

# Force and Motion

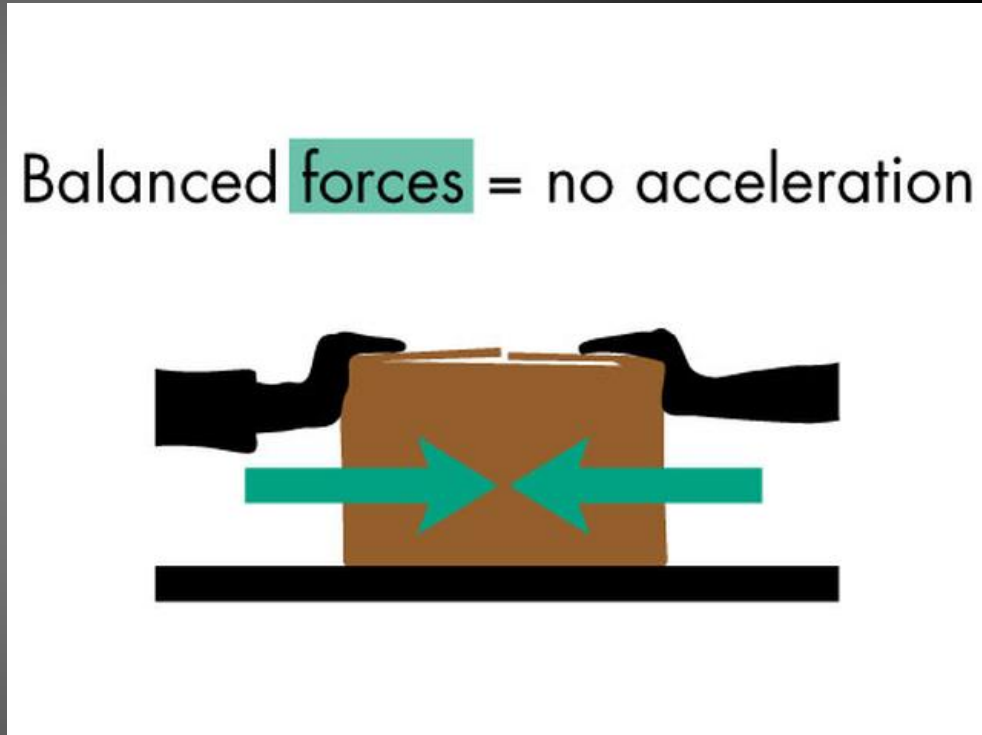
# Force -

- a push or pull
- The  
combination of  
all forces acting  
on an object is  
the net force.



