

Physics 1180

Section 1.2.2: Dynamics

Part 1: Inertia & Newton's 1st Law

Chapter 2 Topics

- What is **inertia**?
- Newton's **First Law** of Motion
- The concept of **force**
- Net force and **equilibrium**

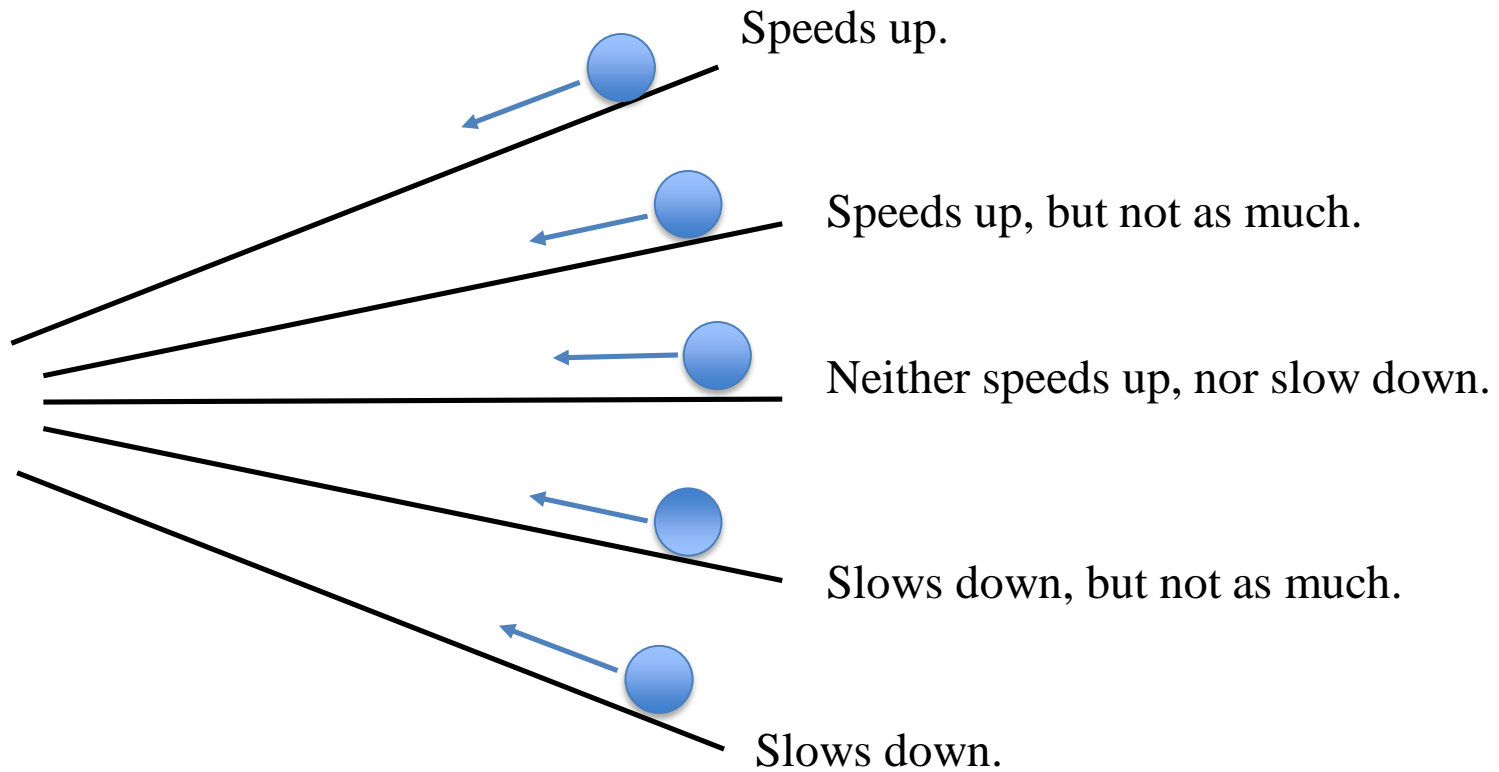
What is INERTIA?

Inertia is...

