

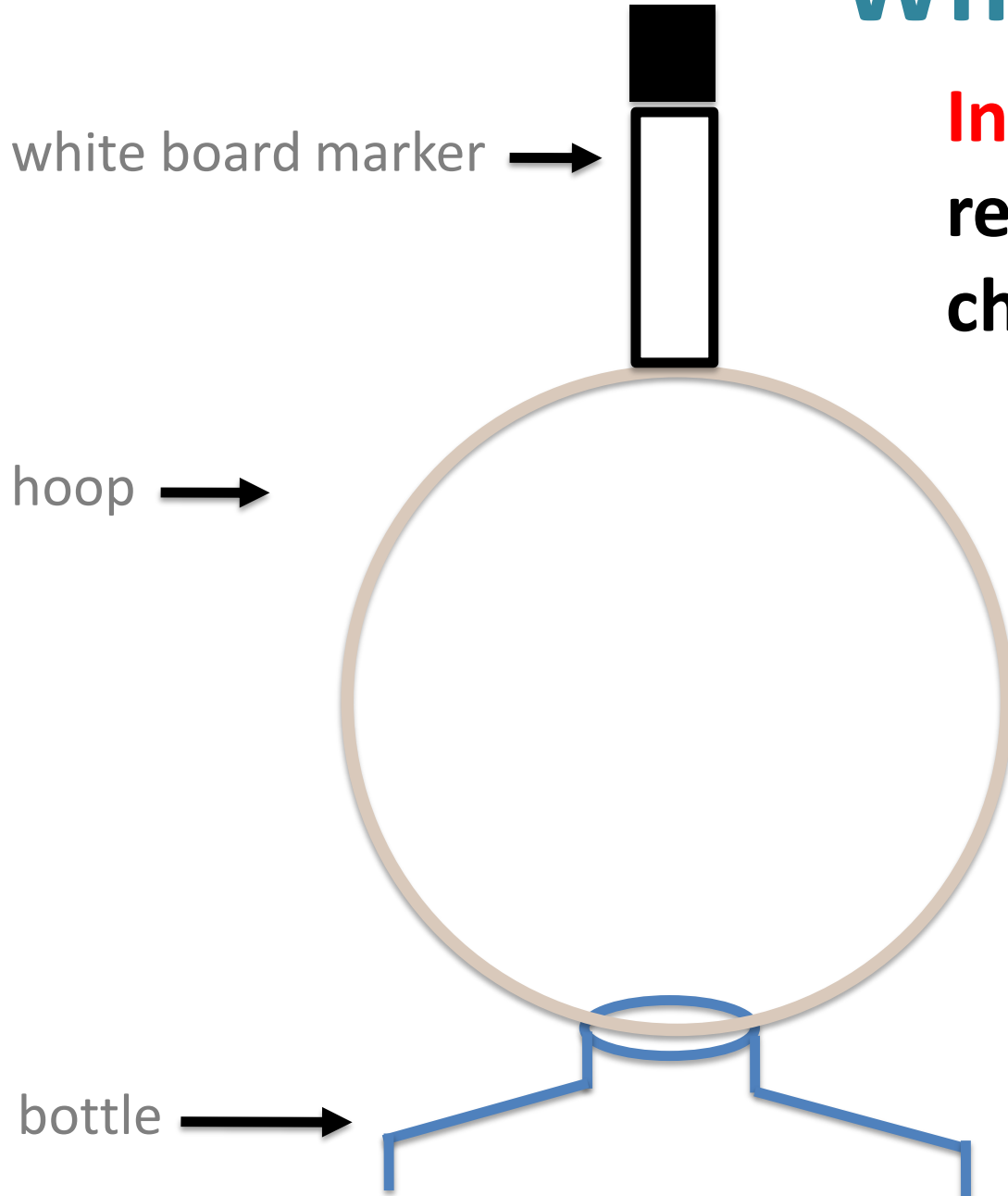


Forces and Newton's First Law



What is inertia?

