FORCES

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FORCE

- Defined as a push or pull
- Motion of object is in the same direction as the force
- To describe a force, you must know:

1. the strength of the force
2. the direction of the force

- The SI unit used to measure force is called- NEWTON
- Direction and size of a force is represented by an arrow

Types of Forces

- Contact Force
  - When one object pushes or pulls another object by touching it, the first object is applying a contact force to the second.
- Gravity
  - The force of attraction between two masses.
- Friction
  - Force that resists motion between two surfaces that are pressed together.

Net Force

- The combination of all forces acting on an object is called NET FORCE

- NET FORCE determines if an object moves AND in what direction it moves

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UNBALANCED FORCES

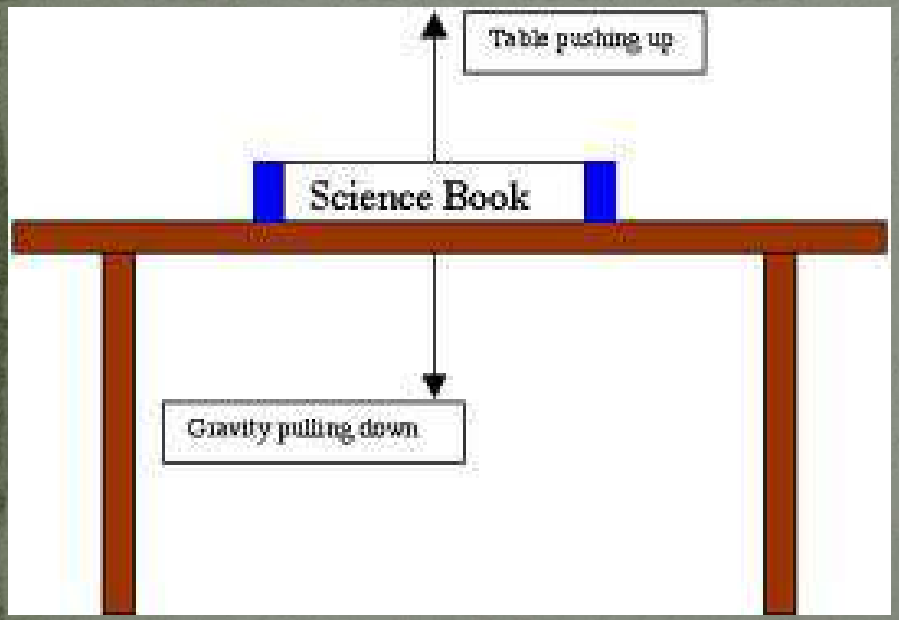
- Forces that are NOT equal in size or direction
- Cause a change of motion in an object:

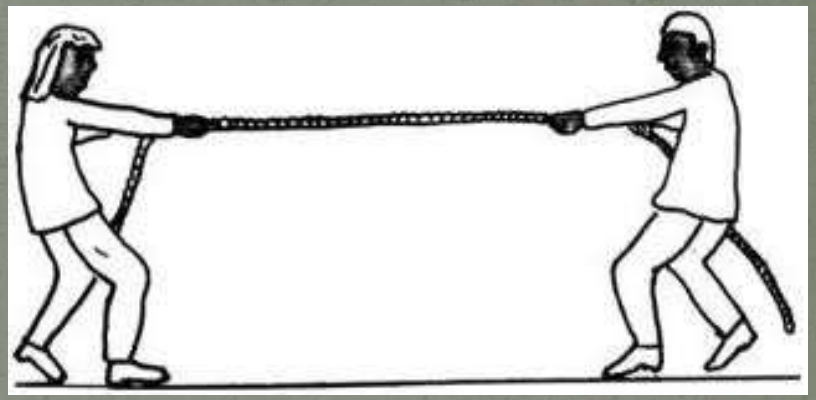
(1) At rest, the object will move

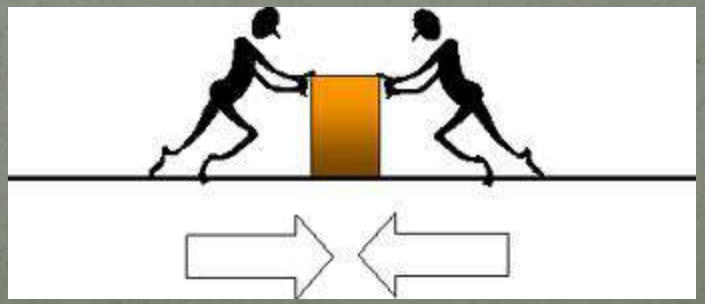
(2) Acting on a moving object, the motion of the object will change (speed up, slow down, stop or change direction)

BALANCED FORCES

- Forces that are equal in size, but opposite in direction
- DO NOT cause a **change** in motion







GRAVITY

- The force of attraction between **ALL** objects in the universe
- Newton: all objects in the universe are attracted to one another because of gravity
- Every object is pulled toward Earth's center.... WHY?($9.8 m/s^2$)
- The amount of gravitational force between two objects depends on mass and distance (larger mass = greater gravitational; closer together = greater gravitational force)

FRICTION

- The force that opposes the motion of an object
- Always in the opposite direction of the motion

Strength of friction depends on two things

1. The type of surface
2. How hard the surfaces push together

5 Types of FRICTION

1. Static
2. Sliding
3. Rolling
4. Fluid
5. Air Resistance*

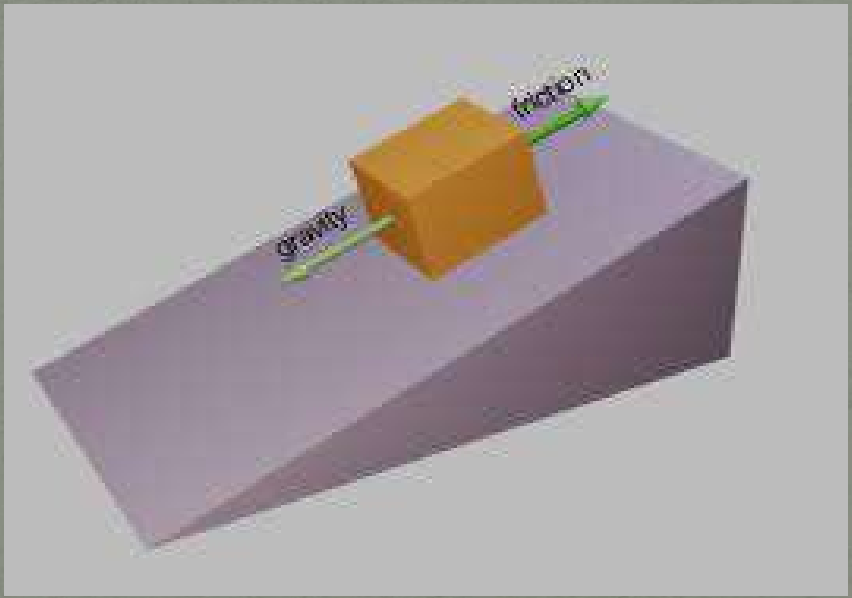
STATIC FRICTION

- Force that must be overcome to **start an object moving**

Strongest type of Friction….. WHY?