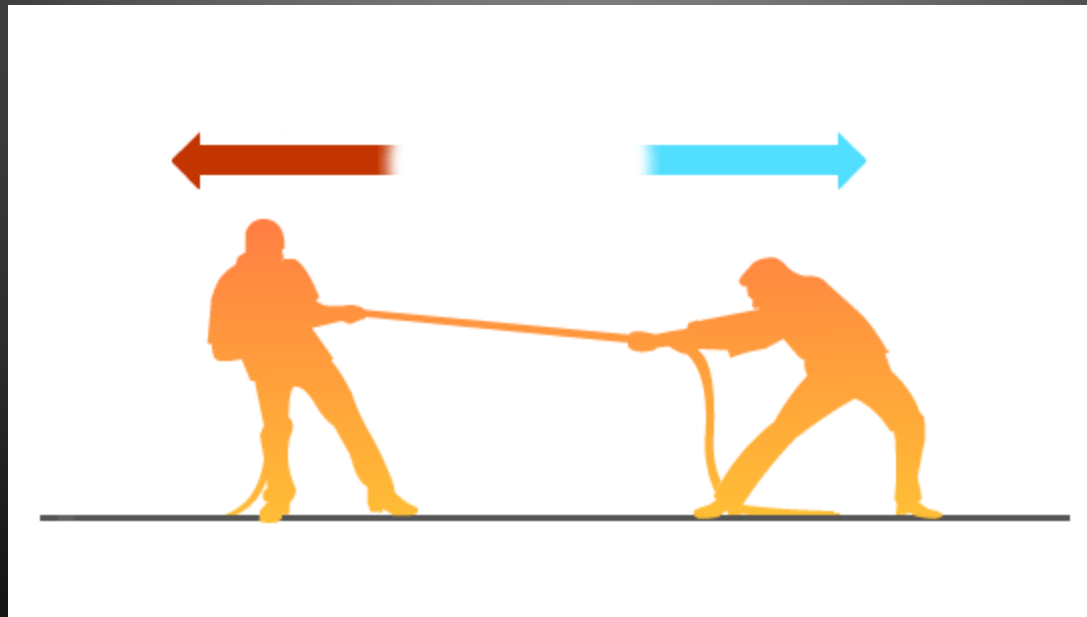
# Balanced Force

- Two or more forces exerted on an object are balanced if their effects cancel each other and do not cause a change in the object's motion.
- The net force is zero.



# Unbalanced Force

- Occurs when the forces acting on the object changes the object's motion.
- The net force is NOT zero.



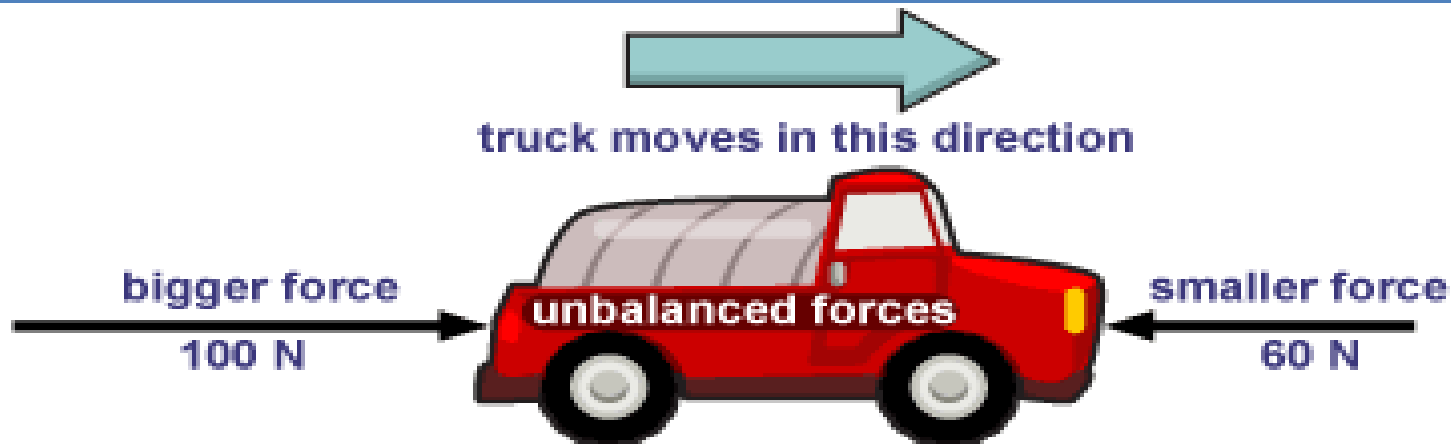
# Balanced Force



Equal forces in opposite directions produce no motion

# Unbalanced Forces

Unequal opposing forces  
produce an unbalanced force  
causing motion



# Friction -

- is a force that resists the sliding between two touching surfaces.
- Friction is an opposing force
- Friction will always slow a moving object.



# Types of Friction



- **Static friction** causes surfaces to stick together. It keeps an object at rest.
- **Sliding friction** slows down an object that slides.
- **Rolling friction** is needed to make a wheel turn.
- **Fluid friction** is air and/or water resistance.



# INERTIA

- The tendency of an object to remain at a constant speed unless another force acts upon it.
- If it is moving at a certain speed it will stay at that speed unless a force acts on it.
- If it is still, then it will stay still unless a force acts on it



Gravity: a force of attraction between objects that is due to their mass



- All matter has mass
- All matter experiences gravity



The earth's mass is large, therefore its  
gravitational pull is large



# British scientist Sir Isaac Newton developed the “Law of Universal Gravitation”



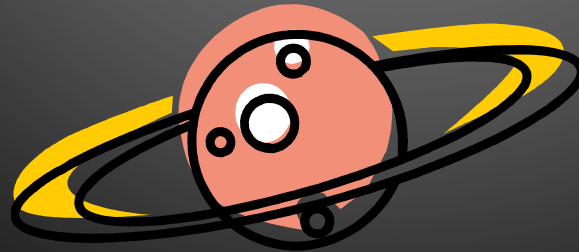
# What is Gravity?

