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Newton's Laws of Motion

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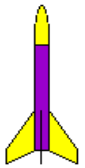
Force and mass



- Force – push or pull; required to change an object's motion.
- Vector – show magnitude and direction

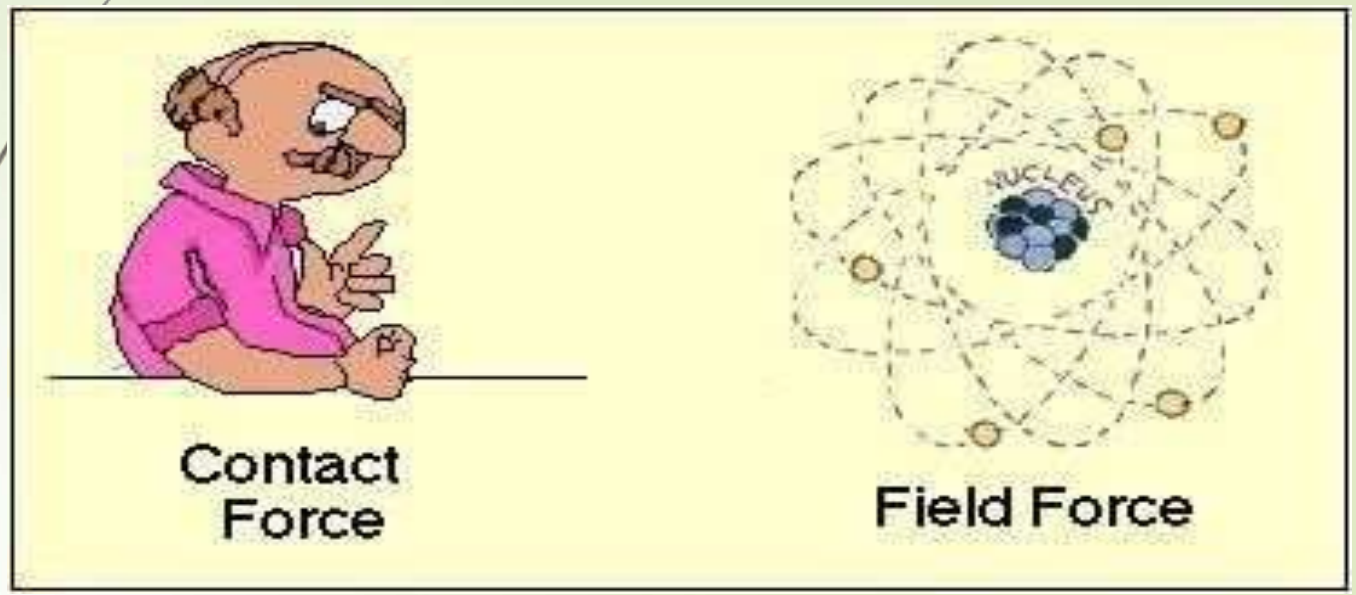
Four Forces Known in the Universe

- **Electromagnetic- caused from electric and magnetic interactions**
- **Strong Nuclear- Responsible for holding nucleus together in the atom; strongest force; acts over the shortest distance**
- **Gravitation- weakest force; acts over the longest distance**
- **Weak Nuclear- Responsible for radioactivity in atoms**

Types of Forces

There are two main types of forces

- Contact
- Field



Contact Forces

- Contact Force
  - Exists when an object from the external world touches a system and exerts a force on it
- Think About a Book on a Table
  - If you push it, you are exerting a contact force
  - If you put it down, no longer interacting… so no more force from you
  - But table is touching it- table is now exerting a force

Field Forces

- An object can move without something directly touching it
- What if you dropped the book?It falls due to gravity
- Gravitational Force is a field force.
- They affect movement without being in physical contact
- Can you think of other field forces?
  - Magnetic fields
  - Electric Forces
  - Nuclear Forces

