Types of Friction

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Climbing a vertical rock wall means pitting your strength and stamina against the force of gravity, which pulls you down toward the ground. Another force helps you to climb the vertical rock wall by keeping your hands and feet from slipping. That force is friction.

### Four Types of Friction

Friction is the force that opposes motion between any surfaces that are in contact. There are four types of friction: static, sliding, rolling, and fluid friction. Static, sliding, and rolling friction occur between solid surfaces. Fluid friction occurs in liquids and gases. All four types of friction are described below.

#### Static Friction

Static friction acts on objects when they are resting on a surface. For example, if you are hiking in the woods, there is static friction between your shoes and the trail each time you put down your foot (see Figure 1.1). Without this static
friction, your feet would slip out from under you, making it difficult to walk. In fact, that’s exactly what happens if you try to walk on ice. That’s because ice is very slippery and offers very little friction.

![Figure 1.1](image)

**Q:** Can you think of other examples of static friction?

**A:** One example is the friction that helps the people climb the rock wall in the opening picture above. Static friction keeps their hands and feet from slipping.

**Sliding Friction**

Sliding friction is friction that acts on objects when they are sliding over a surface. Sliding friction is weaker than static friction. That’s why it’s easier to slide a piece of furniture over the floor after you start it moving than it is to get it moving in the first place. Sliding friction can be useful. For example, you use sliding friction when you write with a pencil. The pencil “lead” slides easily over the paper, but there’s just enough friction between the pencil and paper to leave a mark.

**Q:** How does sliding friction help you ride a bike?

**A:** There is sliding friction between the brake pads and bike rims each time you use your bike’s brakes. This friction slows the rolling wheels so you can stop.

**Rolling Friction**

Rolling friction is friction that acts on objects when they are rolling over a surface. Rolling friction is much weaker than sliding friction or static friction. This explains why most forms of ground transportation use wheels, including bicycles, cars, 4-wheelers, roller skates, scooters, and skateboards. Ball bearings are another use of rolling friction. You can see what they look like in the **Figure 1.2.** They let parts of a wheel or other machine roll rather than slide over on another.

**Fluid Friction**

Fluid friction is friction that acts on objects that are moving through a fluid. A **fluid** is a substance that can flow and take the shape of its container. Fluids include liquids and gases. If you’ve ever tried to push your open hand through the water in a tub or pool, then you’ve experienced fluid friction. You can feel the resistance of the water against your hand. Look at the skydiver in the **Figure 1.3.** He’s falling toward Earth with a parachute. Resistance of the air against the parachute slows his descent. The faster or larger a moving object is, the greater is the fluid friction resisting its motion. That’s why there is greater air resistance against the parachute than the skydiver’s body.
FIGURE 1.2
The ball bearings in this wheel reduce friction between the inner and outer cylinders when they turn.

FIGURE 1.3

Watch the video below to learn more about the different types of friction:

MEDIA
Click image to the left or use the URL below.
URL: http://www.ck12.org/flx/render/embeddedobject/246387

Summary

• Friction is the force that opposes motion between any surfaces that are in contact. There are four types of friction: static, sliding, rolling, and fluid friction.
• Static, sliding, and rolling friction occur between solid surfaces. Static friction is strongest, followed by sliding friction, and then rolling friction, which is weakest.
• Fluid friction occurs in fluids, which are liquids or gases.

Review

1. List four types of friction.
2. You can move heavy boxes by sliding them over the ground. Or you can put them on a dolly, like the one in the Figure 2, and then roll them over the ground. Explain which way makes it easier to move the boxes.
3. What is a fluid? Give an original example of fluid friction.

References

1. Ray Sawhill. Friction helps this person to walk. CC BY 2.0
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