Rockets Away!

A Study of Learning and Fun Focused on Force and Motion

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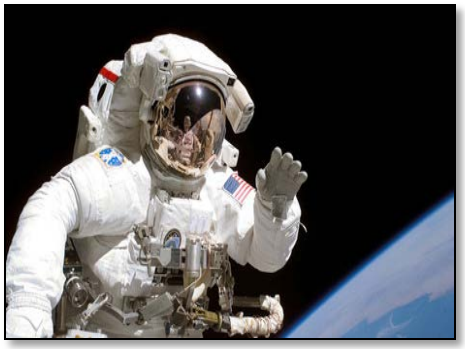
A **rocket** is a container enclosing a gas under pressure.

A small opening at one end of the container allows the gas to escape in one direction. That provides **thrust** that propels the rocket in the opposite direction.


NASA Dryden Flight Research Center Photo Collection
http://www.dfrc.nasa.gov/gallery/photo/index.html
NASA Photo: E-4942 Date: 1959 Photo by: NASA photo
X-15 launch from B-52 mothership



- According to NASA, **thrust** is the **force** that moves an aircraft through the air. Thrust is used to overcome the **weight** of a rocket.

- Thrust is made by the **engines** of the aircraft through some kind of **propulsion system**. Propulsion systems need fuel.

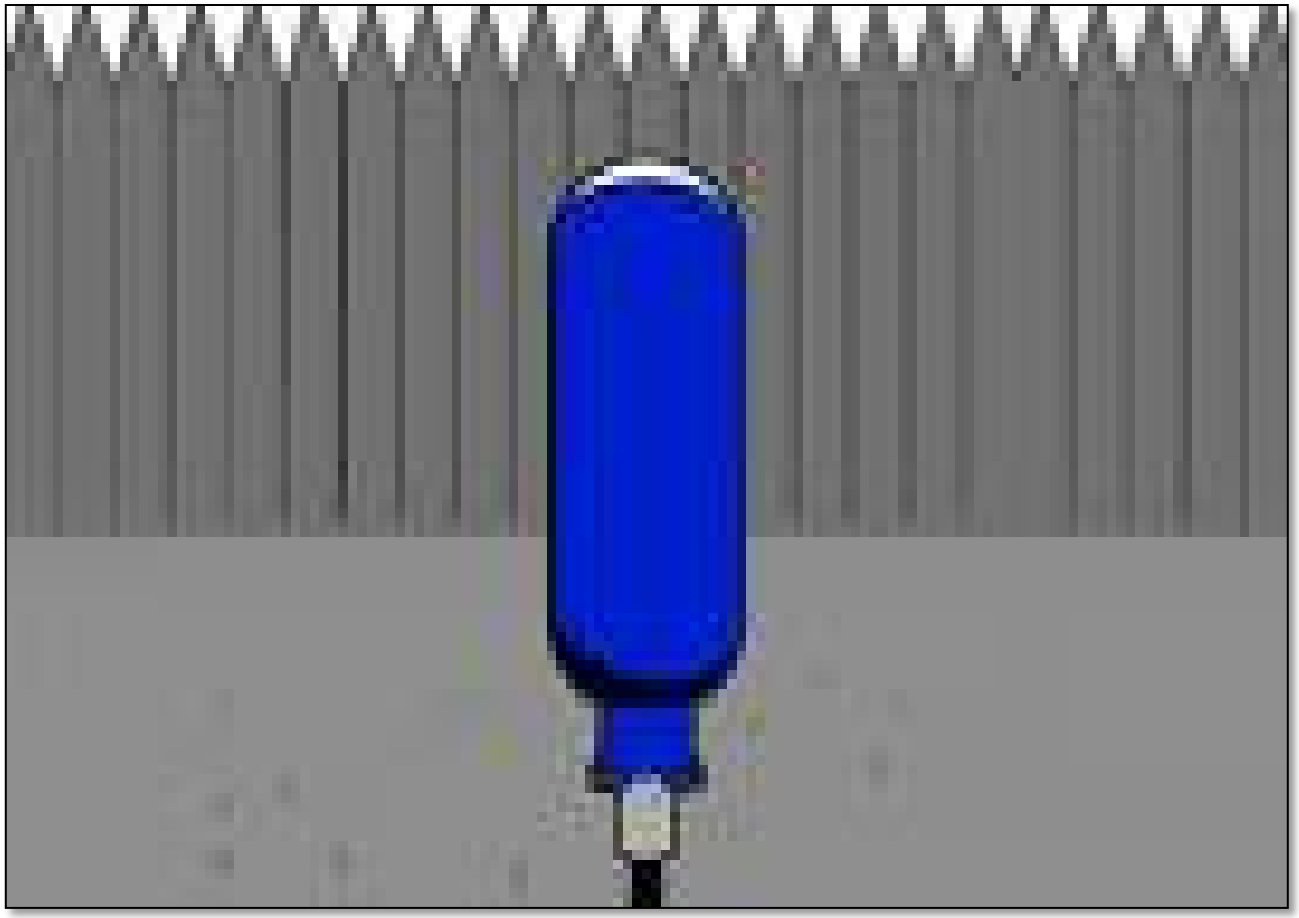
How do we get a rocket—
or anything—to move?

