

NEWTON'S LAWS OF MOTION

What's going on?!?

Dynamics - problems involving the relation of motion to its causes. The study of dynamics helps to explain **why** objects move the way they do.

Force- any kind of push or pull on an object.

Mass- the measurement of inertia and the SI unit of mass is the kilogram. The greater the mass of a body, the less it accelerates under the action of an applied force.

Units = Newton

$$\text{Newton} = \frac{\text{Kgm}}{\text{s}^2}$$

Two types of Forces!!

Contact forces - forces that result from the physical contact between two objects.

Ex. - pulling a wagon, kicking a football, pushing a lawn mower

Field forces - forces that do not involve physical contact between two objects. Michael Faraday (1791-1867) introduced the concept of a *field*.

Ex. magnetic fields, electrical fields, gravitational force (weight)

Newton's First Law of Motion

An object at rest remains at rest, and an object in motion continues in motion with constant velocity (that is, constant speed in a straight line), unless it experiences a net external force.

Every body continues in a state of rest or of uniform speed in a straight line unless acted on by a nonzero net force.

Newton's First Law of Motion

Often called the *Law of Inertia*

Inertia-The tendency of an object to resist any attempt to change its motion.

We can think of Inertia as an objects ability to resist a change in its motion, or lack there of.

Newton's 2nd Law

The acceleration of an object is directly proportional to the net force acting on it and is inversely proportional to its mass. The direction of the acceleration is in the direction of the net force acting on the object.

$$F = ma$$

The 3rd Law of Motion

Whenever one object exerts a force on a second object, the second exerts an equal and opposite force on the first.

To every action there is an equal and opposite reaction. Action and Reaction forces are acting on **different objects**.

Unaccompanied forces *do not* exist in nature.

Some examples of the 3rd law

- ◉ Walking on the floor- your foot pushes on the floor and the floor pushes on your foot.
- ◉ A rocket exerts a strong force on the gases, expelling them- the gases exert an equal and opposite force on the rocket thus propelling it.
- ◉ A person throws a package out of a boat- the boat moves in the opposite direction.
- ◉ You push down on the seat of your desk- the desk pushes against you