- Gravity=FORCE!
- Gravity is a force of attraction.
- Gravity PULLS.



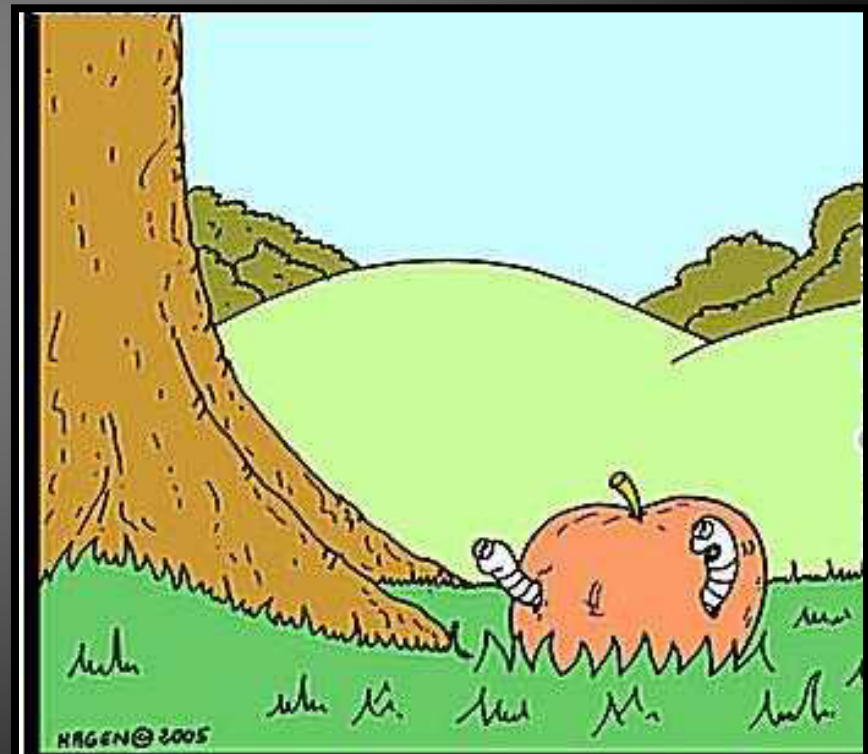
# Matter & Gravity Facts

- All matter has mass.
- All matter experiences gravity.
- All objects experience a gravitational attraction toward each other.



# Law of universal gravitation

- All objects in the universe attract each other through gravitational force.
- The size of the force depends on mass and distance.



Poor Mr Newton, we fell right onto his head...  
Hope he'll be OK...



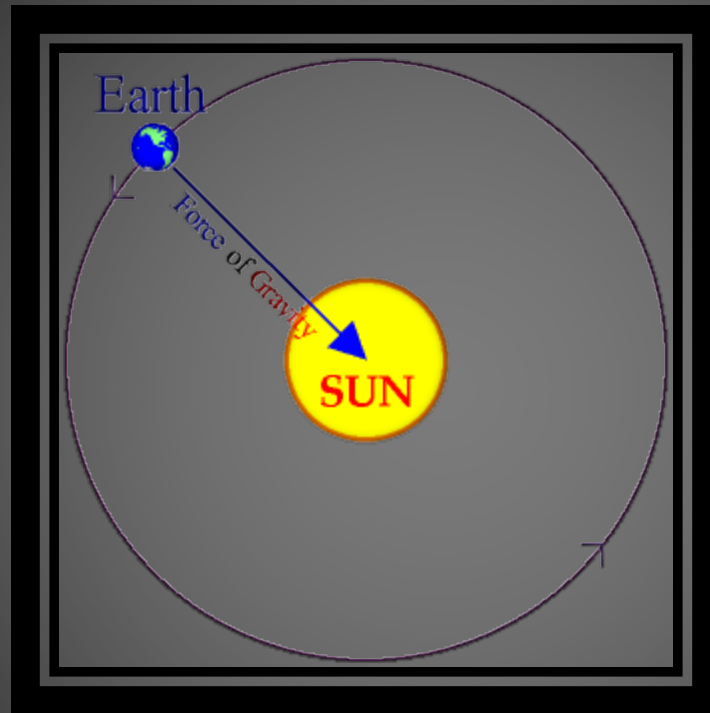
# Law of Universal Gravitation Part 1:

Gravitational force increases as mass increases



# Gravity and Mass

Greater mass=greater gravitational pull.