What do we need to overcome?

Let’s think about that as we look more closely at rockets.

(Keep thinking . . .)

Thrust and Pressure in a Bottle Rocket



Airplanes versus Rockets

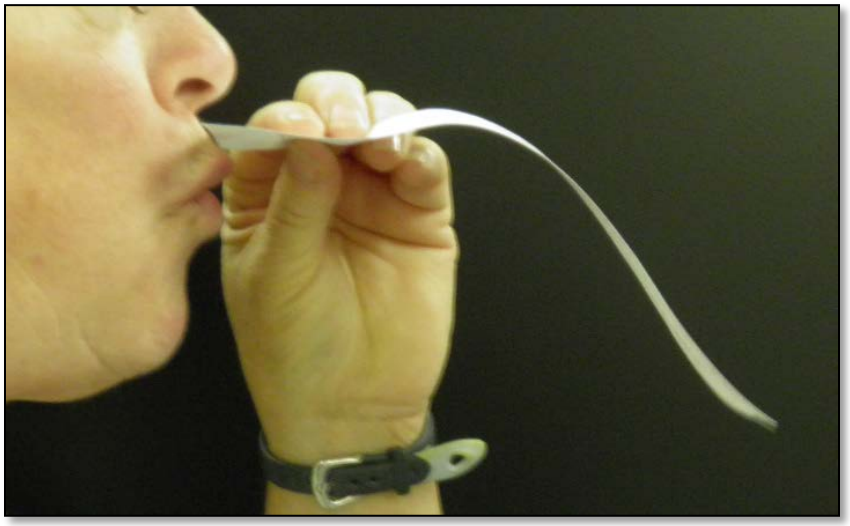
How is flight in an airplane different than a rocket? (Hint: Bernoulli has something to do with it.)

Lift and the Bernoulli Effect

Where there is moving air, there is low air pressure.

Step 1: Take a piece of paper about 2″ x 8″.

Step 2: Put the paper under your nose and blow (moving air) under the paper.



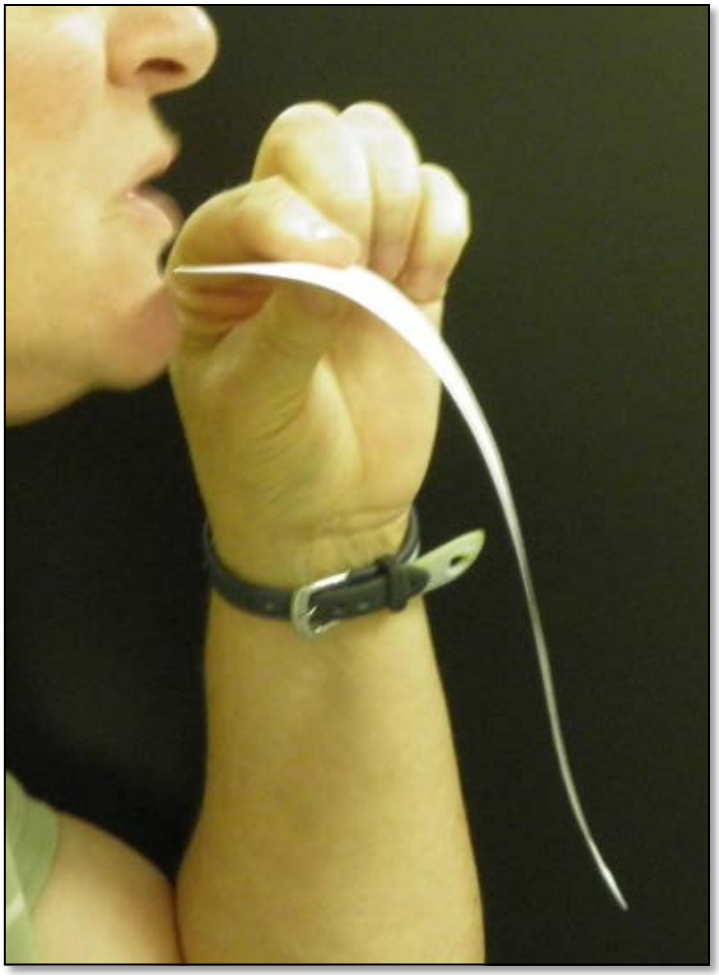
What did you think was going to happen?

