



# Newton's First Law

Inertia

# Old Ideas about Motion

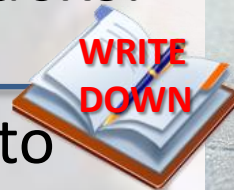
- You push a box.
  - It moves, . . .
  - But then it stops.
- Since moving objects eventually come to a stop, people thought the natural state for an object was to be at rest.
- It was believed that an object had to have a force applied to it to be in motion.



# It's Friction

- You're ice skating.
- You push off.
- You glide away.
- The ice turns to sand paper.
- You stop dead in your tracks.  
It's friction.

- Friction = force that acts to resist sliding between touching surfaces

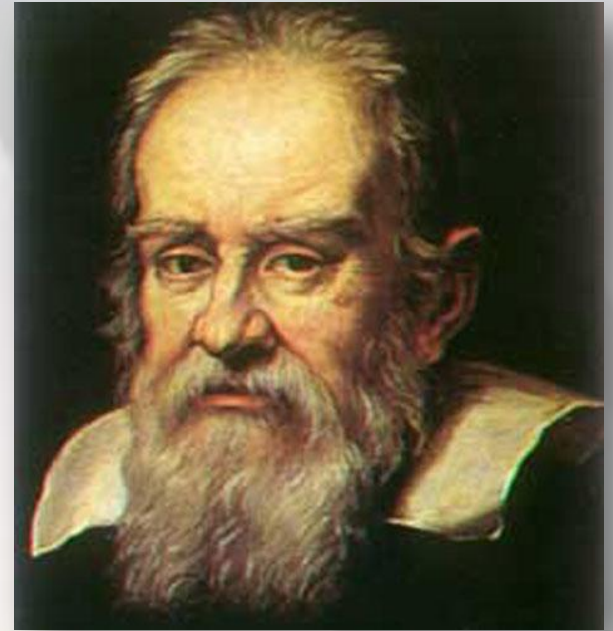


- Equal forces make you move further on ice than on sandpaper because there is less friction.



# Recognizing Friction's Role

- Galileo realized that an object in constant motion is as natural as an object at rest.
- Friction stops moving objects.
- Force needs to be applied to a moving object to overcome friction.
- Reducing friction also helps objects to move.



Galileo

# Causes of Friction



## Friction is caused by:

- Molecular adhesion = molecular force of attraction resulting when two materials are brought into close contact with each other
- Surface roughness is a factor in friction when the materials are rough enough to cause serious abrasion.
- Plowing effect = deformations in soft surfaces
  - When one or more of the materials is relatively soft, much of the resistance to movement is caused by deformations or a plowing effect.

# Types of Friction



- Static friction = force that prevents an object at rest from moving when a force is applied
- Sliding friction = force that resists the movement of one surface past another
  - Usually less than static friction
- Rolling friction = friction that results when an object rolls across a surface
  - Usually less than sliding friction

# The First Law

- You're a passenger in a fast car.
  - It turns sharply to the right.
  - You lean to the left, . . .
  - But you're really going in the same direction as you originally were.



- Newton's First Law = if the net force on an object is zero, it maintains its state of motion
  - An object in motion will remain in motion at the same speed and in the same direction.
  - An object at rest will remain at rest.