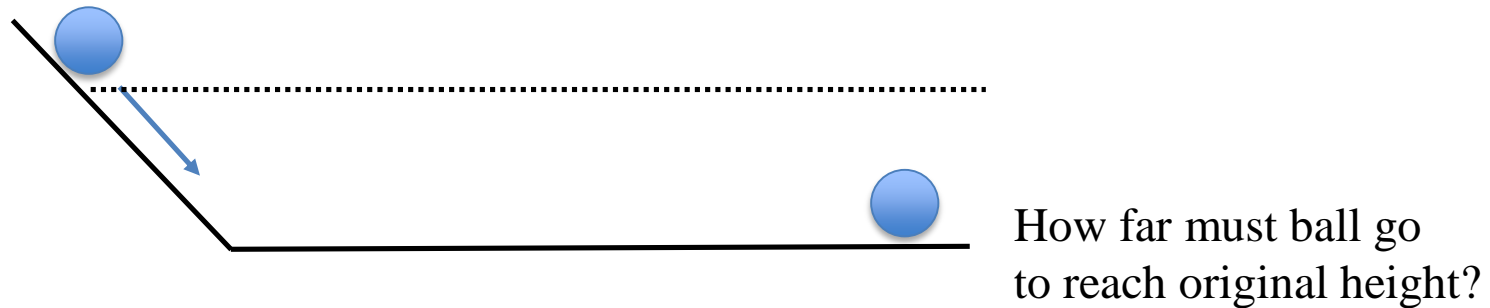
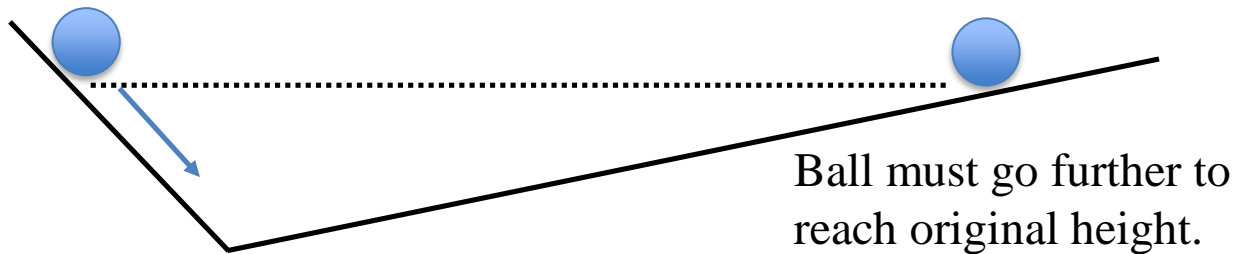
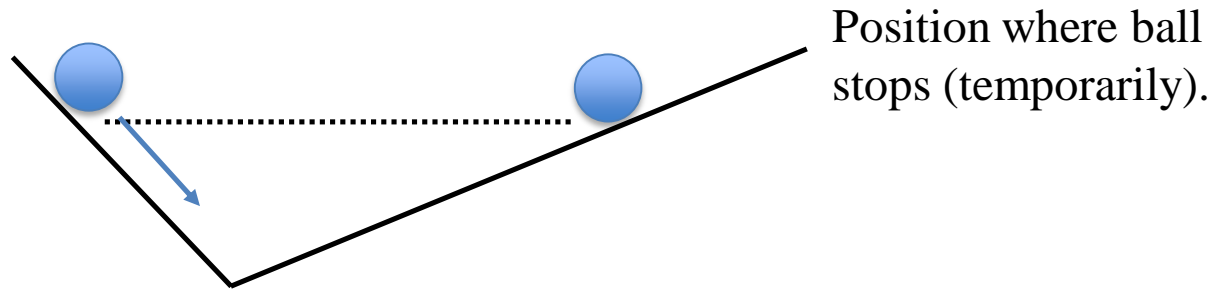
- ...“laziness.” (Translation from Latin.)
- ...resistance to change.
- ...the tendency for things to “keep on doing what they are already doing.”

In this context, inertia is an object’s resistance to change in its state of motion.

Galileo's Experiments



Galileo's Experiments (cont'd)



Newton's First Law of Motion

Isaac Newton took Galileo's Principle of Inertia and incorporated it into his first law of motion:

An object at rest will remain at rest
and an object in *uniform motion** will remain in motion
unless acted upon by a (net) force.

