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FORCES

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FORCE

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A force is the push or pull on an object.

This is a result from the object's interaction with another object.

Think of it as...

The forces needed to:

- Holding planets in orbit
- Pushing a heavy box
- Lifting weights

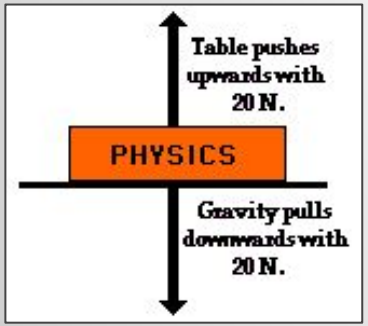
etc...

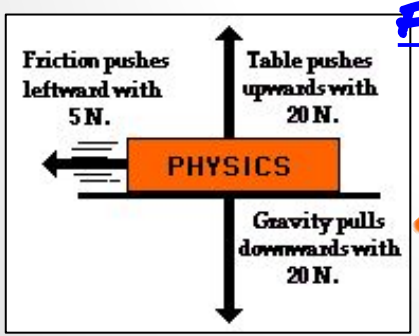
FORCE

Force is a **vector** quantity.

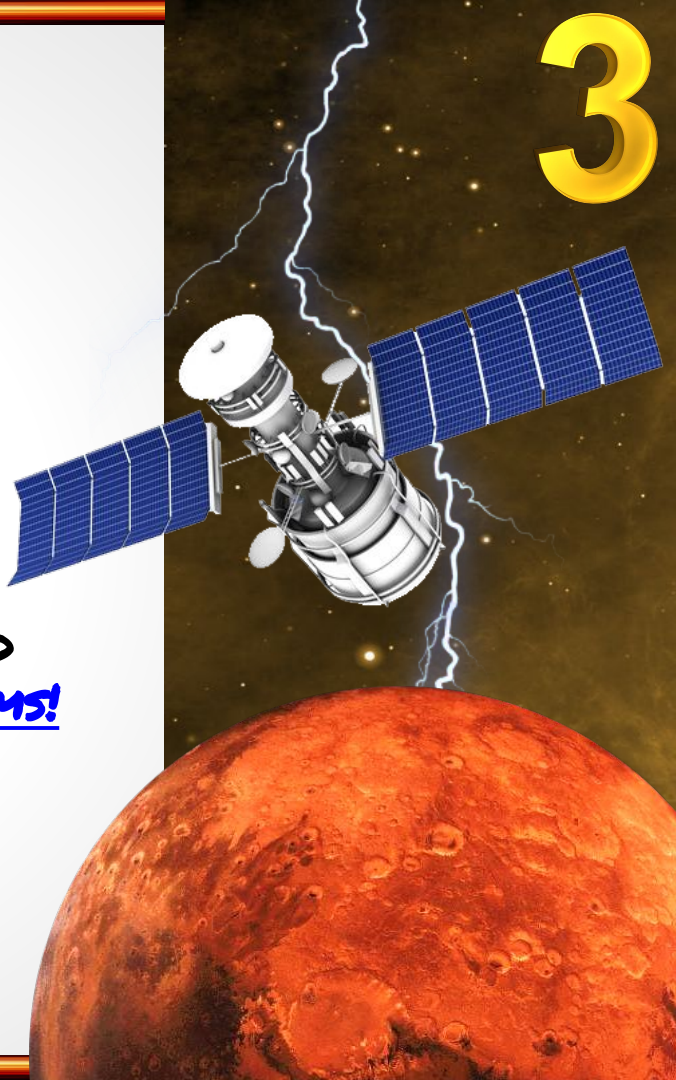
a **vector quantity** is a quantity that has both magnitude and direction.

Because a force is a vector that has a direction, it is common to represent forces using diagrams in which a force is represented by an arrow.





These are called **Free-Body Diagrams!**



FORCE

Force is measured in Newtons (N)

One Newton is the amount of force required to give a 1-kg mass an acceleration of 1 m/s/s.

Thus, the following unit equivalency can be stated:

1 Newton = 1 kg • m/s2

FORCE

All forces can be placed into two categories:

contact forces: **are forces that result when the two interacting objects are perceived to be physically contacting each other.**

Example: **frictional, tensional, spring, normal forces, air resistance, etc.**

Action-at-a-distance forces: **are forces that result even when the two interacting objects are not in physical contact with each other, yet are able to exert a push or pull despite their physical separation.**

Example: **gravitational, electrical, magnetic forces, etc.**

NEWTON'S 1ST LAW

The first law of motion...

an object will remain at rest or in uniform motion in a straight line unless acted upon by an external force.

The first law of motion covers inertia.

Inertia is how much a body resists motion.

The inertia is determined by an object's mass.

(To be continued...)

NEWTON'S 1ST LAW

Inertial Reference Frames

The first law does not work in all reference frames.

Think of it this way: you are in a roller coaster with a silly hat on going 20 mph, the roller coaster comes to a sudden halt and your hat flies off. To you the hat has suddenly moved away from you!

NEWTON'S 2ND LAW

The second law of motion...

The acceleration of an object is directly proportional to the net force acting on it and is inversely proportional to its mass.

The direction of the acceleration is in the direction of the net force acting on the object.

