theta = \omega t; \qquad v = \omega\, r$$

$$\frac{d\hat{r}}{dt} = \omega\, \hat{\theta}; \qquad \frac{d\hat{\theta}}{dt} = -\omega\, \hat{r}$$

$$\vec{r}_{PA} = \vec{r}_{PB} + \vec{r}_{BA}$$

$$\vec{v}_{PA} = \vec{v}_{PB} + \vec{v}_{BA}$$

$$\vec{a}_{PA} = \vec{a}_{PB} + \vec{a}_{BA}$$

$$\Sigma\vec{\mathbf{F}} = m\vec{\mathbf{a}}$$

$$W \equiv \vec{\mathbf{F}}.\vec{\mathbf{d}} = |\vec{\mathbf{F}}||\vec{\mathbf{d}}|cos\theta$$

$$W \equiv \int_{x_i}^{x_f} F_x dx$$

$$\mathcal{P} \equiv \frac{dW}{dt} = \vec{\mathbf{F}}.\vec{\mathbf{v}}$$

$$\vec{\mathbf{A}}.\vec{\mathbf{B}} = |\vec{\mathbf{A}}|\vec{\mathbf{B}}|\ cos\theta$$

$$\vec{\mathbf{F}}_{sp} = -k\vec{\mathbf{x}}$$

$$W_{net} = \Delta K.E.; \qquad K.E. = \frac{1}{2}mv^2$$

$$\Delta E = W_{ext}$$

$$P.E._g = mgh; \qquad P.E_{sp} = \frac{1}{2}kx^2$$

$$W_c = P.E_i - P.E_f = -\Delta P.E$$

$$\Delta E_{thermal} = +f_k d$$

$$F_x = -\frac{dU}{dx}; \qquad U_f - U_i = -\int_{x_i}^{x_f} F_x dx$$

$$\vec{\mathbf{p}} \equiv m\vec{\mathbf{v}}; \qquad \Sigma\vec{\mathbf{F}}_{ext} = \frac{d\vec{\mathbf{p}}_{total}}{dt}; \qquad \vec{\mathbf{I}} \equiv \int_{t_i}^{t_f} \vec{\mathbf{F}} dt = \Delta\vec{\mathbf{p}}; \qquad \Sigma\vec{\mathbf{F}}_{ext} = M\vec{\mathbf{a}}_{c.m.}$$

$$x_{c.m.} = \frac{\Sigma_i m_i x_i}{M}; \qquad y_{c.m.} = \frac{\Sigma_i m_i y_i}{M}$$

$$x_{c.m.} = \frac{1}{M}\int x\,dm; \qquad y_{c.m.} = \frac{1}{M}\int y\,dm$$

$$v_{x,c.m.} = \frac{\Sigma_i m_i v_{x,i}}{M}; \qquad v_{y,c.m.} = \frac{\Sigma_i m_i v_{y,i}}{M}$$

$$v_{1i} - v_{2i} = -(v_{1f} - v_{2f})$$

$$\omega_f = \omega_i \, + \, \alpha t$$

$$\theta_f - \theta_i = \bar{\omega} t = \frac{1}{2}(\omega_i + \omega_f)t$$

$$\theta_f = \theta_i \, + \, \omega_i t \, + \, \frac{1}{2}\,\alpha t^2$$

$$\omega_f^2 = \omega_i^2 \, + \, 2\alpha\,(\theta_f - \theta_i)$$

$$v = r\omega; \qquad a = r\alpha$$

$$I = \Sigma_i m_i {r_i}^2; \qquad I = \int r^2 dm; \qquad K.E = \frac{1}{2} I\omega^2$$

$$I \equiv I_{C.M.} \, + \, Mh^2$$

$$\vec{\tau} = \vec{\mathbf{r}} \times \vec{\mathbf{F}}; \qquad \tau_{net,ext} = I\,\alpha$$

$$\vec{\mathbf{L}} = \vec{\mathbf{r}} \times \vec{\mathbf{p}}; \qquad L_z = I\omega$$

$$\vec{\tau}_{net,ext} = \frac{d\vec{\mathbf{L}}}{dt}$$

Moments of Inertia: Please note that moments of inertia of disks, spheres, rods, etc will be provided if a problem requires their use. You should, however, expect to be asked to use the parallel axis theorem. If the point of the problem is to **find** *the moment of inertia of an object, then of course it won't be given. Nothing more complicated than what's been presented in class will be expected of you on the test.*