Administrative

- Office Hours

10.2 Simple Harmonic Motion and the Reference Circle
Demo: mass on spring, let it bob
- Qualitative Plot of Position Vs. Time and Force Vs. Time
- Mathematical description of Motion: Displacement

Periodic Functions
- Amplitude
- Period
- Frequency
- Angular Frequency

Example 1: Say our mass bobs up and down 4 times in 6 seconds. A) What is the period? B) What is the frequency? C) What is the ‘angular’ frequency?
- Units
- Connection to physical properties, m and k.
  Demo: Mass dependence of frequency

Example 2: Say we observe that our 0.5 kg mass has a period of 1.5 sec. on our spring. What is the spring constant?

Simple Harmonic Motion Generality

Velocity & Acceleration
- Velocity
  - Qualitatively
  - Quantitatively
    - Amplitude

Example 3: Say I pull the mass down 0.1 m and release. It bobs up and down in 1.5 sec. What is the maximum speed?

- Acceleration

Other objects Displaying Simple Harmonic Motion

The Pendulum
- Linear Approximation
- Only an Approximation
- Frequency dependence on g and l

Example 4: How long must be a pendulum to have a period of 2 sec?
14. A loudspeaker diaphragm is producing a sound for 2.5 s by moving back and forth in simple harmonic motion. The angular frequency of the motion is $7.54 \times 10^4$ rad/s. How many times does the diaphragm move back and forth?

17. Concept Simulation 10.3 at www.wiley.com/college/cutnell (edition 6) illustrates the concepts pertinent to this problem. An 0.80 kg object is attached to one end of a spring, as in Figure 10.6, and the system is set into simple harmonic motion. The displacement $x$ of the object as a function of time is shown in the drawing. With the aid of these data, determine (a) the amplitude $A$ of the motion, (b) the angular frequency $\omega$, (c) the spring constant $k$, (d) the speed of the object at $t = 1.0$ s, and (e) the magnitude of the object’s acceleration at $t = 1.0$ s.

42. A pendulum clock can be approximated as a simple pendulum of length 1.99 m and keeps accurate time at a location where $g = 9.83$ m/s$^2$. In a location where $g = 9.78$ m/s$^2$, what must be the new length of the pendulum, such that the clock continues to keep accurate time (that is, its period remains the same)?