

Newton's Laws of Motion

Kinetics

The branch of mechanics concerned with the study of forces causing movement

Force: Push or Pull that tends to cause movement. (vector)

movement: change in space in same time period.
(position)

Newton's Laws of Motion

motion $\Rightarrow$ velocity

1. Uniform Motion (aka Law of Inertia)

An object will continue with its state of motion unless a force causes a change in motion. (substitute w/velocity)

Observation

momentum = quantity of motion

$$= mv$$

$$\text{units: } \frac{\text{kgm}}{\text{s}}$$

mass: measure of inertia

units: kg

Inertia: Object's resistance to change motion

2. Law of acceleration

When a force acts on an object,
velocity will change & is described
by the equation $\Sigma \vec{F} = m \vec{a}_{cm}$

Alternative:

An object's acceleration is proportional
to Force $\propto F$

An object's rate of change of momentum
is equal to the force (and in the
direction of the force)

$$F = \frac{\Delta(mv)}{\Delta t} = m \frac{\Delta v}{\Delta t} = F = ma$$

$$\Sigma \vec{F}_{on} = m \vec{a}_{cm}$$

Σ = Add up all forces acting on object.

m = mass (which is a measure of inertia)

a_{cm} : Acceleration of center of mass of object.

↳ Point where all mass seems
to be concentrated.

"on" : Forces acting on object

units: $\frac{kg \cdot m}{s^2} = N$ (Newton) [USA: lbs]

3. Action - Reaction

For every force acting ON an object
there is a equal and opposite force
created BY the object.

For every force created BY an object,
there is an equal and opposite
force acting ON the object.

$$\sum \underset{\uparrow}{F}_{\text{on}} = ma_{\text{com}}$$