

Information for the Quiz on HW #4 and Exam #1

Fundamental Concepts

Things you must know:

(1) Definition of and approximation for average velocity (and the position update formula)

(2) Definition of momentum $\gamma = \frac{1}{\sqrt{1 - (|\vec{v}|/c)^2}}$

(3) The Momentum Principle (also, the momentum update formula and derivative form)

Specific Results

Projectile Motion:

$$x_f = x_i + v_{xi} \Delta t \qquad y_f = y_i + v_{yi} \Delta t - \frac{1}{2} g (\Delta t)^2$$
$$v_{xf} = v_{xi} \qquad v_{yf} = v_{yi} - g \Delta t$$

$$\vec{F}_{\text{grav on 2 by 1}} = -G \frac{m_1 m_2}{|\vec{r}|^2} \hat{r} \qquad |\vec{F}_{\text{grav}}| \approx mg \text{ near Earth's surface}$$

$$\vec{F}_{\text{elec on 2 by 1}} = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{|\vec{r}|^2} \hat{r} \qquad |\vec{F}_{\text{spring}}| = k_s |s|$$

$$Y = \frac{F_T/A}{\Delta L/L} \text{ (macro)} \qquad Y = \frac{k_{s,i}}{d} \text{ (micro)} \qquad v = d \sqrt{\frac{k_{s,i}}{m_a}}$$

$$\vec{F}_{\parallel} = \frac{d|\vec{p}|}{dt} \hat{p} \qquad \vec{F}_{\perp} = |\vec{p}| \frac{d\hat{p}}{dt} = |\vec{p}| \frac{|\vec{v}|}{R} \hat{n}$$

$$x(t) = A \cos(\omega t) \qquad \omega = \sqrt{\frac{k_s}{m}} \qquad T = \frac{2\pi}{\omega}$$

Physical Constants

$$c = 3 \times 10^8 \text{ m/s} \qquad g = 9.8 \text{ m/s}^2 \qquad G = 6.7 \times 10^{-11} \text{ N} \cdot \text{m}^2 / \text{kg}^2$$
$$m_{\text{proton}} = 1.7 \times 10^{-27} \text{ kg} \qquad m_{\text{electron}} = 9 \times 10^{-31} \text{ kg} \qquad N_A = 6.02 \times 10^{23} \text{ atoms/mole}$$
$$e = 1.6 \times 10^{-19} \text{ C} \qquad 1/4\pi\epsilon_0 = 9 \times 10^9 \text{ N} \cdot \text{m}^2 / \text{C}^2$$