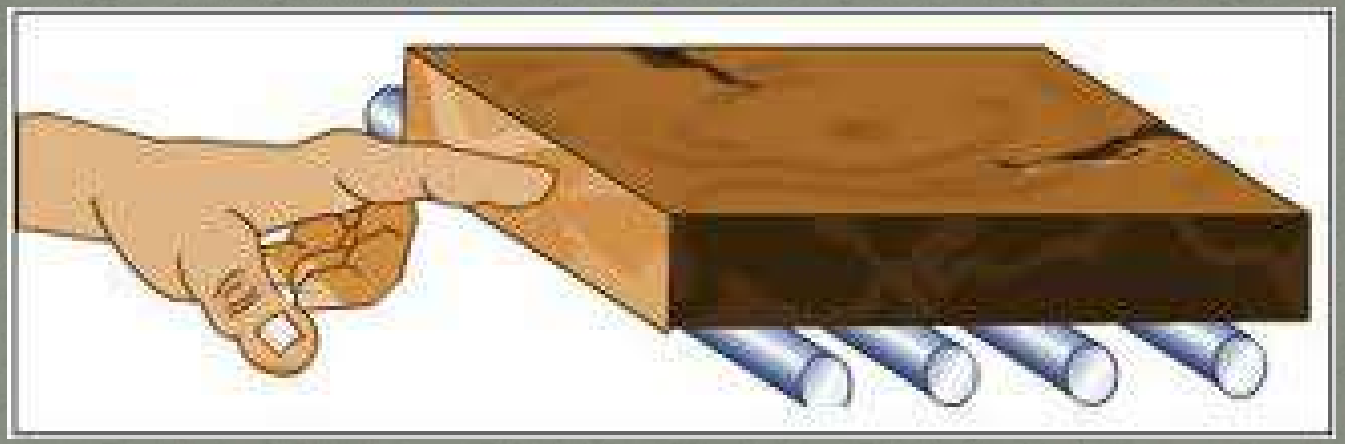
SLIDING FRICTION

- The source of the friction is the *contact* between the surface of the object & the object it is resting on



ROLLING FRICTION

- The source of friction is the contact between wheels of an object and the floor or object in which it is resting



FLUID FRICTION

- Occurs when a solid object moves through a fluid

Air Resistance

- The force that opposes the movement of an object in air
- The greater the surface area of an object, the greater the air resistance (air pushes up against the object)
- Terminal velocity: the speed at which air resistance & gravity acting on a falling object are equal
- Vacuum: empty space – no air resistance = nothing to slow object down

DECREASING/ INCREASING FRICTION

DECREASING

(1) Change sliding friction to rolling friction

(2) Use a lubricant

(3) Smooth out the surface area

(4) "Lighten the load"

INCREASING

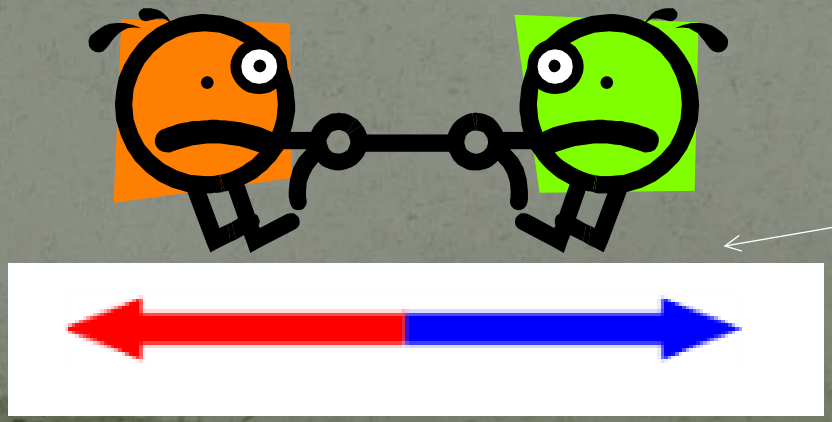
(1) Make the area more textured or more rough

(2) Increase the mass of the object to increase the force between the objects

Size and Direction of Forces

- Force is a vector
  - It has both size and direction.
  - Arrows are used to represent forces.
  - Length of the arrow shows the size of the force.