What actually happened?

Step 3: Put the paper under your nose and blow (moving air) over the paper.

What did you think was going to happen?

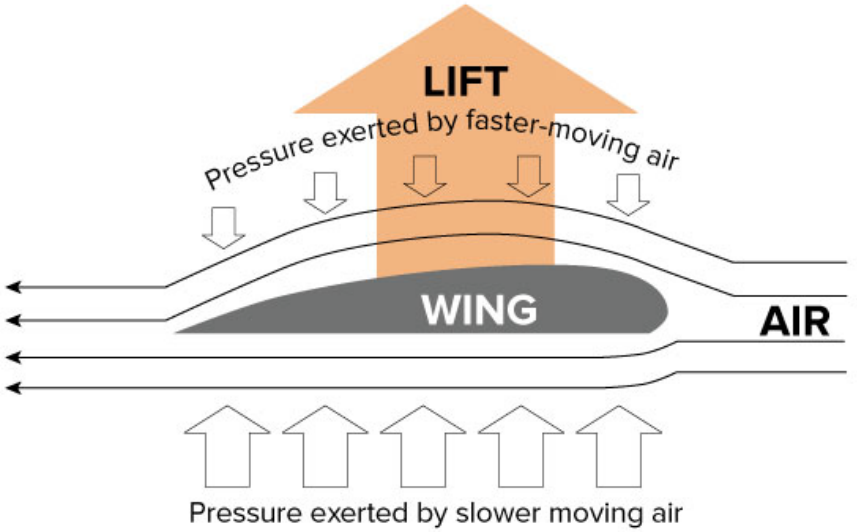
What actually happened?



The paper went up!

Moving air created low pressure over the paper and the higher pressure under the paper (or wing) lifted it!

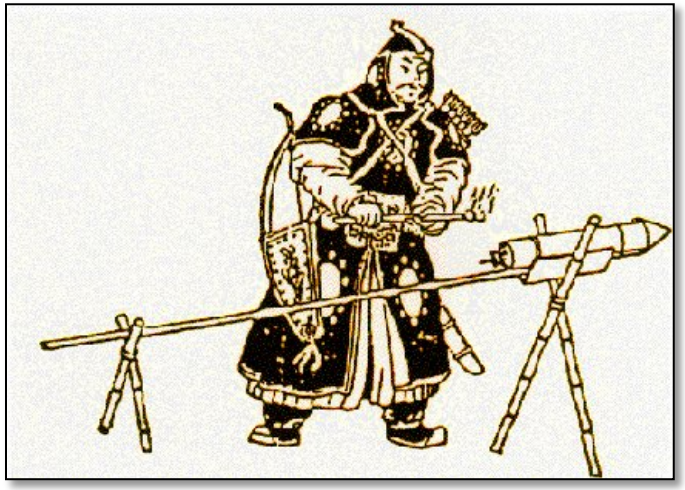
The **Bernoulli Effect**!



That is how airplanes fly! Thank you, Mr. Bernoulli!

A Brief History of Rocketry

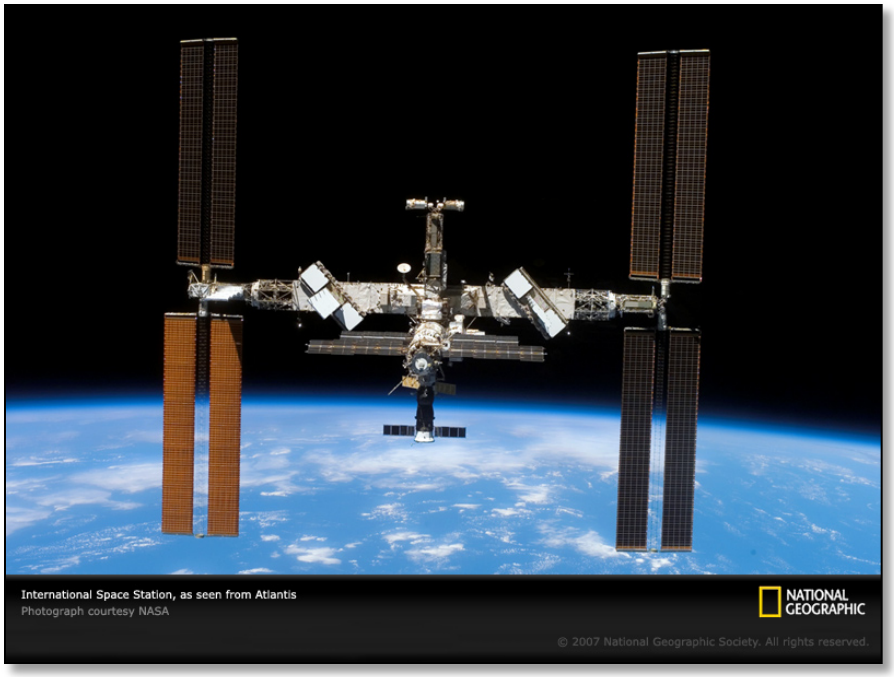
- Sometime in 1000s Chinese had rockets fueled by gunpowder.