Two Types of Forces

- Example of Contact Forces
  - Friction
  - Tension

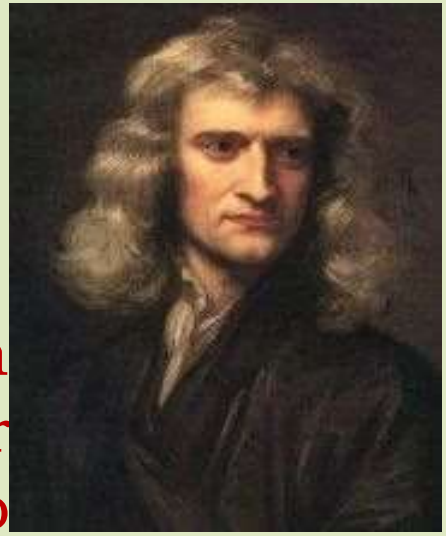
- Examples of Field Forces
- Gravitational
- Electric
- Magnetic
  - Applied
  - Spring

Force and mass

- Mass – measurement of how difficult it is to change the objects velocity.
- Inertia – resistance to change in velocity.
- So mass is a measurement of an object's inertia.

Newton’s Laws

Background



Sir Isaac Newton (1643-1727) an English scientist and mathematician famous for his discovery of the law of gravity also discovered the three *laws of motion*.

Today these laws are known as *Newton's Laws of Motion* and describe the motion of all objects on the scale we experience in our everyday lives.

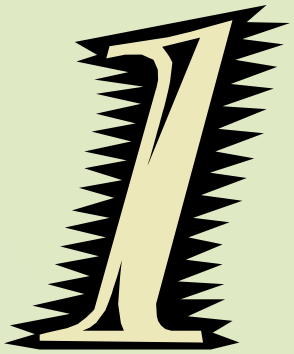
Newton's Laws of Motion

An object in motion tends to stay in motion and an object at rest tends to stay at rest unless acted upon by an unbalanced force.

Force equals mass times acceleration (F = ma).

For every action there is an equal and opposite reaction.

Newton's First Law



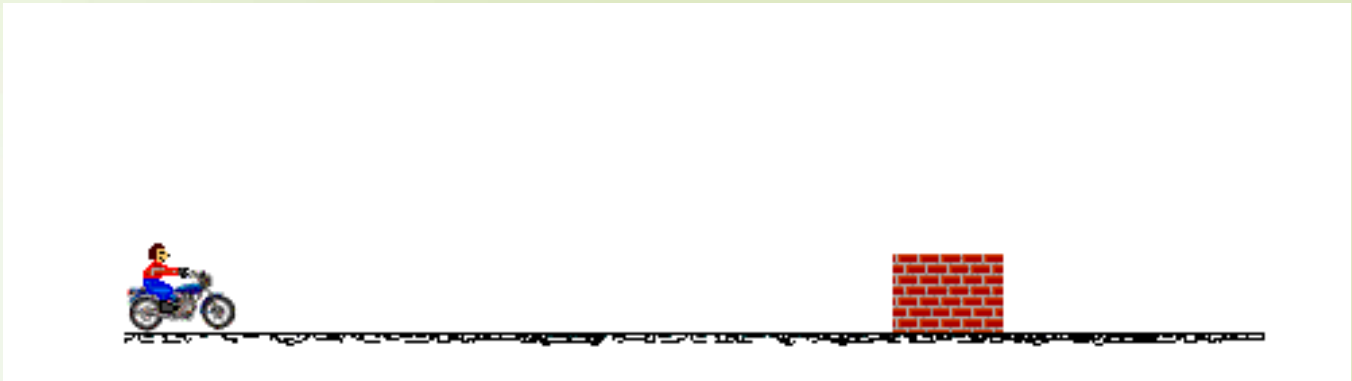
An object at rest tends to stay at rest and an object in motion tends to stay in motion unless acted upon by an unbalanced force.

What does this mean?

