Dynamics

There are four fundamental forces in nature:

Strong Nuclear Force

- Force that holds protons and neutrons in the nucleus of the atom
- It is an extremely strong force necessary to overcome the repulsive force between two protons
- Only acts at short ranges of about 10^{-15}m.

Weak Nuclear Force

- Force exerted between all subatomic particles
- It enables the conversion of one type of quark into another
- Responsible for some types of nuclear decay

Gravitational Force

- Attractive force that all objects exert on each other
- Dependent on the objects' mass

Electromagnetic Force

- The force that charged particles exert on each other

Forces

- Intuitively, we experience force as a push or a pull on an object. (Pushing a shopping cart or a stalled car, pulling a wagon)
- Applying a force on an object does not always cause motion.
- You can push against the school and it probably won't move.

Newton developed three laws to describe how forces cause motion.

First Law

- Every body continues in its state of rest or of uniform speed in a straight line unless acted on by a nonzero net force.
- This is also known as the **law of inertia**.

Second 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.

$$\sum F = ma$$

Third Law

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

Force is measured in Newtons, N.

Example 1

- A boy pulls a 2 kg wagon with a horizontal net force of 10 N. What is the acceleration of the wagon?

Example 2

- A 1000 kg car, starting from rest, accelerates to 25 m/s in 10 s.
  - What is the acceleration of the car?
  - What is the net force acting on the car?