Topics 6-7 Study Guide

I. Things to memorize. On the test you will be given a blank space where you will be asked to reproduce the following information from memory.

A. Definitions

- Work: $W = \int \vec{F} \cdot d\vec{x}$, often it is sufficent to use $W = F_{\parallel} \Delta x$
- Kinetic Energy: $KE = \frac{1}{2}mv^2$
- Power: $P = \frac{dW}{dt}$

B. Units:

- The SI unit for both work and energy is the Joule (J) which is equivalent to a $kg \cdot m^2/s^2$
- The SI unit for power is the Watt (W) which is equivalent to a J/s

C. (Partial) list of conservative forces and their corresponding potential energy functions:

- Gravity: $PE_g = mgh$
- Springs: $PE_s = \frac{1}{2}kx^2$

II. Proofs:

- Starting with Hooke's Law ($F_s = -kx$) and the definition of work, show that the work done by a spring in moving an object from x_1 to x_2 is $W = \frac{1}{2}kx_1^2 - \frac{1}{2}kx_2^2$
- Show that $W = \Delta KE$ by starting with $W = \int F dx$ where $F = ma = m\frac{d^2x}{dt^2}$ and $dx = vdt = \frac{dx}{dt}dt$. Use u-substitution and let $u = \frac{dx}{dt}$ and therefore $du = \frac{d^2x}{dt^2}dt$ and the integral becomes $W = m\int u du$.

III. Problem solving. There will be 1 or 2 questions directly from the HW and 1 or 2 original questions.