

Static Friction Four types of friction are shown in Figure 6. The friction that acts on objects that are not moving is called **static friction**. Because of static friction, you must use extra force to start the motion of stationary objects. For example, think about what happens when you try to push a heavy desk across a floor. If you push on the desk with a force less than the force of static friction between the desk and the floor, the desk will not move. To make the desk move, you must exert a force greater than the force of static friction. Once the desk is moving, there is no longer any static friction. However, there is another type of friction—sliding friction.

Sliding Friction Sliding friction occurs when two solid surfaces slide over each other. Sliding friction can be useful. For example, you can spread sand on an icy path to improve your footing. Ballet dancers apply a sticky powder to the soles of their ballet slippers so they won't slip on the dance floor. And when you stop a bicycle with hand brakes, rubber pads slide against the tire surfaces, causing the wheels to slow and eventually stop. On the other hand, sliding friction is a problem if you fall off your bike and skin your knee!

Rolling Friction When an object rolls across a surface, **rolling friction** occurs. Rolling friction is easier to overcome than sliding friction for similar materials. This type of friction is important to engineers who design certain products. For example, skates, skateboards, and bicycles need wheels that move freely. So engineers use ball bearings to reduce the friction between the wheels and the rest of the product. These ball bearings are small, smooth steel balls that reduce friction by rolling between moving parts.

Fluid Friction Fluids, such as water, oil, or air, are materials that flow easily. **Fluid friction** occurs when a solid object moves through a fluid. Like rolling friction, fluid friction is easier to overcome than sliding friction. This is why the parts of machines that must slide over each other are often bathed in oil. In this way, the solid parts move through the fluid instead of sliding against each other. When you ride a bike, fluid friction occurs between you and the air. Cyclists often wear streamlined helmets and specially designed clothing to reduce fluid friction.


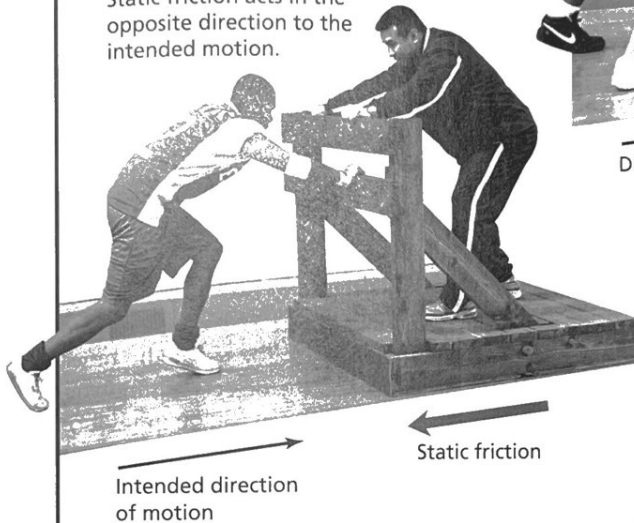
 **Reading Checkpoint** What are two ways in which friction can be useful?

FIGURE 6
Types of Friction

Types of friction include static, sliding, rolling, and fluid friction. *Making Generalizations* In what direction does friction act compared to an object's motion?

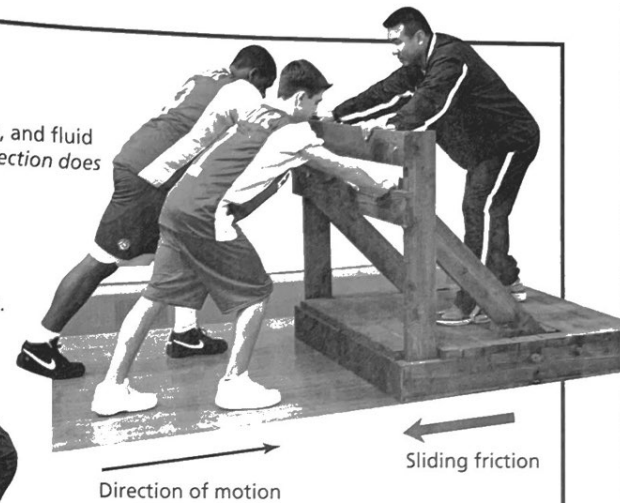
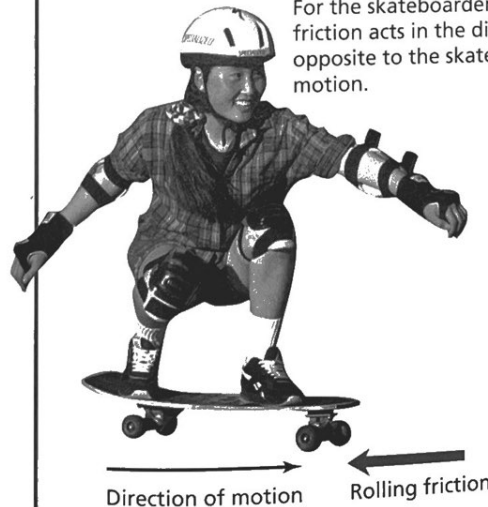
Static Friction ▼

To make the sled move, the athlete first has to overcome the force of static friction. Static friction acts in the opposite direction to the intended motion.



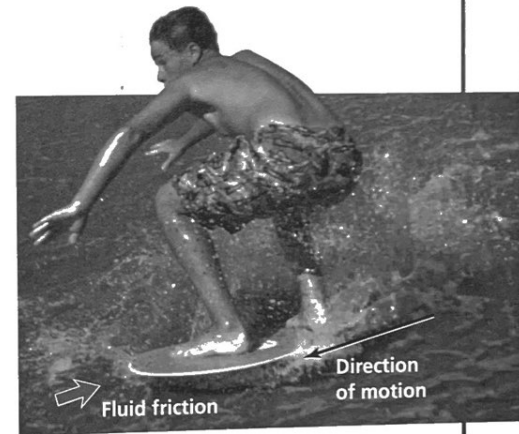
Rolling Friction ▼

Rolling friction occurs when an object rolls over a surface. For the skateboarder, rolling friction acts in the direction opposite to the skateboard's motion.



Sliding Friction ▲

Once the sled is moving, it slides over the floor. Sliding friction acts between the sled and the floor in the opposite direction to the sled's motion.



Fluid Friction ▲

When an object pushes fluid aside, friction occurs. The surfer must overcome the fluid friction of the water.