Earth's gravitational force is due to its enormous mass.

# Law of Universal Gravitation Part 2:

## Gravitational force decreases as distance increases

- a** Gravitational force is small between objects with small masses.



**Figure 20** The arrows indicate the gravitational force between the objects. The width of the arrows indicates the strength of the force.

- b** Gravitational force is larger between objects with larger masses.

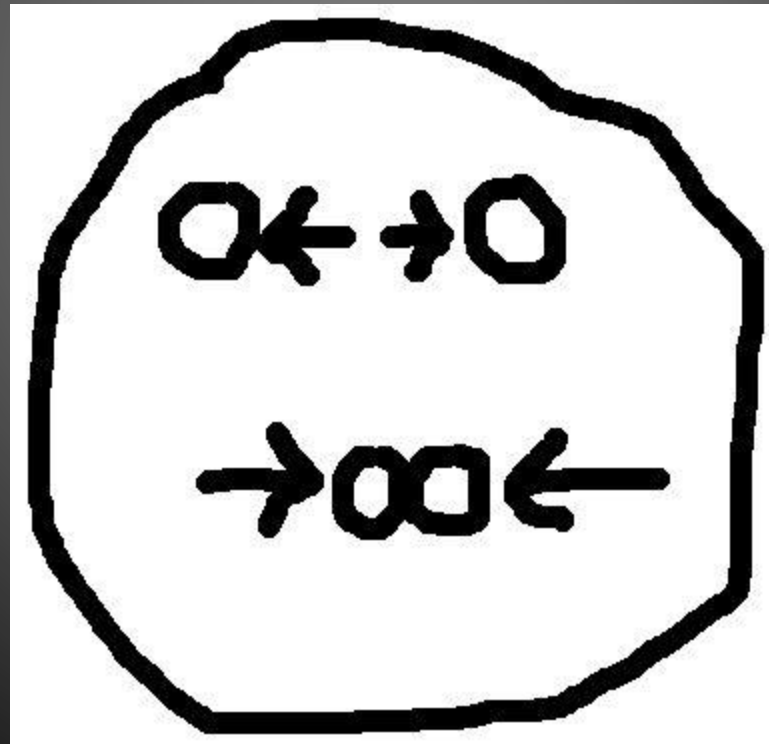


- c** If the distance between two objects is increased, the gravitational force pulling them together is reduced.

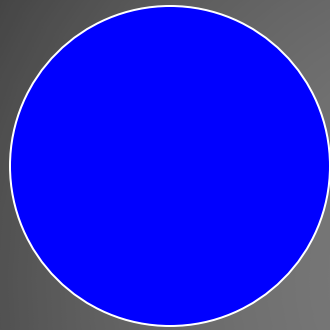


# Gravity and Distance

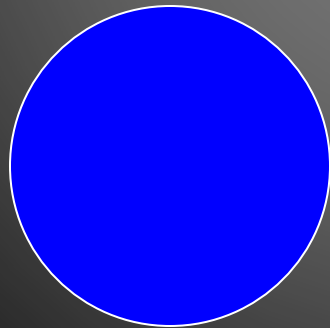
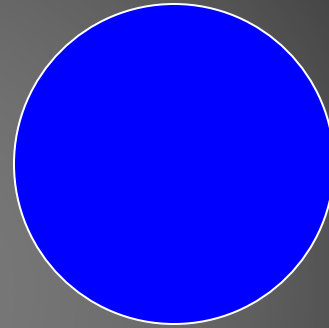
Closer together=greater gravitational pull.



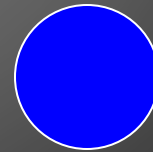
Which ones have more  
gravitational pull?



