PRACTICE A

Hooke's Law

1. Suppose the spring in Sample Problem A is replaced with a spring that stretches 36 cm from its equilibrium position.
   a. What is the spring constant in this case?
   b. Is this spring stiffer or less stiff than the one in Sample Problem A?
2. A load of 45 N attached to a spring that is hanging vertically stretches the spring 0.14 m. What is the spring constant?
3. A slingshot consists of a light leather cup attached between two rubber bands. If it takes a force of 32 N to stretch the bands 1.2 cm, what is the equivalent spring constant of the two rubber bands?
4. How much force is required to pull a spring 3.0 cm from its equilibrium position if the spring constant is 2.7×10^3 N/m?

A stretched or compressed spring has elastic potential energy

As you saw in the chapter "Work and Energy," a stretched or compressed spring stores elastic potential energy. To see how mechanical energy is conserved in an ideal mass-spring system, consider an archer shooting an arrow from a bow, as shown in **Figure 2.** Bending the bow by pulling back the bowstring is analogous to stretching a spring. To simplify this situation, we will disregard friction and internal energy.

Once the bowstring has been pulled back, the bow stores elastic potential energy. Because the bow, arrow, and bowstring (the system) are now at rest, the kinetic energy of the system is zero, and the mechanical energy of the system is solely elastic potential energy.

When the bowstring is released, the bow's elastic potential energy is converted to the kinetic energy of the arrow. At the moment the arrow leaves the bowstring, it gains most of the elastic potential energy originally stored in the bow. (The rest of the elastic potential energy is converted to the kinetic energy of the bow and the bowstring.) Thus, once the arrow leaves the bowstring, the mechanical energy of the bow-and-arrow system is solely kinetic. Because mechanical energy must be conserved, the total kinetic energy of the bow, arrow, and bowstring is equal to the elastic potential energy originally stored in the bow.

Figure 2
The elastic potential energy stored in this stretched bow is converted into the kinetic energy of the arrow.