Inertia is an object's resistance to changing its motion



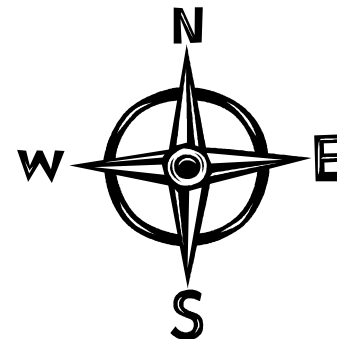
Velocity is speed and direction

What is the difference between speed and velocity?
Review: What is speed?
What is velocity?

$$\text{speed} = \frac{\text{distance traveled}}{\text{time}}$$

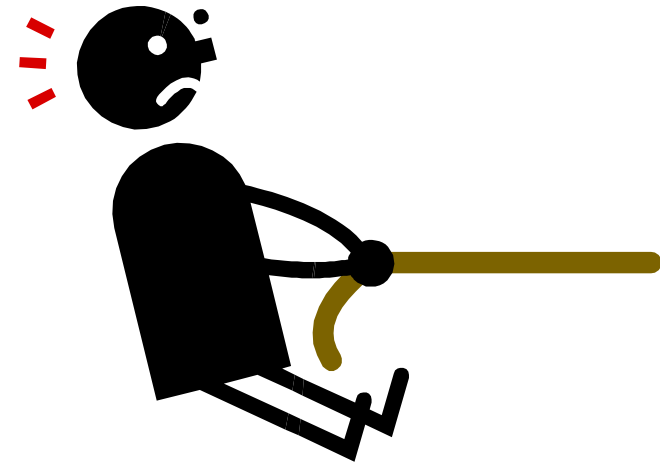


Acceleration is a change in velocity



A force is a push, pull or twist

Examples of **contact forces**



Applying a force can change an object's velocity.

Applying a force can cause an object to **accelerate**.