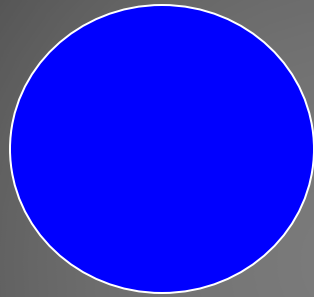
Vs.



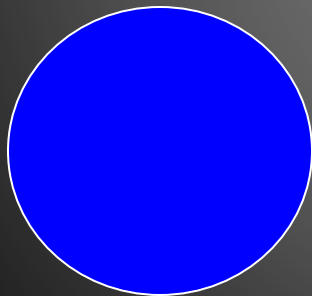
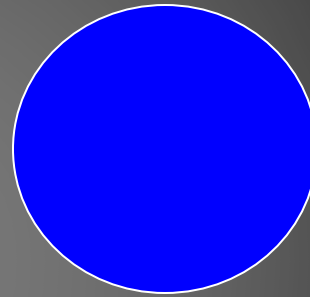
Vs.



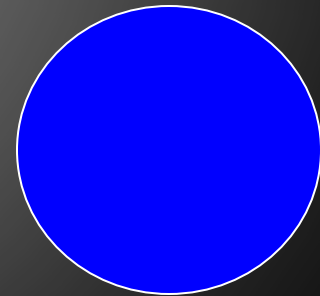
Which ones have more  
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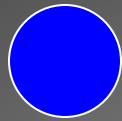
Vs.



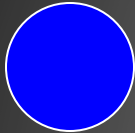
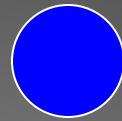
Vs.



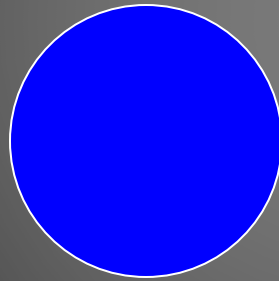
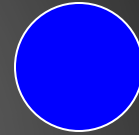
# Now which ones?



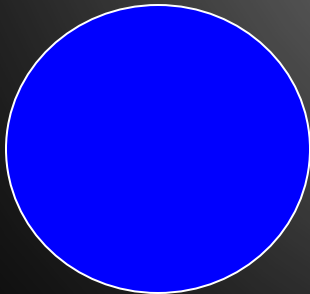
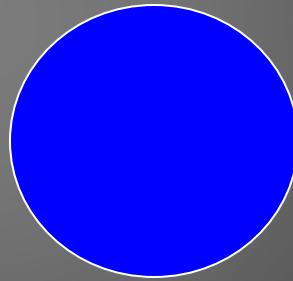
Vs.



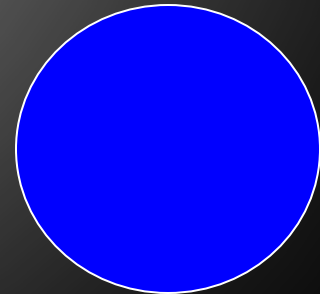
Vs.



Vs.



Vs.