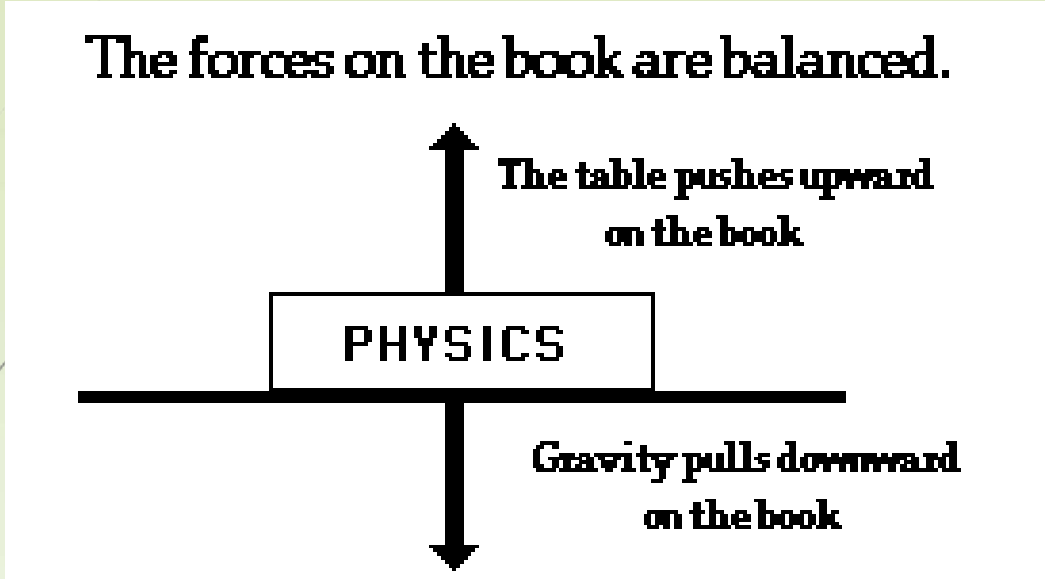
Basically, an object will "keep doing what it was doing" unless acted on by an unbalanced force.

If the object was sitting still, it will *remain stationary*. If it was moving at a constant velocity, it will *keep moving*.

It takes *force* to change the motion of an object.



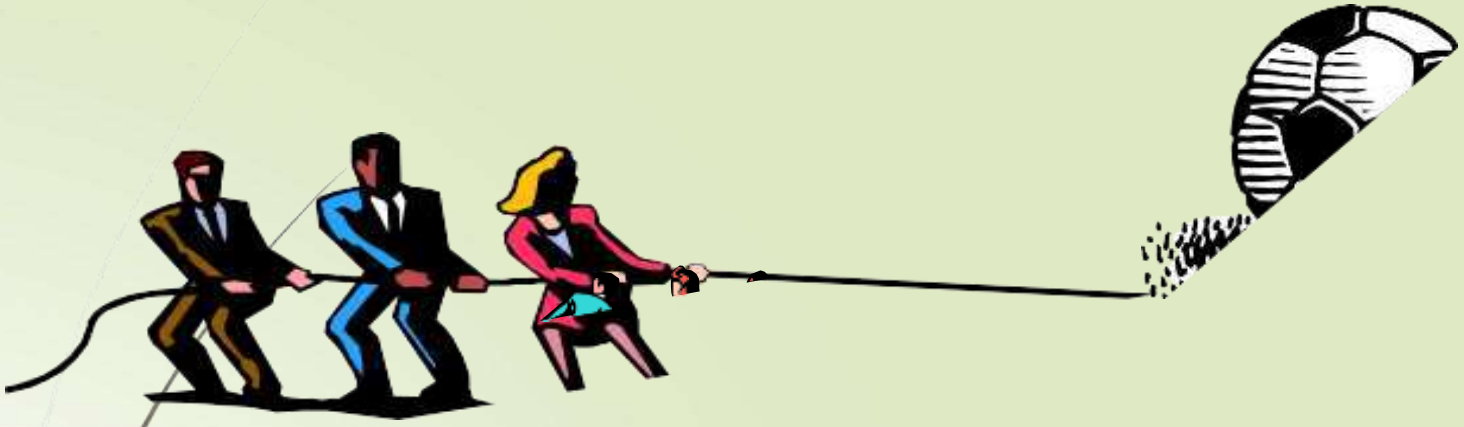
What is meant by *unbalanced force?*



If the forces on an object are equal and opposite, they are said to be balanced, and the object experiences no change in motion. If they are not equal and opposite, then the forces are unbalanced and the motion of the object changes.

Some Examples from Real Life

A soccer ball is sitting at rest. It takes an unbalanced force of a kick to change its motion.



Two teams are playing tug of war. They are both exerting equal force on the rope in opposite directions. This balanced force results in no change of motion.

Newton's First Law is also called the *Law of Inertia*

Inertia: the tendency of an object to resist changes in its state of motion.

The First Law states that *all objects have inertia*. The more mass an object has, the more inertia it has (and the harder it is to change its motion).


Thank
You