

FRICTION

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Friction

- ▶ Suppose you decide to ride a skateboard.
- ▶ You push off the ground and start moving.
- ▶ According to Newton's First Law of Motion, if **no** other forces are acting on your skateboard, you will continue to move....**BUT**
- ▶ What happens?
- ▶ You slow down



Friction



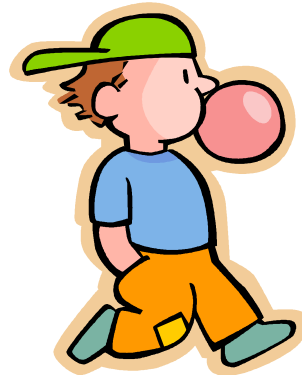
- ▶ Your skateboard slows down because of friction.
- ▶ **Friction** is the force that **opposes** motion between two surfaces that are touching each other.
- ▶ The amount of two surfaces depends on two things:
 - Kind of surface
 - Forces pressing the surfaces together

What Causes Friction?

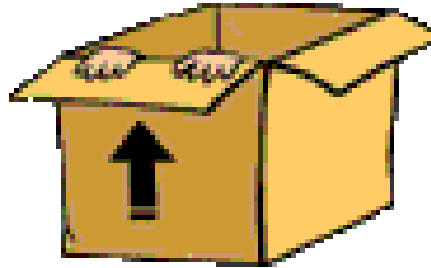
- ▶ Even though a surface may look smooth, if you magnify the surface it isn't smooth.
- ▶ Everything is made of molecules. The molecules come together to make bumps. Some surfaces have molecules that leave large bumps and some leave smaller bumps, but all surfaces have bumps.
- ▶ **Microwelds** occur when two bumpy surfaces are rubbed up against each other they **stick together**.

Sticking Together

- ▶ The greater the force on the object, the greater the force of the microwelds and the greater force is needed to overcome the microwelds to move the object.



Static Friction

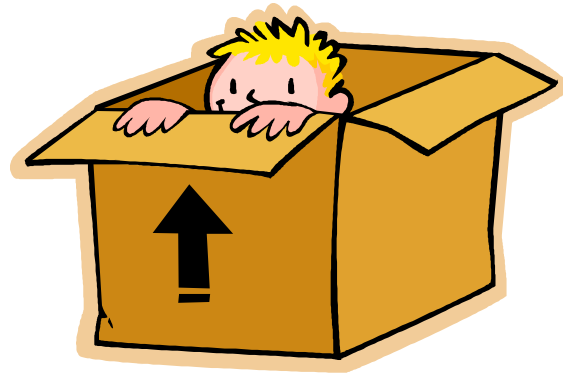


- ▶ Suppose your kid brother gets into a box and wants you to move him. He is too heavy to lift.
- ▶ You try to push the box and it doesn't move.
- ▶ What type of acceleration does it have?
- ▶ Zero Acceleration

Static Friction

- ▶ Remember Newton's Second Law of Motion
- ▶ If the acceleration is zero, the net force is zero.
- ▶ Therefore, because you can't move it, another force is being applied to cancel out your force.
- ▶ That opposing force is friction caused by the microwelds between the bottom of the box and the floor.
- ▶ This type of friction is called static friction.

Static Friction



- ▶ Static Friction is the friction between two surfaces that are not moving past each other.
- ▶ In this case, your push is not large enough to break the microwelds and the box remains stuck to the floor.

Sliding Friction



- ▶ To help you move your kid brother, you decide to ask a friend.
- ▶ You both push and slowly, but not easily, the box starts to slide across the floor.
- ▶ When you stop pushing, it quickly stops moving.
- ▶ Sliding the box is difficult and there is still resistance.
- ▶ Although you have overcome the microwelds, there is still a sliding friction occurring.

Sliding Friction

- ▶ Sliding Friction is the force that opposes the motion of two surfaces sliding past each other.
- ▶ Sliding friction is caused by microwelds constantly breaking and then forming again as the box slides along the floor.
- ▶ To keep the box moving, you must continually apply a force to overcome sliding friction.

Rolling Friction



- ▶ Have you ever seen a car stuck in the snow. Every time the driver steps on the gas, the tires just spin and the car doesn't go anywhere?
- ▶ This is because there isn't enough friction between the slippery ground and the tires.
- ▶ How could you create more friction to get the tires to move the car?
- ▶ Drop sand, gravel, put a board under each of the front tires.

Rolling Friction



- ▶ The friction between the rolling tires and the ground is called rolling friction.
- ▶ Rolling friction works partly because of microwelds.
- ▶ Rolling friction is much less friction than static or sliding friction.
- ▶ That is why it is easier to use a dolly than pushing your kid brother in the box.