- In 1812 at Fort McHenry in Baltimore, Francis Scott Key wrote a poem that included the phrase " . . . the bombs bursting in air . . ."

Ancient and Modern Warfare

Modern Uses of Rocketry



U.S. Inventor of Modern Rocketry

Dr. Robert Goddard launched the world's first liquid-fueled rocket on March 16, **1926.**

His work is as important as the Wright Brothers flight experiments.

Newton's Discoveries: Gravity and Laws of Motion

- 1687—Englishman Sir Isaac Newton discovered three Laws of Motion.

Gravity

Gravitation is a **natural phenomenon** by which objects with **mass** attract one another.

Gravity refers specifically to the force exerted by the Earth on objects on the planet and in its vicinity.

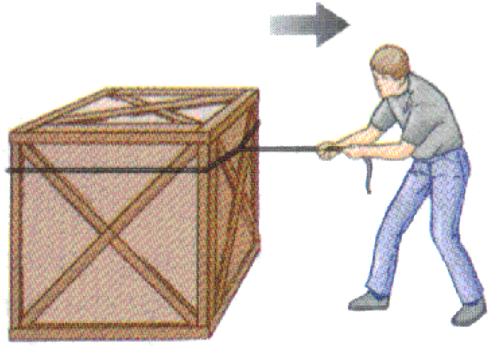
What does gravity do?

- Everything is pulled to the earth.
- What if gravity were turned off?
  (For example, on the moon.)
- Do we need gravity? Why?
- Is gravity one of those things we need to think about when launching a rocket?
- Or when throwing and hitting a ball?

Newton's First Law of Motion

Objects at rest will stay at rest, or objects in motion will stay in motion unless acted upon by an unbalanced force.

Force



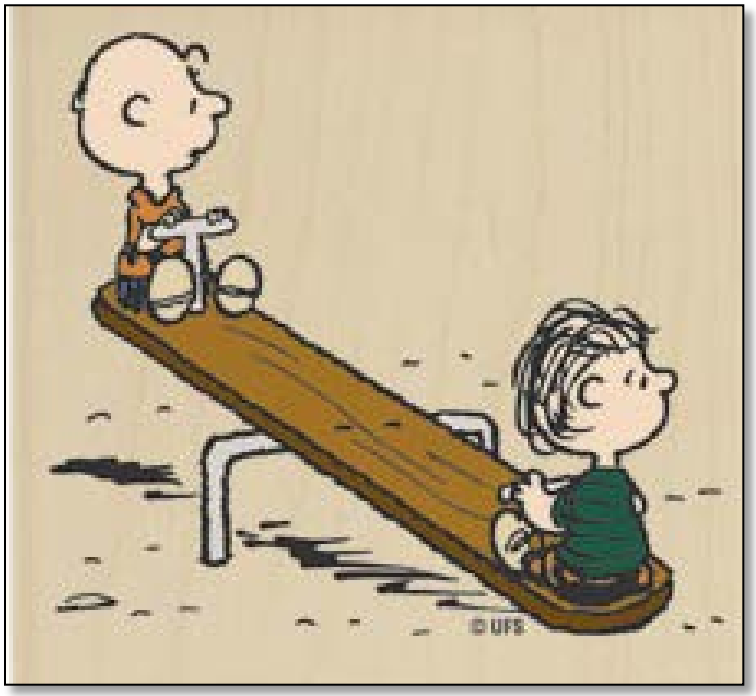
Force is a **push** or **pull** upon an object that may result in motion. Forces move objects!

(Remember this when we see the elephant . . . really!)

Unbalanced Forces

When two forces are not equal they work against each other.

Can you explain what is happening is this picture?



Experiments for Newton's First Law

Unbalanced Forces

1. Hold a yellow tennis ball.
2. Let go of it.

What happened?

What force caused the change?

What would happen on the moon?

Why?