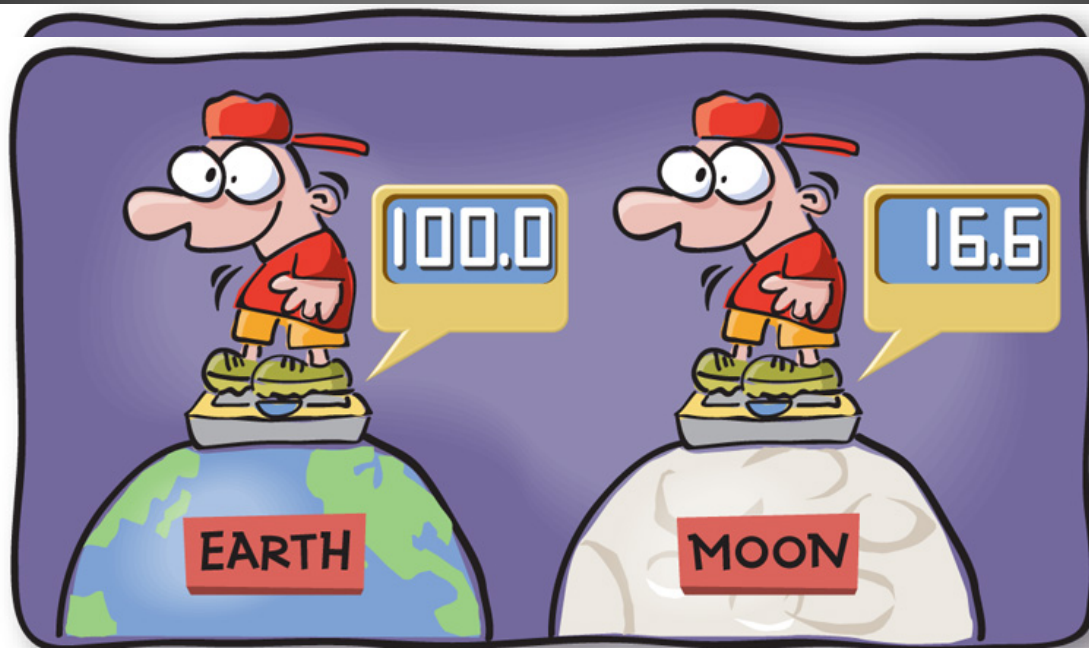


# Mass

- Amount of matter in an object.
- Does not change with location.
- Unit=grams

# Weight

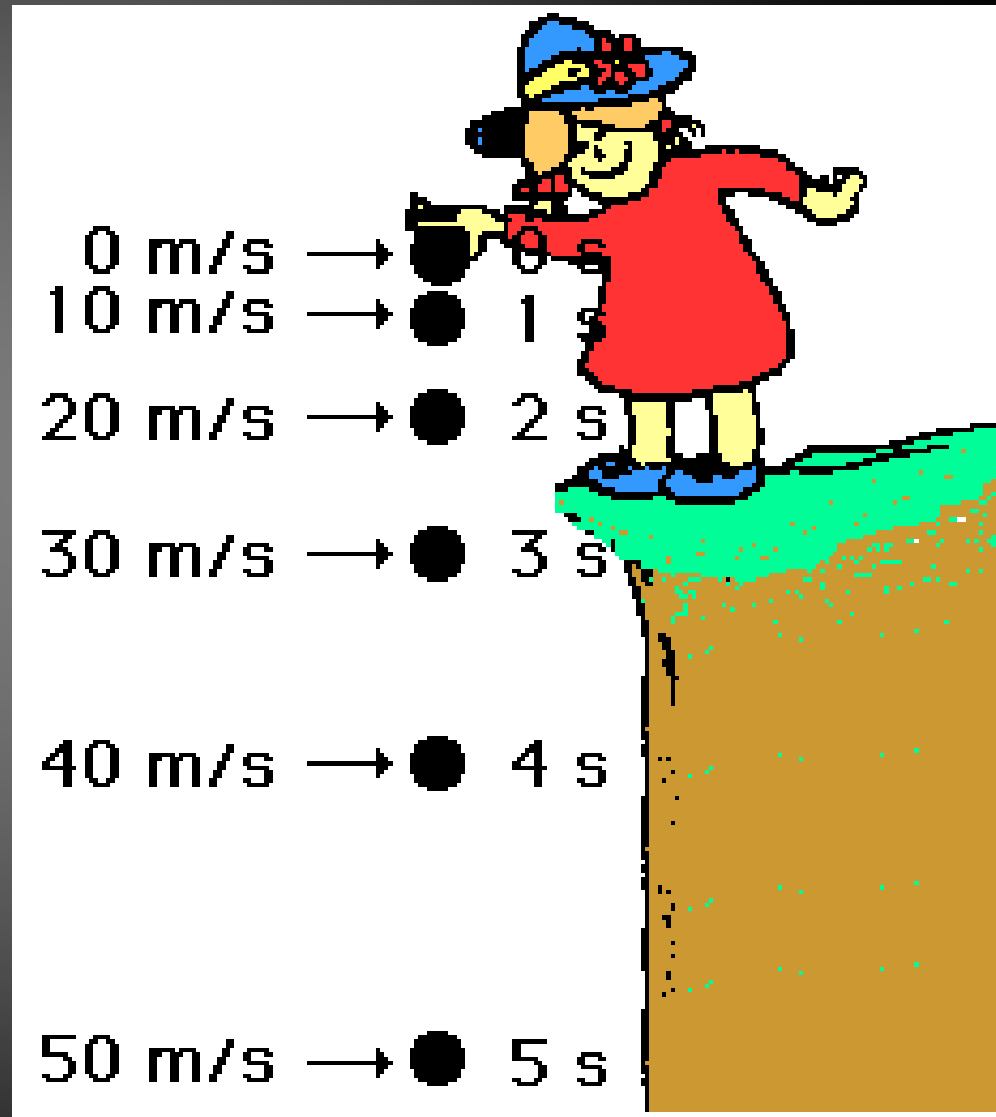
- Measure of the gravitational force exerted on an object.
- Changes with location.
- Unit=Newtons
- A newton is the amount of force it takes to accelerate 1 kg of mass 1 m/s



