1. A mass of 210 grams rests on a horizontal surface that is not frictionless. It is attached to a firmly-anchored spring that has a spring constant of k=47 N/m. The spring is stretched by 7 cm and the mass is released. What must be the coefficient of kinetic friction between the mass and the surface such that the mass comes to rest exactly at the equilibrium position?

2. Plot the potential energy, as a function of time, of a simple harmonic oscillator with spring constant k, amplitude A, and holding a mass m.

3. Plot the kinetic energy, as a function of time, of a simple harmonic oscillator with spring constant k, amplitude A, and holding a mass m.

4. Plot the sum of the kinetic and potential energies of the harmonic oscillator considered in the previous two problems.

5. A molecule of carbon monoxide vibrates as though the two atoms in it were held together by a spring. The spring constant in this situation is 465.5 N/m. Find the **circular** frequency (f) of the vibrations of this molecule. (Note: Because the two masses move together rather than one mass moving while the other end of the spring stays fixed (as in our usual setup) you must use the "reduced mass" for this system. This is $\mu = \frac{m_1 m_2}{m_1 + m_2}$ where the masses are those of the carbon and oxygen atoms, respectively. Just use μ anywhere you would normally use *m* in this calculation.)

6. A cat walks down a narrow path between a pond and a brook. The cat, hating water, attempts to avoid both bodies of water. The closer it gets to one, the more it attempts to avoid it. Determine a suitable “ω” value for this situation.

7. Consider real-world situations in your life. Come up with an example of a situation in which oscillatory behavior might be expected and determine the factors that would influence the frequency of oscillation in it.