Experiments for Newton's First Law

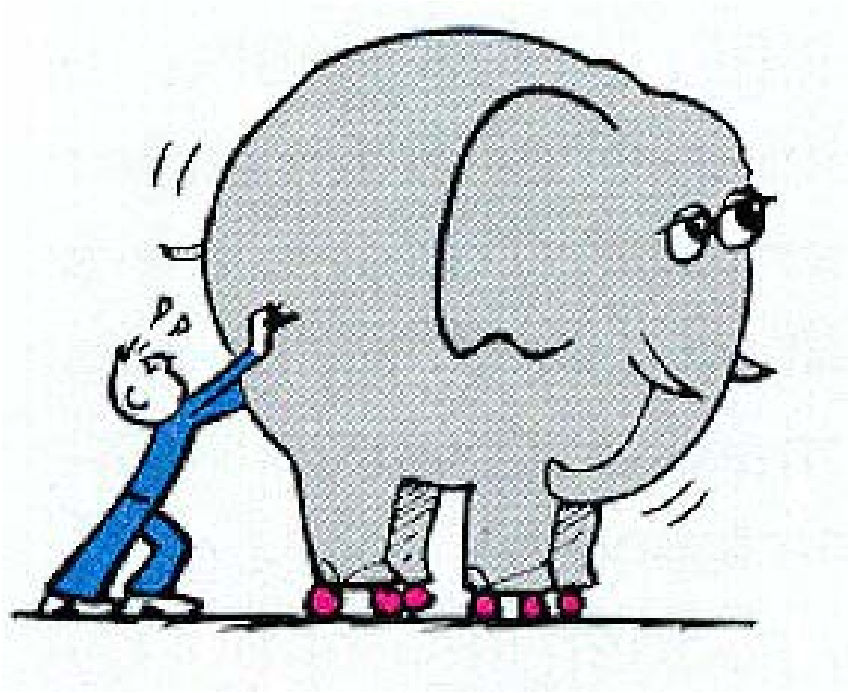
Why should we care about measuring force??

So what?

How *can* we measure force?

Newton's Second Law of Motion

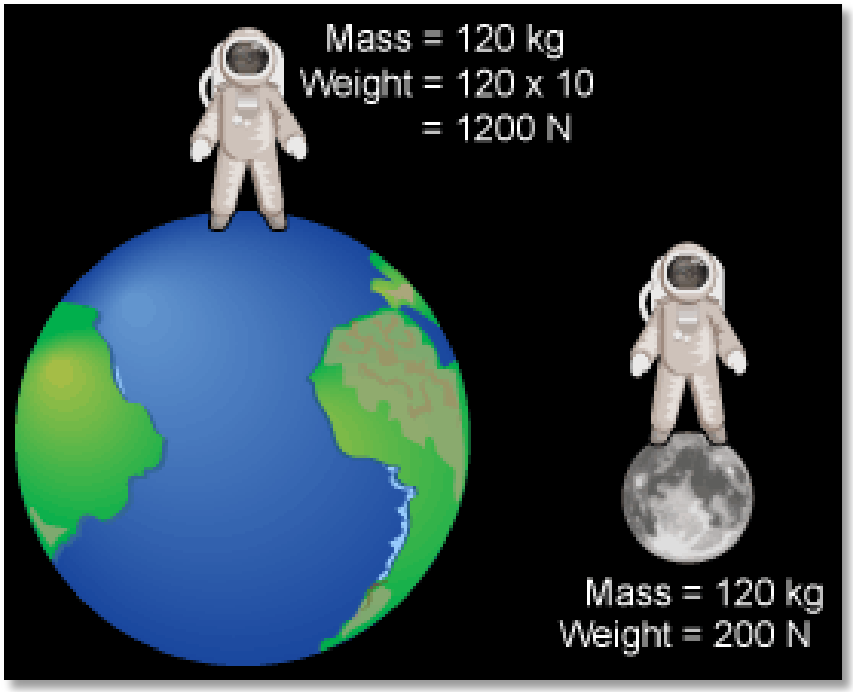
The greater the mass of an object the greater the force needed to move that object.



More Vocabulary

Mass is a measurement of how much matter is in an object.