Types of Forces

Contact forces: interactions between objects that touch



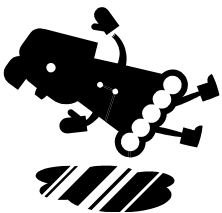
applied force



spring force



drag force

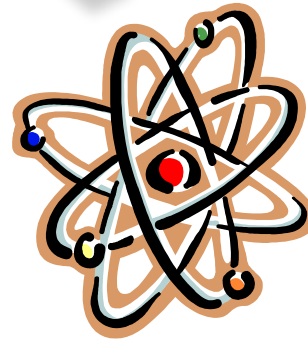


frictional force

Non-contact forces: attract or repel, even from a distance



magnetic force

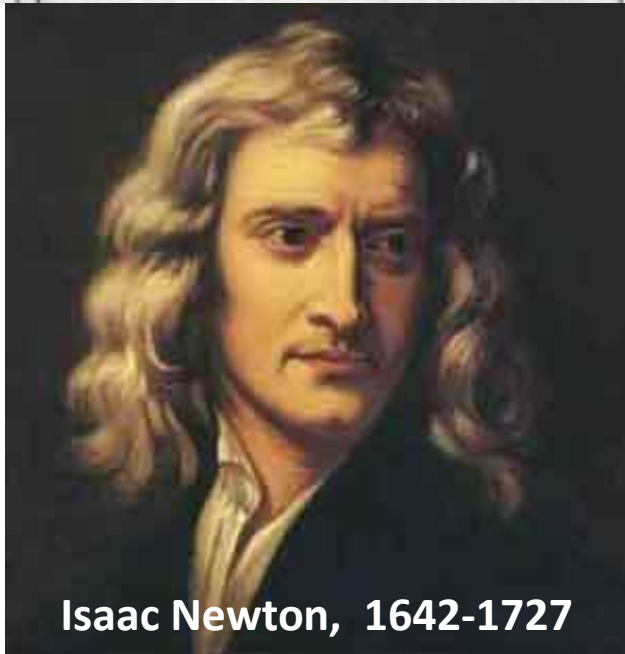
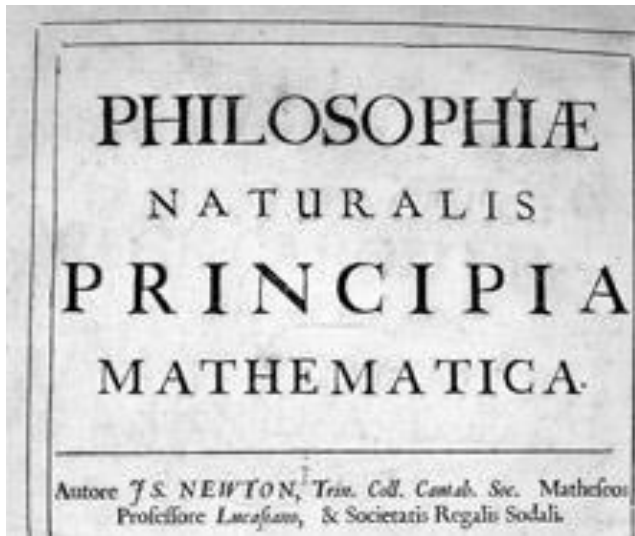


electric force



gravitational force

Deciphering Newton's First Law



Isaac Newton, 1642-1727

“Every body persists in its state of being at rest or of moving uniformly straight forward, except insofar as it is compelled to change its state by force impressed.”

—Sir Isaac Newton
Principia Mathematica (1687)

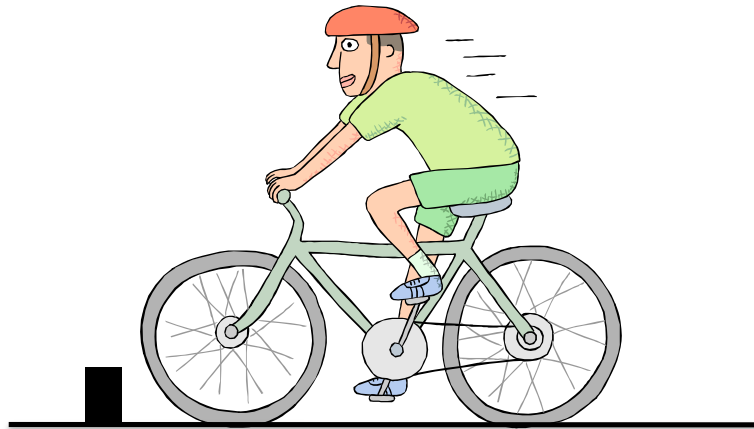
Write: In your own words, what does this mean?