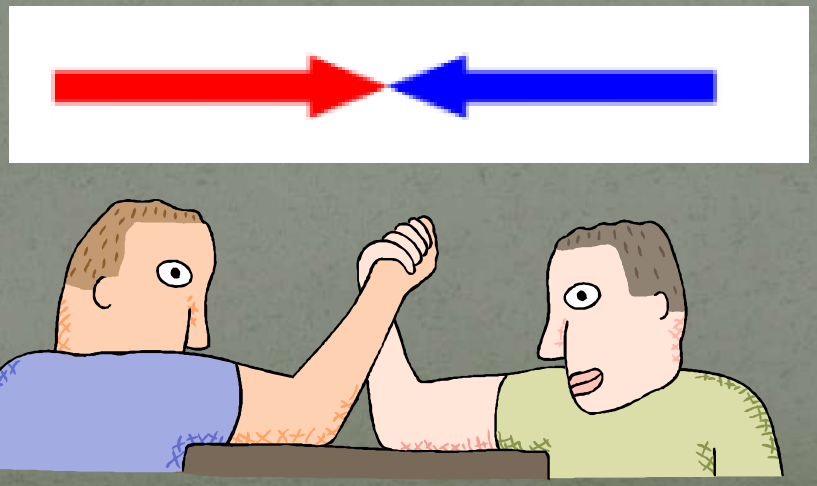
    Longer arrow means greater force.



Equal arrow length,
Shows balanced force

Balanced Forces

- Balanced forces do not cause change in motion
- They are equal in size and opposite in direction



Unbalanced Forces

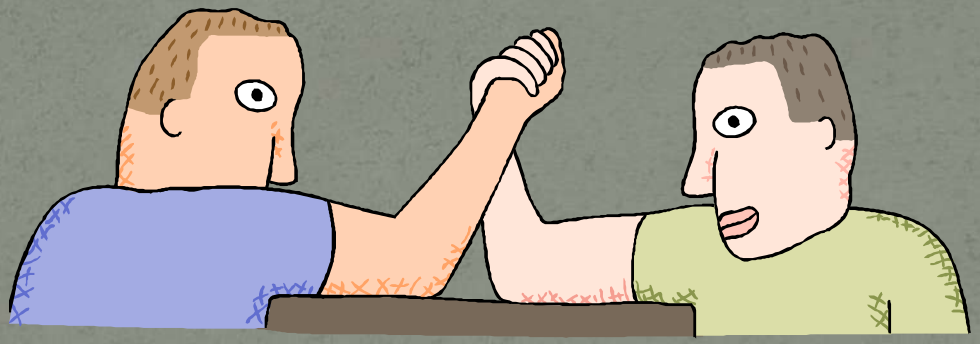
- An unbalanced force **always** causes a change in motion
- When unbalanced forces act in opposite directions you can find the net force
  - **Net force** = the overall force acting on an object when all the forces are combined.

We can use force diagrams to show this:

The block has 2 opposing forces being applied to it:
7N to the right and 4N to the left. They are Unbalanced Forces.