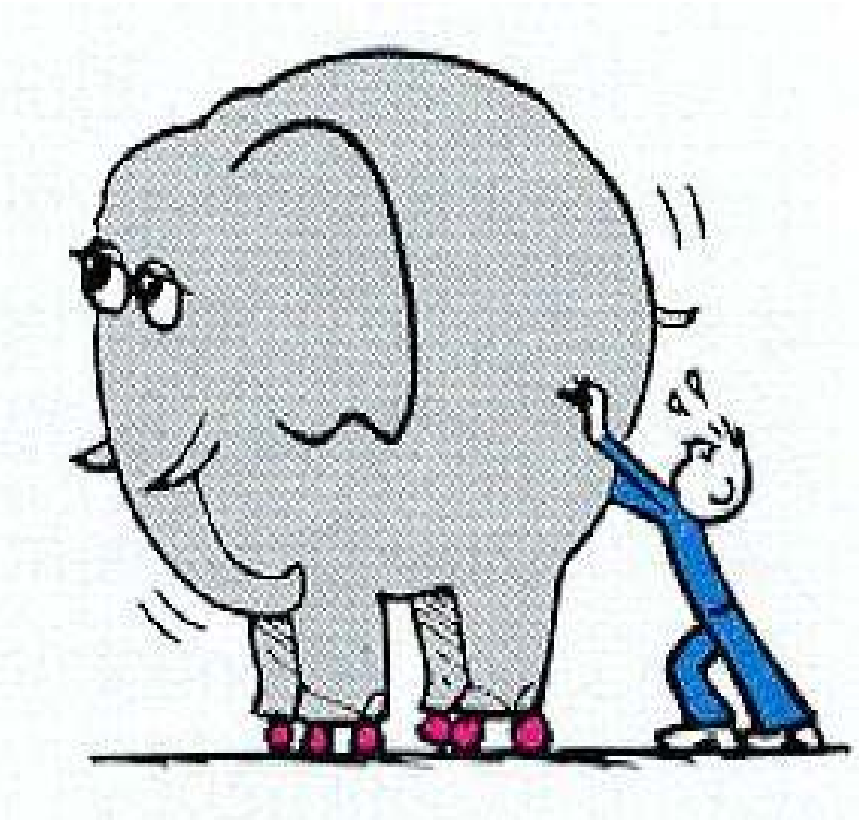
Weight is the measure of the force of gravity acting on an object.



Less **gravity** means less **weight;** however, the object has the **same mass.**

What would we measure here?

- Force
- Mass



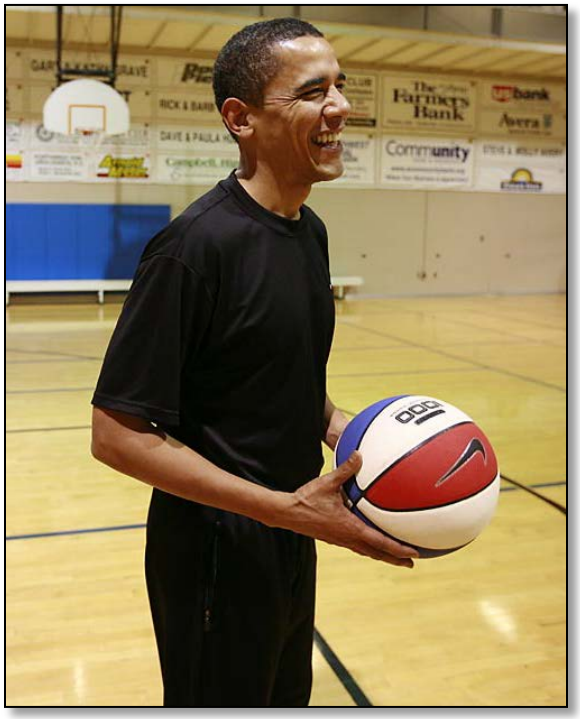
Experiments for Newton's Second Law

Single Jump for the Ceiling:

Two people jump together side-by-side and try to reach the ceiling.

Experiments for Newton's Second Law

Golf balls, baseballs, and basketballs



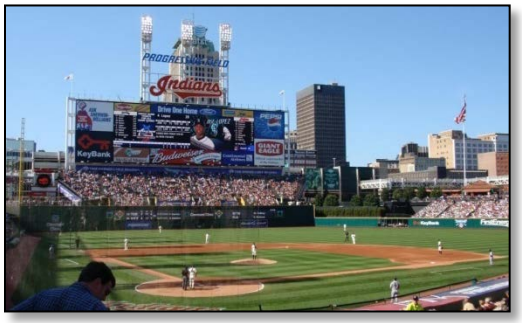
Why do we use the smallest ball on the largest playing field, and the largest ball on the smallest?

Golf course

3,008 yards

Basketball court

32 yards from end to end



Baseball field

123 yards to center field for Cleveland Indians

Newton's Third Law of Motion

For every action, there is always an equal and opposite reaction.

