

CLIL Project – Physics in English
Anno scolastico 2013-2014

Newton's Laws
Force and Motion
Lecture 2

Classe 3^a A Linguistico
Istituto Superiore "Marini-Gioia" - AMALFI

Newton's Laws

Content of the unit:

DYNAMIC PRINCIPLES *(The three Newton's law)*

- The First Law: *Force and Inertia*
- The Second Law: *Force, Mass and Acceleration*
- The Third Law: *Action and Reaction*

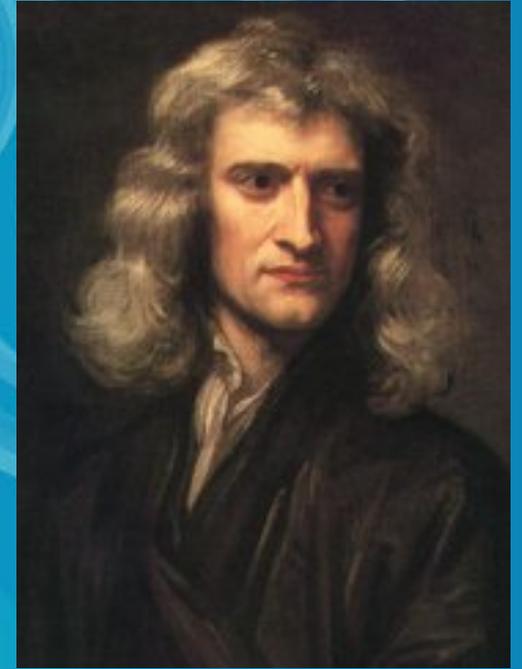
Newton's Laws

Objectives:

- *Describing how the law of inertia affects the motion of an object.*
- *Giving an example of a system or invention designed to overcome inertia.*
- *Measuring and describing force in Newtons (N) and Pounds (lb).*
- *Calculating the net force for two or more forces acting along the same line.*
- *Calculating the acceleration of an object from the net force acting on it.*
- *Determining whether an object is in equilibrium by analyzing the forces acting on it.*
- *Drawing a diagram showing an action-reaction pair of forces.*
- *Determining the reaction force when given an action force.*

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. He published them in his book “*Philosophiae Naturalis Principia Mathematica*” (mathematic principles of natural philosophy) in 1687. 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.



“If I have ever made any valuable discoveries, it has been owing more to patient attention, than to any other talent.”

The First Law: Force and Inertia

Statement:

“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.”

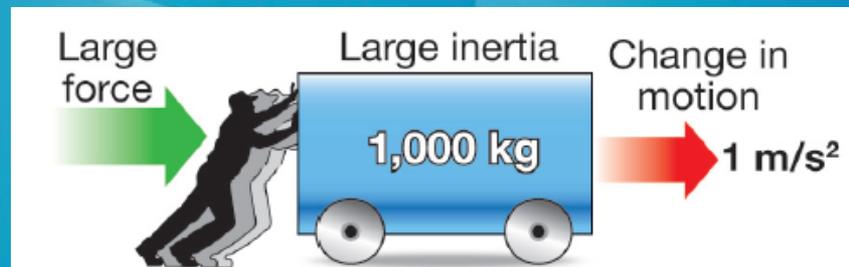


The First Law: Force and Inertia

The idea of “force”

Force is an action that can change motion.

