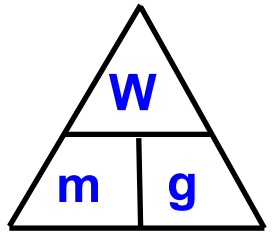
big idea for chapter 3

Summary of Newton's 1st Law

mass is the amount of matter
and is the same everywhere

W - weight

m - mass



weight is a force and
depends on gravity

g - acceleration due to gravity

Inertia is based on mass

Inertia means resisting change in motion

which means changing speed or direction

which means changing velocity

which is acceleration

which require net forces

friction is a force and acts opposite the direction of motion

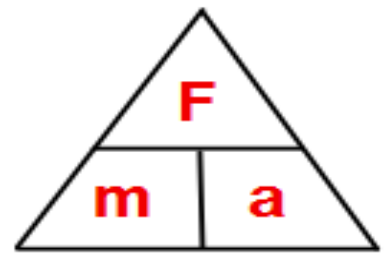
mass has inertia which resists change in motion which is what acceleration is

so acceleration and mass are inversely proportional

more mass means less acceleration

Newton's second law relates acceleration, mass, and force

$$a = \frac{F}{m}$$



$F = ma$

if F = ma, what are the base units that a newton breaks down into?

N = (units for m) (units for a)

if mass is 10 times bigger, acceleration is 10 times smaller

if mass is half as much, acceleration is twice as much

Newton's Second Law as a Guide to Thinking

- Doubling of the net force results in a doubling of the acceleration (if mass is held constant). Similarly, a *halving* of the net force results in a *halving* of the acceleration (if mass is held constant). Acceleration is **directly proportional** to net force.
- The relationship between mass and acceleration: doubling of the mass results in a *halving* of the acceleration (if force is held constant). And similarly, a *halving* of the mass results in a doubling of the acceleration (if force is held constant). Acceleration is **inversely proportional** to mass.
- Whatever alteration is made of the net force, the same change will occur with the acceleration. Double, triple or quadruple the net force, and the acceleration will do the same. On the other hand, whatever alteration is made of the mass, the opposite or inverse change will occur with the acceleration. Double, triple or quadruple the mass, and the acceleration will be one-half, one-third or one-fourth its original value.

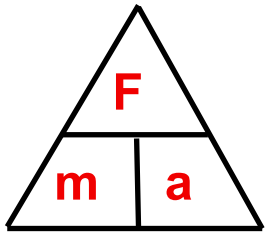
Terminal Velocity Notes

- **Terminal Speed** When the air resistance force on a falling object, like the sky divers, builds up to the point where it equals the weight of the object, then the net force on the object is zero and the object stops accelerating. We say that the object has reached its terminal speed. **Terminal speed** is the speed at which the acceleration of a falling object is zero because friction balances the weight. **Terminal velocity** is terminal speed together with the direction of motion.
- **A skydiver jumps from a high-altitude balloon. As she falls faster and faster through the air, does air resistance increase, decrease, or remain the same?** *Increase* **Does the net force on her increase, decrease, or remain the same?** *Decrease, because the net force acting on her is her weight minus air resistance. As air resistance increases, net force decreases.*
  As she falls faster and faster, does her acceleration increase, decrease, or remain the same? *Acceleration decreases because net force decreases. When she falls fast enough, her acceleration will reach zero and she will have reached terminal velocity.*

big idea for chapter 6

Newton's 2nd Law

acceleration and force are directly related



acceleration and mass are inversely related

forces cause accelerations which are in the direction of the net force

terminal velocity - maximum fall speed

force of gravity down matches force of air resistance up

net force is zero, acceleration is zero, speed is constant

Ch 6 notes - Newton's 2nd Law

$$a = \frac{F}{m}$$

forces cause accelerations

if the net force is zero, there may or may not be velocity, but there is no acceleration

the acceleration is in the direction of the net force

force and acceleration are directly proportional

this means if the force is twice as big, so is the acceleration

if the acceleration is 10 times smaller, so is the force

if an object is at rest or moving in a straight line at constant speed, there is no change in velocity, therefore no acceleration, therefore a net force of zero

for every N gravity pulls down, one N pushes up to balance air resistance up

for every N we pull forward, friction pulls back with one N

acceleration and force are directly related, more force means more acceleration

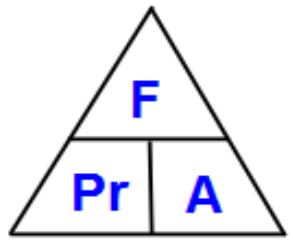
acceleration and mass are inversely related, more mass means less acceleration

terminal velocity - maximum fall speed

Pressure

pressure is force per unit area

$$\text{pressure} = \frac{\text{force}}{\text{area of application}} \qquad P = \frac{F}{A}$$



the unit for pressure is the pascal, seen as Pa

a pascal is a force unit (N) divided by units of area (m2)

if you spread the same weight over a larger area, each piece feels less pressure

if you shrink the area holding the same weight, each piece feels more pressure

if you put the flat side of a knife against your steak, the force is spread out and it doesn't do anything

if you put the sharp edge of a knife against a steak, the force is focused and presses through the meat