Things to Memorize: Newton's Laws

Force

- A **Force** is push or a pull on something.
- Force is a Vector. It is symbolized by the symbol $\vec{F}$
- Force is measured in kg m/s^2. This is often abbreviated as N (newtons).

Newton's First Law

Objects in motion will stay in motion and objects at rest will stay at rest until acted on by an external, unbalanced force.

- This means that if there are no forces acting on an object, it will continue to move in the same way it was moving initially - either at rest or in a straight line at a constant speed.
- In order for an object to remain at rest, all the forces must be balanced.
- In order for an object to travel with constant velocity, all the forces must be balanced.

Newton's Second Law

The acceleration of an object as produced by a net force is directly proportional to the magnitude of the net force, in the same direction as the net force, and inversely proportional to the mass of the object.

- This is often written as a formula: $\Sigma\vec{F} = m\vec{a}$ or $\vec{F_{net}} = m\vec{a}$
- If an object is accelerating, there must be at least one unbalanced force acting on the object.
- The first law is just a special case of the second law: If the net force acting on an object is zero, its acceleration will be zero.

Newton's Third Law

For every action there is an equal and opposite reaction.

- The action and reaction pairs are always simultaneous.
- The action and reaction pairs are always the same in magnitude.
- The action and reaction paris are always in opposite directions.

Mass and Weight

- The **mass** of an object measures how much matter an object is made of. It is measured in kilograms.
- The **weight** of an object is a force due to gravity. It is measured in newtons.

Friction

- Friction is a force that opposes motion or even the tendency to move.
- Friction comes in two types:
  - **Static** friction is present when an object is at rest relative to the surface it is on.
    - A wheel that is rolling has static friction where it contacts the ground.
  - **Kinetic** friction is present when an object is sliding across a surface.
- The **maximum static friction** is always greater than or equal to the **kinetic friction**.
- The **Coefficient of Friction** measures how hard it is for two surfaces to slide past each other.
  - Most coefficients of friction are between 0 and 1, but certain specially-made materials can be much higher.
  - A **low** coefficient of friction indicates a slippery surface.
  - A **high** coefficient of friction indicates a surface that is very hard to slide on.