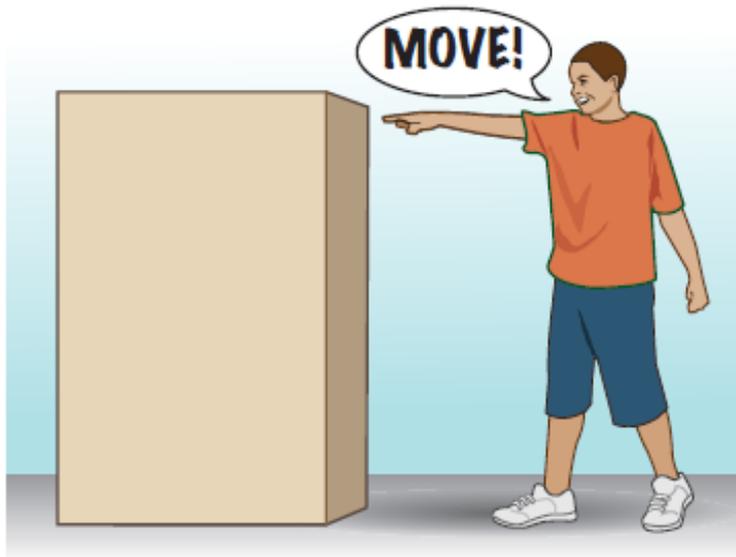
- A force is what we call a push or a pull, or any action that has the ability to change an object's motion.
- Forces can be used to increase the speed of an object, decrease the speed of an object, or change the direction in which an object is moving.



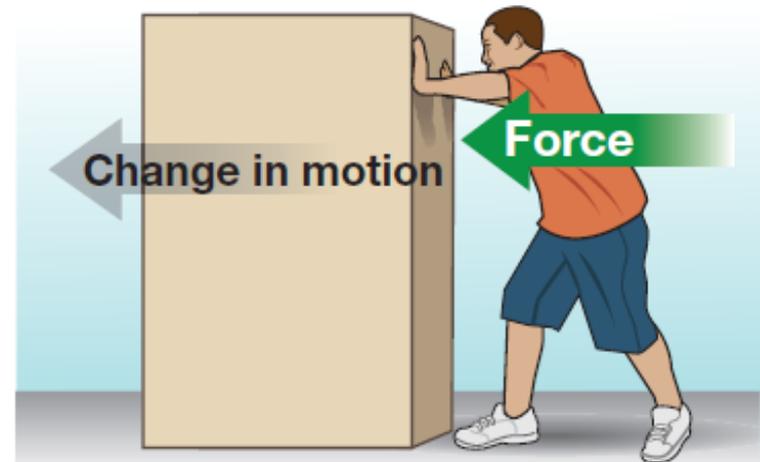
The First Law: Force and Inertia

The idea of “force”

This will not work.



Only **force** has the ability to change motion.



The First Law: Force and Inertia

The idea of “inertia”

Inertia is the term used to measure the ability of an object to resist a change in its state of motion.

An object with a lot of inertia takes a lot of force to start or stop; an object with a small amount of inertia requires a small amount of force to start or stop.

The word “inertia” comes from the Latin word *inertus*, which can be translated as “lazy.”



The First Law: Force and Inertia

Newton's First Law meaning

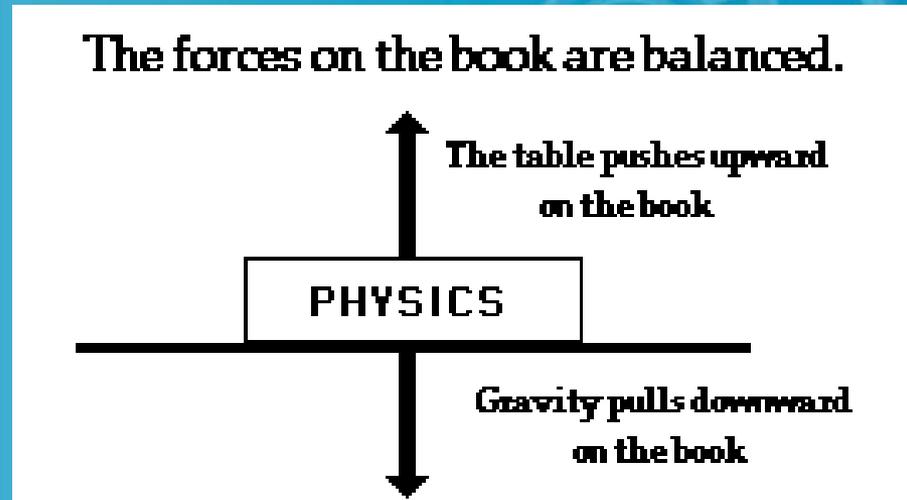
*Basically, an object will “keep doing what it was doing” unless acted on by an **unbalanced** force.*

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.

