University Physics I and 1A: Equation Sheet for Exams

(You may detach this sheet from the test. It does not need to be handed in.)

Math

$$\vec{A}\cdot\vec{B} = \left|\vec{A}\right| \left|\vec{B}\right| \cos(\theta) = A_x B_x + A_y B_y + A_z B_z \qquad \left|\vec{A}\times\vec{B}\right| = \left|\vec{A}\right| \left|\vec{B}\right| \sin(\theta)$$

$$\vec{A}\times\vec{B} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ A_x & A_y & A_z \\ B_x & B_y & B_z \end{vmatrix} = (A_y B_z - A_z B_y)\,\hat{i} + (A_z B_x - A_x B_z)\,\hat{j} + (A_x B_y - A_y B_x)\,\hat{k}$$

Classical Mechanics

$$v_x = v_{0x} + a_x t \qquad x = x_0 + v_{0x} t + \frac{1}{2} a_x t^2 \qquad v_x^2 = v_{0x}^2 + 2a_x (x - x_0) \qquad x = x_0 + \frac{1}{2}(v_{0x} + v_x)\, t$$

$$a_{\text{centripetal}} = \frac{v^2}{r} \qquad \sum \vec{F} = m\vec{a} \qquad f_k = \mu_k n \qquad f_s \le \mu_s n \qquad F_x = -kx$$

$$F_G = G\frac{m_1 m_2}{r^2} \qquad U_G = -G\frac{m_1 m_2}{r} \qquad G = 6.674\times 10^{-11}\,\mathrm{N\cdot m^2/kg^2}$$

$$W = \int \vec{F}\cdot d\vec{r} \qquad W_{\text{net}} = \Delta K \qquad P = \frac{dW}{dt}$$

$$K = \frac{1}{2} m v^2 \qquad U_{\text{el}} = \frac{1}{2} k x^2 \qquad U_g = mgh$$

$$F_x = -\frac{dU}{dx} \qquad W_{\text{non-cons}} = -\Delta U_{\text{int}}$$

$$W_{\text{non-cons}} = \Delta K + \Delta U \qquad E_{\text{mech,i}} = E_{\text{mech,f}} + \Delta U_{\text{int}}$$

$$\vec{p} = m\vec{v} \qquad \vec{J} = \int \vec{F}\,dt = \vec{F}_{\text{avg}}\Delta t = \Delta\vec{p} \qquad \vec{r}_{\text{cm}} = \frac{\sum m_i \vec{r}_i}{\sum m_i} = \frac{\int \vec{r}\,dm}{M}$$

$$\omega = \omega_0 + \alpha t \qquad \theta = \theta_0 + \omega_0 t + \frac{1}{2}\alpha t^2 \qquad \omega^2 = \omega_0^2 + 2\alpha(\theta - \theta_0) \qquad \theta = \theta_0 + \frac{1}{2}(\omega_0 + \omega)t$$

$$v_t = r\omega \qquad a_t = r\alpha \qquad a_{\text{centripetal}} = \omega^2 r$$

$$I = \sum_i m_i r_i^2 = \int r^2\,dm \qquad I_{\parallel} = I_{\text{cm}} + Md^2$$

$$\vec{\tau} = \vec{r} \times \vec{F} \qquad \sum \vec{\tau} = I\vec{\alpha}$$

$$K_{\text{rot}} = \frac{1}{2}I\omega^2$$

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

$$\frac{d^2x}{dt^2} = -\omega^2 x \qquad x(t) = A\cos(\omega t + \phi) \qquad \omega = \frac{2\pi}{T} = 2\pi f \qquad \omega = \sqrt{\frac{k}{m}} \qquad \omega = \sqrt{\frac{Mdg}{I}}$$

$$y(x,t) = A\cos(kx \pm \omega t + \phi) \qquad k = \frac{2\pi}{\lambda} \qquad v = \lambda f = \frac{\omega}{k} \qquad v = \sqrt{\frac{F_T}{\mu}}$$

$$y_{\text{sw}} = A_{\text{sw}}\sin(kx)\sin(\omega t)$$