



Forces & Motion Unit Vocabulary

Motion

- *The state in which one object's distance from another is changing*
- Must determine motion based on a reference point
- An object is in motion if it changes position relative to a reference point

Speed

- *The distance an object travels in one unit of time*

- $\text{Speed} = \frac{\text{distance}}{\text{time}}$

- Constant speed when the speed of an object is the same at all times during its motion

- $\text{Average Speed} = \frac{\text{total distance}}{\text{total time}}$

Velocity

- *Speed in a given direction*
 - Speed plus direction
- Example: 25 km/h Westward
- It's the speed of an object with its direction included

Acceleration

- *The rate at which velocity changes*
 - Positive Acceleration = Speeding Up
 - Negative Acceleration = Slowing Down
- All considered accelerating
 - Speeding up
 - Slowing down
 - Turning
- Acceleration =
$$\frac{\text{final velocity} - \text{initial velocity}}{\text{time}}$$

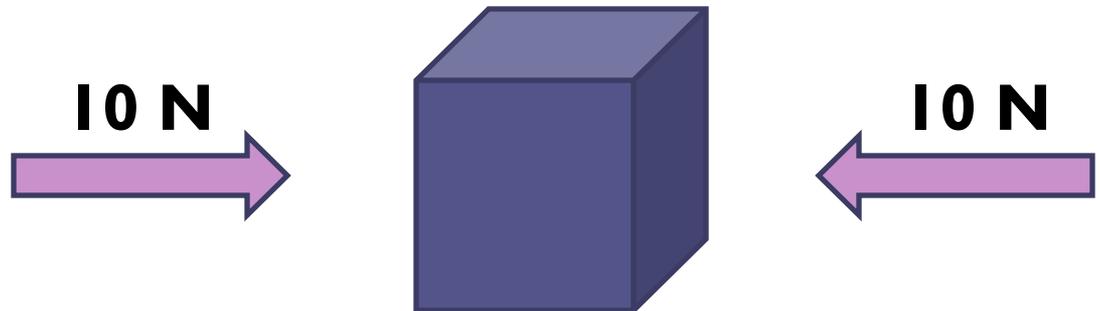
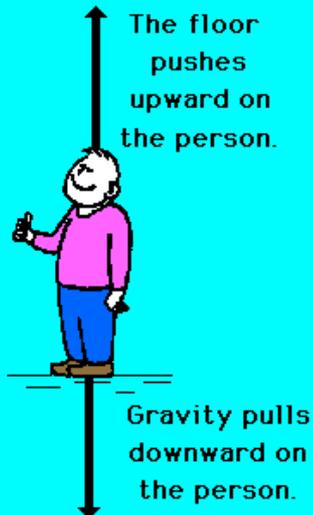
Force

- *A push or pull exerted on an object*
 - Causes something to move or change direction or speed
 - Can be balanced or unbalanced
- Forces are described by how strong they are and the direction they are in
- Unit = Newton (N)

Balanced Force

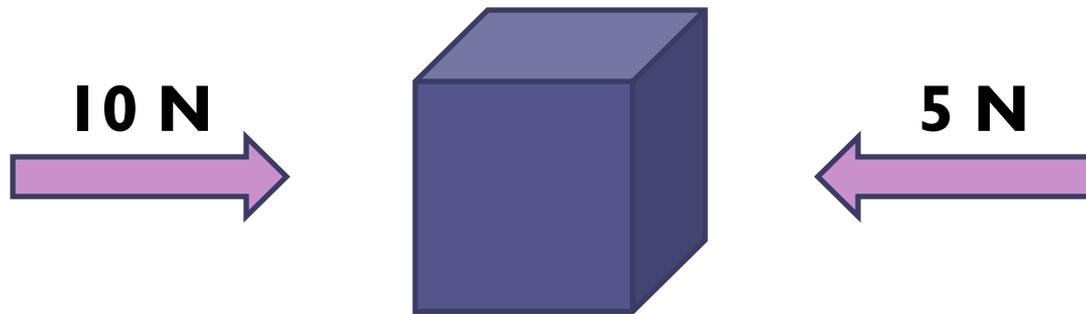
- *Equal forces acting on an object in opposite directions*
- Net force = 0
- Will not change an object's motion

The forces on the person are balanced.