The First Law: Force and Inertia

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.

The First Law: Force and Inertia

Examples from everyday 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.

The First Law: Force and Inertia

Examples from everyday life

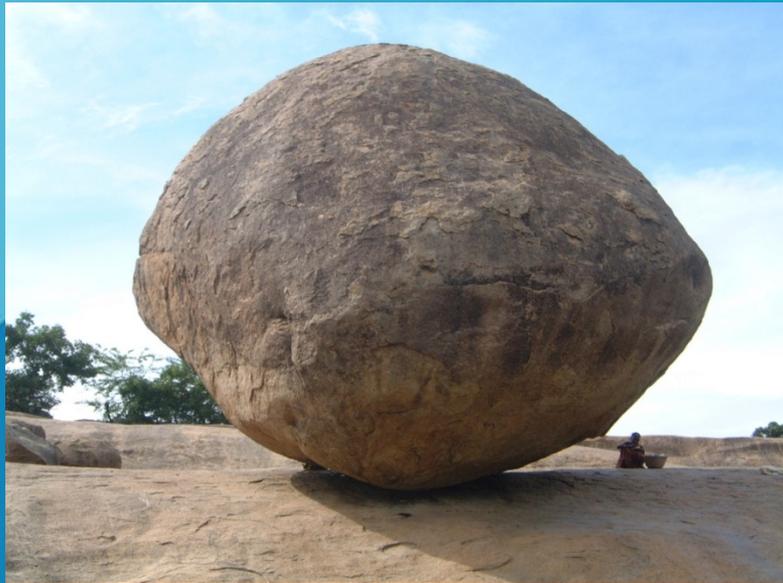
Can you explain why the long table would make the trick hard to do?



The First Law: Force and Inertia

It's also called: law of "inertia". Why ?

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



Object with great inertia

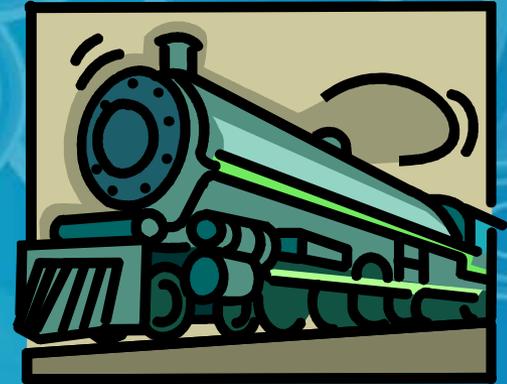


Objects with small inertia

The First Law: Force and Inertia

Examples from everyday life

A powerful locomotive begins to pull a long line of boxcars that were sitting at rest. Since the boxcars are so massive, they have a great deal of inertia and it takes a large force to change their motion. Once they are moving, it takes a large force to stop them.



On your way to school, a bug flies into your windshield. Since the bug is so small, it has very little inertia and exerts a very small force on your car (so small that you don't even feel it).

The First Law: Force and Inertia

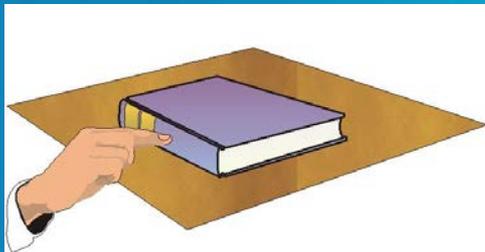
Critical consideration

If objects in motion tend to stay in motion, why don't moving objects keep moving forever?



Things don't keep moving forever because **there's almost always an unbalanced force acting upon them.**

A book sliding across a table slows down and stops because of the force of friction.



If you throw a ball upwards it will eventually slow down and fall because of the force of gravity.



The First Law: Force and Inertia

Ideal situations

In outer space, away from gravity and any sources of friction, a rocket ship launched with a certain speed and direction would keep going in that same direction and at that same speed forever.



On the earth, a similar situation can be experienced by skating on dry ice, a skater will apply a very little force to start moving.

The First Law: Force and Inertia

Video on inertia...

7 Inertia Demos