

# Unit 4 – Dynamics

**Kinematics** – the study of motion, without examining the forces which produce/affect the motion.

**Dynamics** – the study of motion and the forces which produce/affect the motion.

**Force** – a push or a pull (that can affect the motion of an object).  
– a vector quantity  
– SI unit of force is the Newton (N)

There are four fundamental forces in the universe; they are (in order of strength):

1. Strong Nuclear Force – the force that holds the nucleus of an atom together, acts over a very short range.
2. Electromagnetic Force – the forces between charges and the magnetic force, holds atoms and molecules together and determines atomic and molecular structure.
3. Weak Nuclear Force – the force responsible for radioactive decay, including nuclear fusion and the buildup of heavy nuclei to occur (ex. the burn up of the sun).
4. Gravitational Force – the force of attraction between any objects with mass.

## Newton's Laws of Motion

Newton's first law of motion was developed from Galileo's concept of inertia.

**Inertia** – the tendency of an object at rest to stay at rest or an object in constant motion to stay in constant motion.

(Inertia depends on mass, as mass increases, inertia increases.)

## Newton's 1<sup>st</sup> Law:

An object will remain at rest or continue traveling at a constant velocity unless an unbalanced force acts on it.

Since force is a vector quantity, we can find the resultant force, often called the net force,  $F_{\text{NET}}$ .

ex.

$$F_1 = 3\text{N [E]}$$
$$F_2 = 3\text{N [W]}$$

$$F_{\text{NET}} = 0\text{N}$$

If  $F_{\text{NET}} = 0$ , we have equilibrium, or balanced forces.

ex.

$$F_1 = 3\text{N [E]}$$
$$F_2 = 5\text{N [W]}$$

$$F_{\text{NET}} =$$

If  $F_{\text{NET}}$  is not equal to 0, we have unbalanced forces.