Experiments for Newton's Third Law

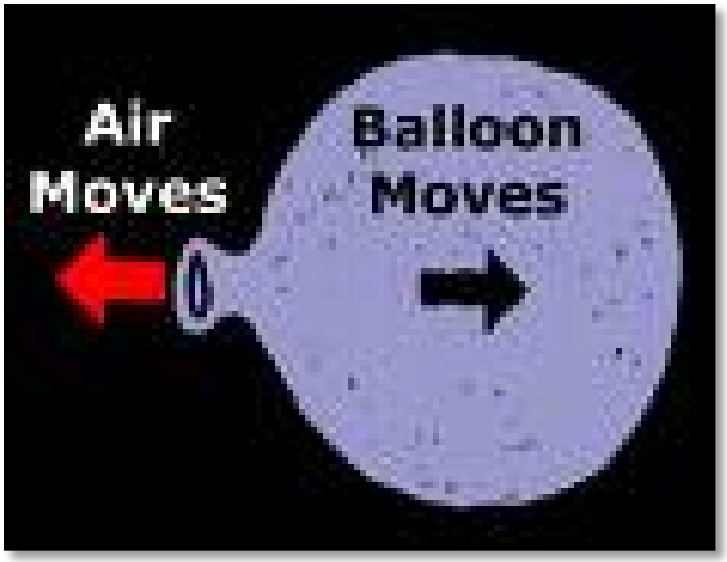
Action – Reaction

What was the action?

Reaction?

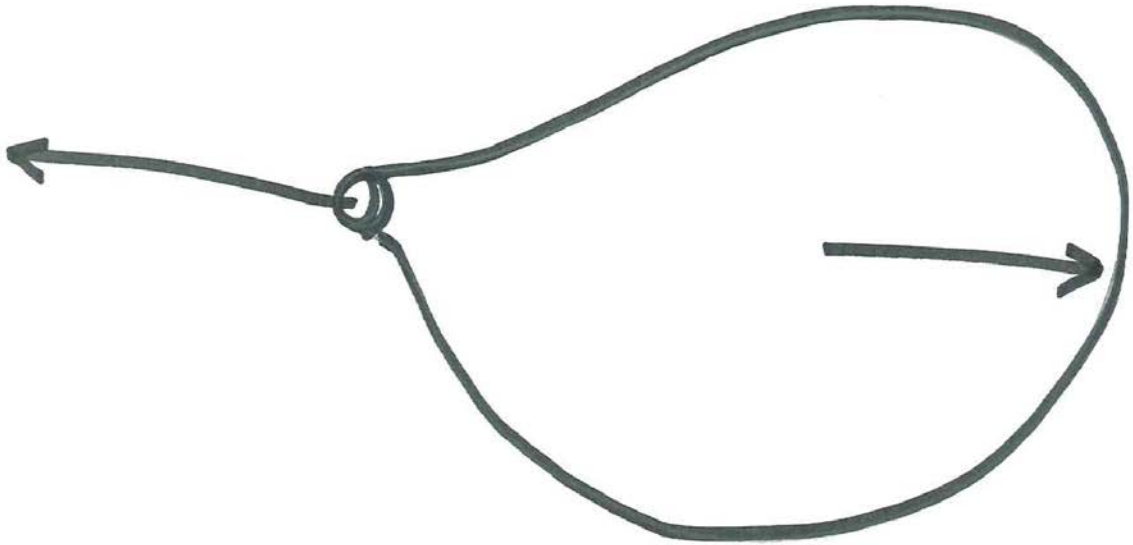
Why did it slow down and stop?

How can we make it a better flight?