Unless an unbalanced force acts on an object,

- An object at rest stays at rest
- An object in motion stays in motion

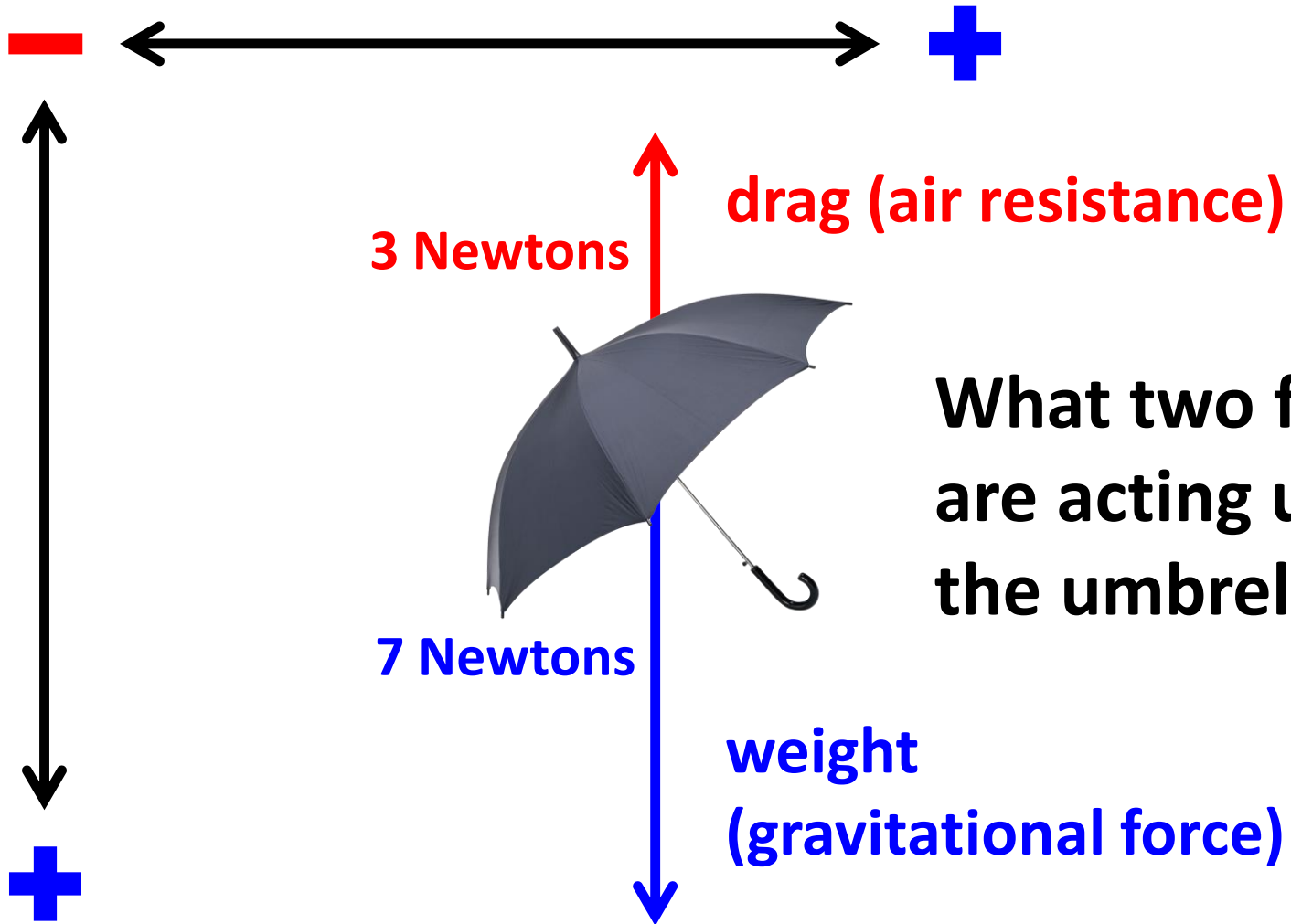
Newton's First Law of Motion

Objects in motion stay in motion and objects at rest stay at rest—unless acted upon by an unbalanced force.



Also called the “**law of inertia.**”

Unbalanced Forces



**What two forces
are acting upon
the umbrella?**

Galileo Galilei: “I found it first!”

I call it *“inertia.”*

Inertia is an object’s resistance to changing its motion.

I wrote:

“A body moving on a level surface will continue in the same direction at constant speed unless disturbed.”

Sure, Newton stated it more thoroughly, but they don’t call me **“the father of modern physics”** for nothing!



Galileo Galilei, 1564-1642

Egg Inertia Puzzle



What's different about these two eggs?



Concept Review

1. An object's resistance to changing its motion is called inertia.
2. Velocity measures speed and direction.
3. A change in velocity is called acceleration.
4. A force is a push, pull or twist.
5. Kicking a ball is an example of a contact force.
6. Newton's first law of motion: Objects in motion will stay in motion and objects at rest will stay at rest, unless acted on by an unbalanced force.