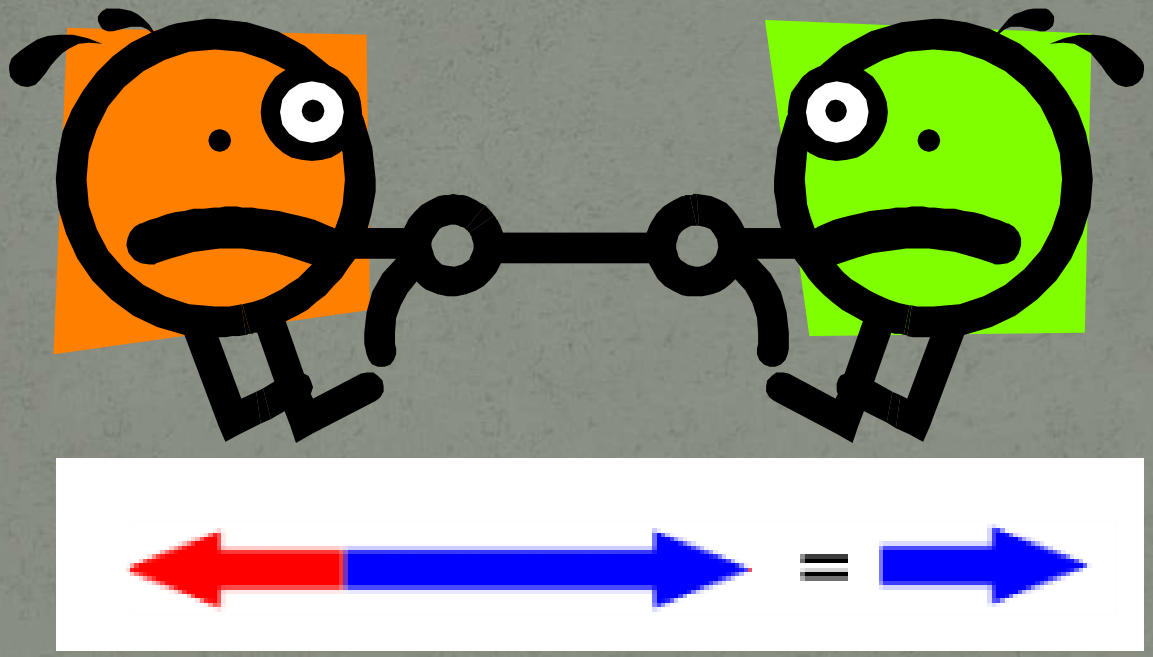
To Calculate the **Resultant Force** (**Fr**),
subtract one from the other: 7N – 4N = **3N to the right**

Unbalanced Forces



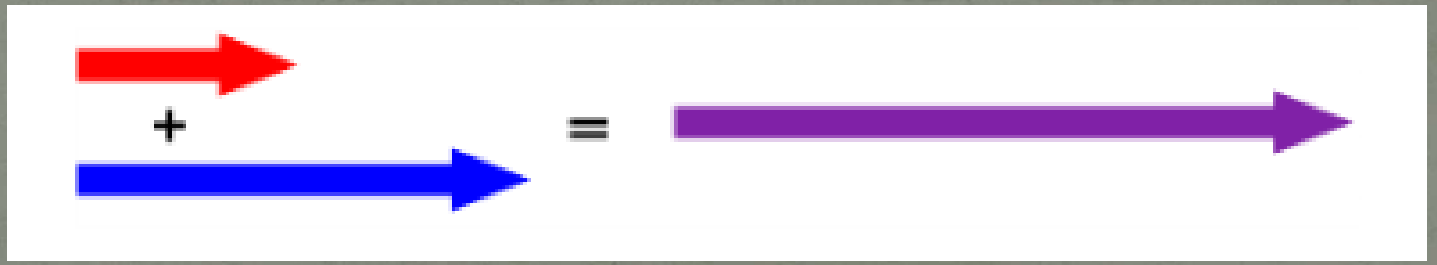
3 N right – 6 N left = 3N, left

Unbalanced Forces



4 N, left – 10 N, right = 6N, right

Unbalanced Forces



5 N, right + 10 N, right = 15N, right

- A man of mass 75 kg has a weight of 750 N. This 750 N will act downward on the table and the table will exert a 750 N force upwards on the man. The forces are balanced.

- What would happen if the upward force were *less than* 750 N?

Newton's 1st Law of Motion
Law of Inertia

Newton's First Law of Motion states that an object at rest will remain at rest, and an object in motion will remain in motion, unless acted upon by an unbalanced force.

Inertia is the tendency of an object to resist change in its motion.

The amount of inertia of an object depends on its mass

Newton's 1st Law of Motion

Newton's Laws of Motion

1st Law – An object will remain at rest or move at a constant speed in a straight line unless it is acted upon by an unbalanced force (Also called the Law of Inertia)

2nd Law – Acceleration depends on the objects mass and the force exerted on it (F = Mass x Acceleration)

3rd – Forces always act in pairs and in opposite directions (action/reaction)