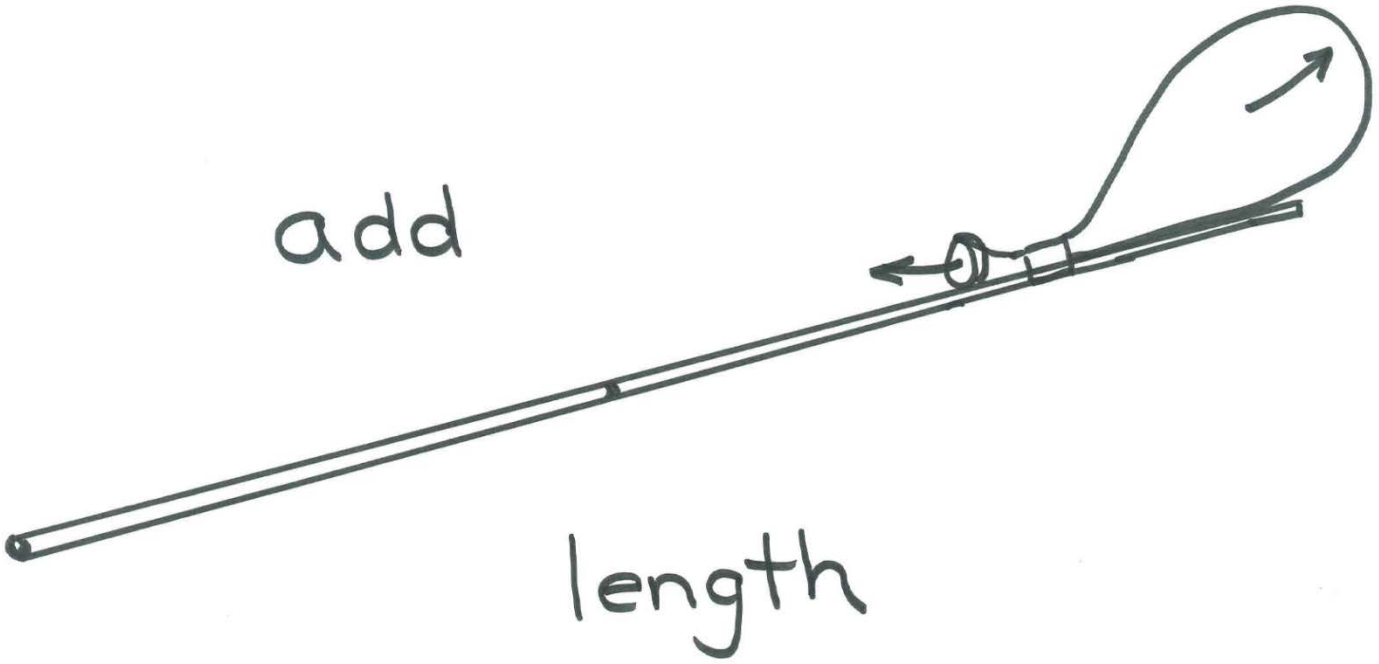
A Balloon as a Rocket

It is **action – reaction!**



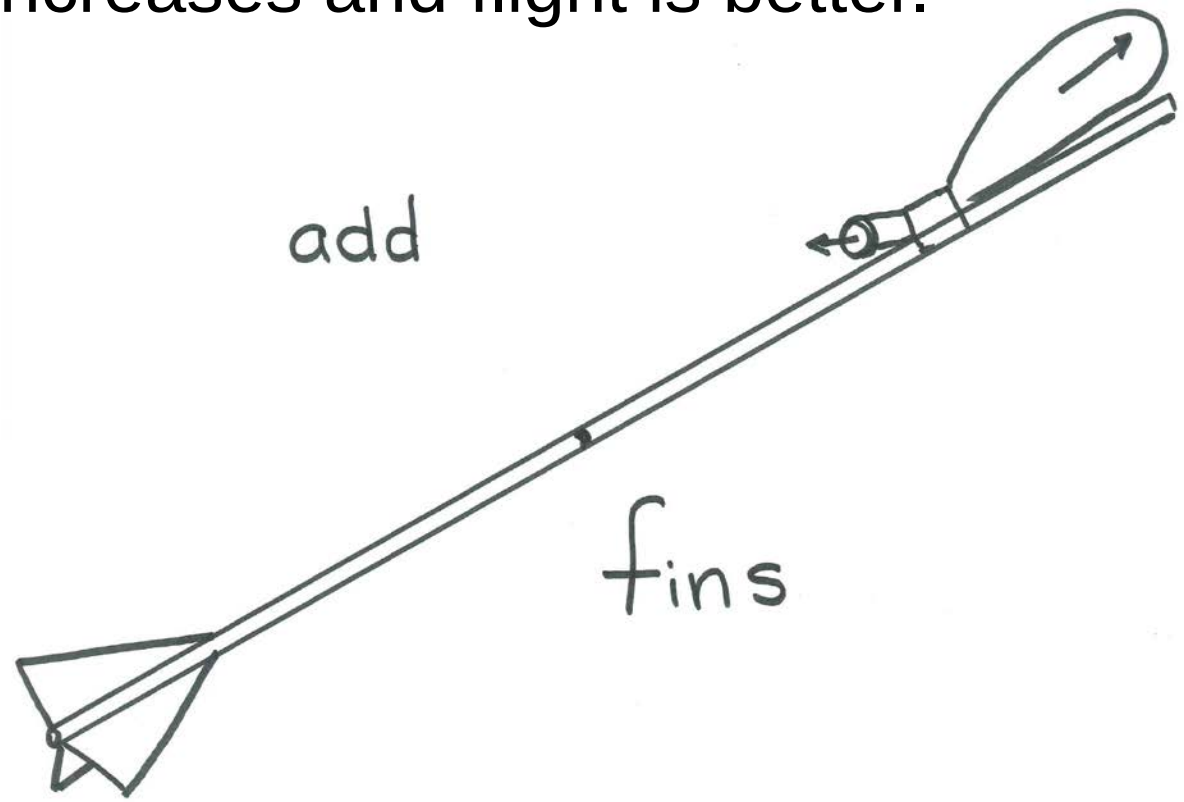
A Balloon with Length

Stability helps the flight.



A Balloon with Length and Fins!

Stability increases and flight is better.



Review Three Laws of Motion

1. Objects at rest stay at rest and objects in motion stay in motion until _____.
2. The more mass the more _____ it takes to move it
3. For every action there is always equal and opposite re_____.