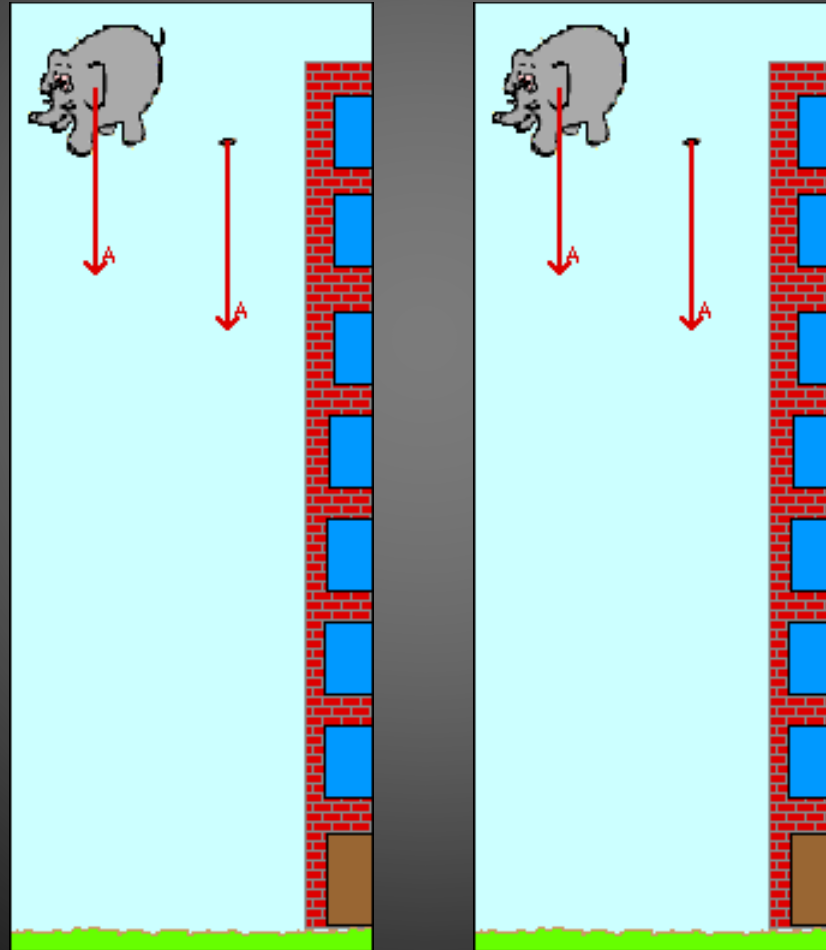


# Acceleration due to gravity

- Rate at which velocity changes because of the pull of gravity.
- Earth=  
 $9.8 \text{ m/s/s}$



# Acceleration due to gravity ( $g$ )



# Gravity & Acceleration due to gravity

All objects fall at the same rate because the acceleration due to gravity is the same for all objects.

- All objects accelerate toward Earth at 9.8 m/s/s

Air resistance,  
a type of friction slows  
down acceleration.

Air resistance is the force of friction  
and the opposing force created by  
going through the air.



# Terminal velocity

- When an object falls at a constant velocity because the air resistance force matches the force of gravity.
- Net force=0