Unbalanced Force

- A nonzero force that changes an object's motion
- Net force NOT 0
- Always causes motion



Net Force = 5

Object will Move Right

Friction

- *The force that one surface exerts on another when the 2 rub against each other*
 - Opposes or slows down motion
- Depends on type of surface & how hard they push together
- Changes Motion into Heat

Gravity

- *The force that pulls objects toward Earth*
 - Opposes or slows down motion
- Gravity on Earth causes all objects to fall 9.8 meters/second (m/s)
- An object will increase its velocity by 9.8 m/s every second
 - After 3 seconds, an object's velocity is 29.4 m/s

Newton's 1st Law of Motion

- An object at rest remains at rest unless acted upon by an unbalanced force
- An object in motion remains in motion unless acted upon by an unbalanced force

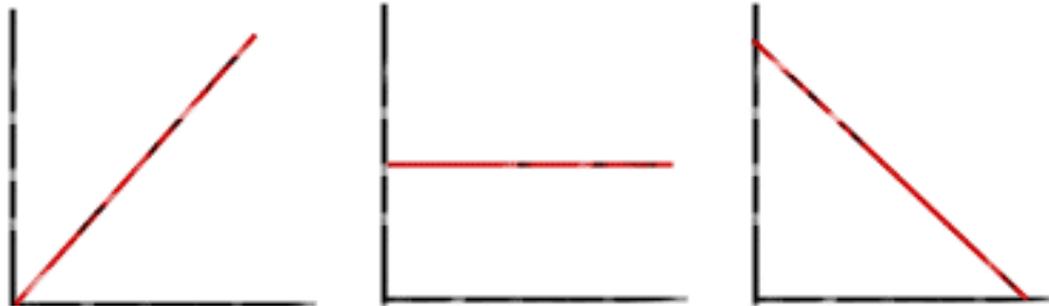
Consider the Following

- Inertia: tendency to resist a change in motion
 - Depends on Mass
 - More Mass = More Inertia

Newton's 1st Law of Motion

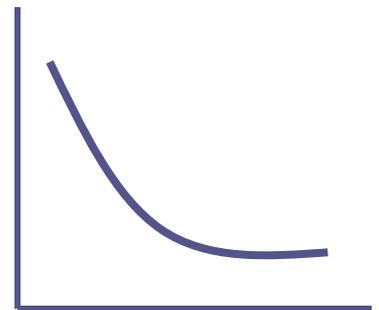
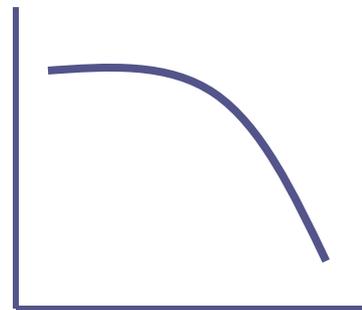
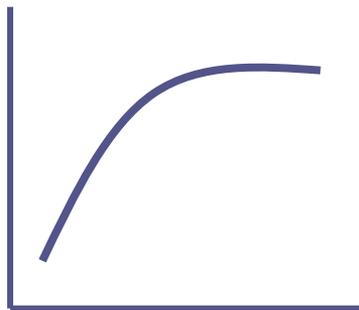
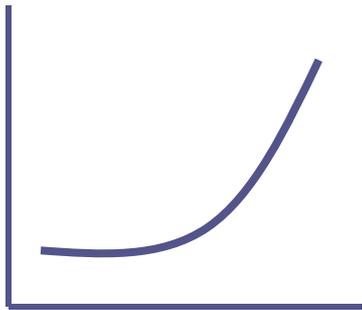
Consider the Following (Cont.)

- Once a force is applied, it will move at a constant speed in a straight line until another force causes it to slow down, stop, or turn
 - These graphs all represent the 1st Law!



Newton's 2nd Law of Motion

- Force = Mass X Acceleration
- Acceleration = $\frac{\text{Force}}{\text{Mass}}$
- These graphs go with the 2nd Law



Newton's 2nd Law of Motion

Consider the Following

- Objects with a large mass require more force
 - More force will create more acceleration
- Momentum
 - Product of an object's mass and velocity
 - Momentum = Mass X Velocity
 - Heavy objects have a lot of momentum
 - Fast things have a lot of momentum

Newton's 3rd Law of Motion

- For every action, there is an equal but opposite reaction
- Examples
 - Newton's Cradle
 - Rocket Ship
 - Jumping on a Trampoline
 - Punching a Wall