*Uniform motion: Constant speed in a straight line.

The Concept of FORCE

What is a **force**?

For now, we will take a force simply as a “push” or a “pull.”

For example, a force can be exerted by...

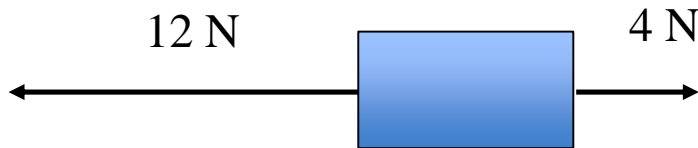
- a person pulling on a rope.
- the gravitational attraction between two objects.
- a tabletop that keeps a book from falling to the floor.
- the friction between surfaces in contact.

(...just to name a few.)

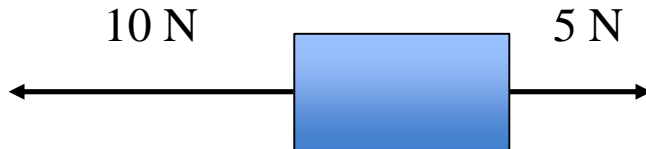
Examples



$$F_{net} = 2 \text{ N}$$



$$F_{net} = 8 \text{ N}$$



$$F_{net} = 5 \text{ N}$$



$$F_{net} = 0 \text{ N}$$

Mechanical Equilibrium

When $\mathbf{F}_{\text{net}} (= \Sigma\mathbf{F}) = 0 \text{ N}$,

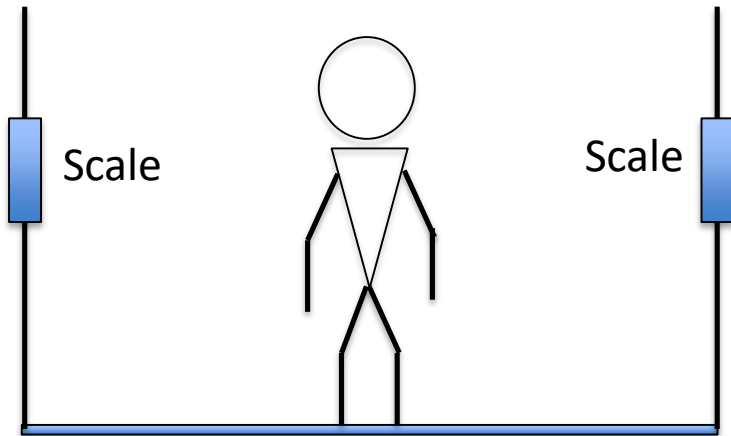
There is no change in the state of motion.

Static equilibrium: Velocity remains zero.

Dynamic Equilibrium: (Nonzero) velocity
remains constant.

Example

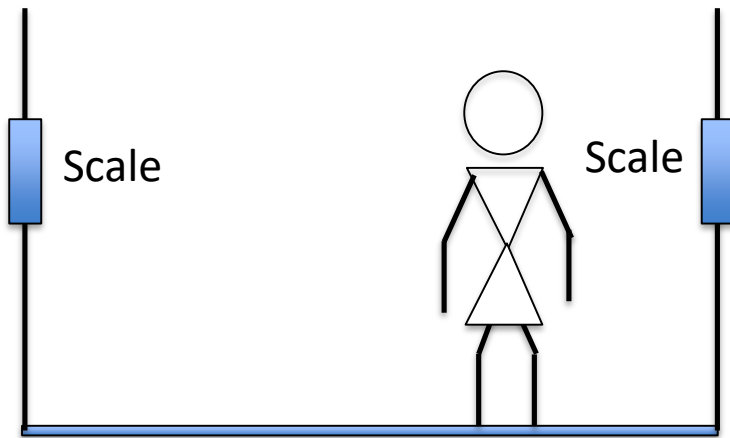
The scaffold weighs 100 N. A person weighing 700 N stands in the middle of the scaffold. What do the left and right scales read?



Each reads 400 N.

Example

Now a 500 N person stand on the scaffold so that the right scale reads 400 N. What does the left scale read?



Left scale reads 200 N.