Mr. Jenkins
Physics I

Assignment Sheet
Simple Harmonic Motion

Objectives
You will be able to:

A. use energy conservation to find the speed of a simple harmonic motion oscillator at any position.
   state where the speed of a SHM oscillator is greatest and least.
   use Newton's second law to find the acceleration of a simple harmonic oscillator.
   explain how one can ascertain whether or not a motion is simple harmonic and how the test method is related to Hooke's law.
   find the period and frequency of the vibration of a spring-mass system and a pendulum, given sufficient data.
   explain why simple harmonic motion is called sinusoidal motion.
   explain what affects (and does not affect) the period of motion.
   indicate the restoring force in the case of a simple pendulum and explain why the motion is only approximately simple harmonic.
B. explain the basic effect of forcing and damping on a simple harmonic motion oscillator.

Reading

A. 13-1, Periodic Motion, p. 416–417
   13-2, Simple Harmonic Motion, p. 417–420†
   13-3, Connection between Uniform Circular Motion and Simple Harmonic Motion, p. 420–426†
   13-4, The Period of a Mass on a Spring, p. 426–430
   13-5, Energy Conservation in Oscillatory Motion, p. 431–437
B. 13-7, Damped Oscillations, p. 439–440
   13-8, Driven Oscillations and Resonance, p. 440–441

†Note: The textbook uses the trigonometric functions sine and cosine more quantitatively that I will emphasize in class. While I'll bring up almost everything the textbook does, the major emphasis will be on consideration of energy and application of Newton's Laws, not applied trigonometry. The text also uses some short-cuts based on the trigonometry (stated, not derived) which I expect you to be able to come up with from first principles.

Focus Questions

1. A pendulum is pulled back from its equilibrium position and then released.
   a. What form of energy is added to the system prior to its release? Explain.
   b. At what points in the motion of the pendulum after release is its kinetic energy the greatest? Explain.
   c. At what points is the potential energy the greatest? Explain.
2. A mass attached to a spring, which in turn is attached to a wall, is free to move on a frictionless horizontal surface. The mass is pulled back and then released.
   a. What form of energy is added to the system prior to the release of the mass? Explain.
   b. At what points in the motion of the mass after its release is potential energy the greatest? Explain.
   c. At what points is the kinetic energy the greatest? Explain.
3. Suppose that the mass in question 2 is half-way between one of the extreme points in its motion and the center point. In this position, what percentage of the energy is kinetic and what percentage is potential?