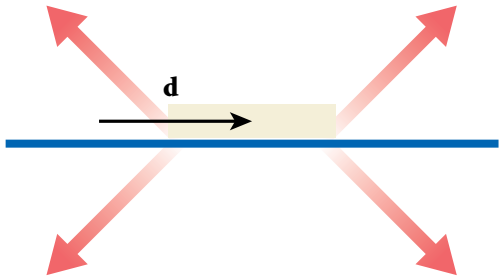
(a)



(b)

Figure 12
(a) As the block slides, its kinetic energy tends to decrease because of friction. The force from the hand keeps it moving. **(b)** Kinetic energy is dissipated into the block and surface.

Mechanical energy is not conserved in the presence of friction

If you have ever used a sanding block to sand a rough surface, such as in **Figure 12,** you may have noticed that you had to keep applying a force to keep the block moving. The reason is that kinetic friction between the moving block and the surface causes the kinetic energy of the block to be converted into a nonmechanical form of energy. As you continue to exert a force on the block, you are replacing the kinetic energy that is lost because of kinetic friction. The observable result of this energy dissipation is that the sanding block and the tabletop become warmer.

In the presence of kinetic friction, nonmechanical energy is no longer negligible and mechanical energy is no longer conserved. This does not mean that energy in general is not conserved—total energy is *always* conserved. However, the mechanical energy is converted into forms of energy that are much more difficult to account for, and the mechanical energy is therefore considered to be "lost."

SECTION REVIEW

1. If the spring of a jack-in-the-box is compressed a distance of 8.00 cm from its relaxed length and then released, what is the speed of the toy head when the spring returns to its natural length? Assume the mass of the toy head is 50.0 g, the spring constant is 80.0 N/m, and the toy head moves only in the vertical direction. Also disregard the mass of the spring. (Hint: Remember that there are two forms of potential energy in the problem.)

2. You are designing a roller coaster in which a car will be pulled to the top of a hill of height h and then, starting from a momentary rest, will be released to roll freely down the hill and toward the peak of the next hill, which is 1.1 times as high. Will your design be successful? Explain your answer.

3. Is conservation of mechanical energy likely to hold in these situations?
- **a.** a hockey puck sliding on a frictionless surface of ice
- **b.** a toy car rolling on a carpeted floor
- **c.** a baseball being thrown into the air

4. Critical Thinking What parts of the kinetic sculpture on the opening pages of this chapter involve the conversion of one form of energy to another? Is mechanical energy conserved in these processes?