$a = \Sigma F/m$

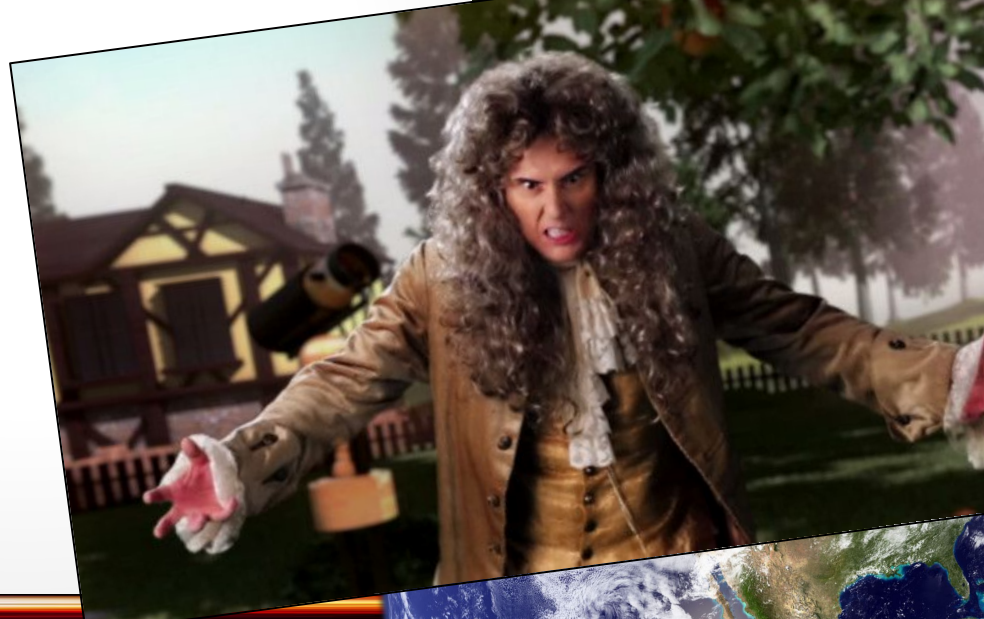
Force = (Mass x Acceleration)
(F = ma)

NEWTON'S 3RD LAW

The third law of motion...

"For every action there is an equal and opposite reaction"

Whenever one object exerts a force on a second object, the second exerts an equal and opposite force on the first. Let it Rain Apples!



MISCONCEPTIONS

1. A common misconception is where a heavier object is falling faster than a smaller object. For example a piano and a baseball are falling. They both fall at the same speed.

2. Another misconception is where people think that whenever something is moving it will eventually be stopped. That is not true to the slightest because if something is thrown, it will move forever until it interacts with another object.

3. An object is hard to push or move because it is heavy. This is not true because it isn't the weight or of the object that makes it hard to move, it is the inertia of the object that keeps it there.

FORCE

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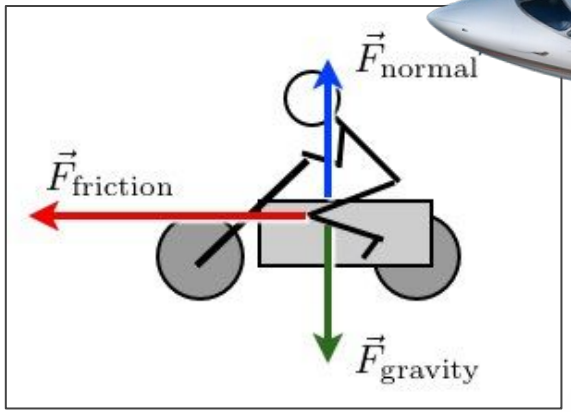
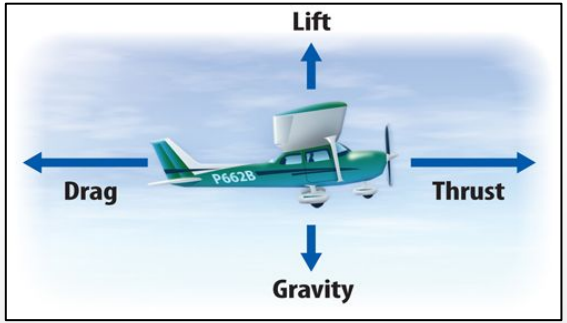
Free-Body Diagrams:

Diagram showing all forces acting on the object involved.

1. **Treat the object as a point.**
2. **Draw arrows to represent each force acting on the given body.**
3. **Draw the arrows coming from the point.**
4. **Be sure to include every force acting on the system.**





MORE KEY TOPICS

Equilibrium:

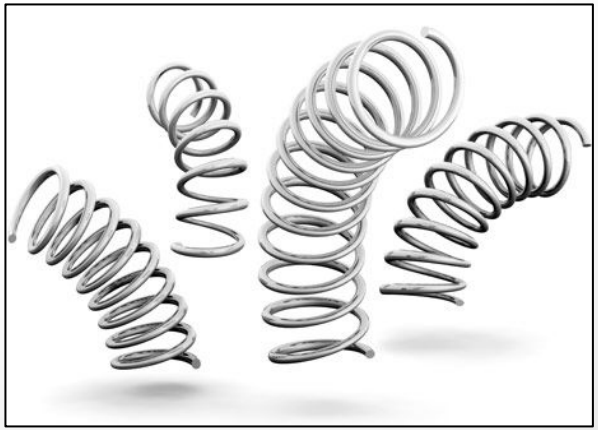
We say a system is in equilibrium if the net force on it is zero.

Example:
Terminal Velocity: the fastest speed an object will reach in freefall!

Tension:

When a flexible cord pulls on an object, the cord is said to be under tension.

Example: Ropes & Cords



MORE KEY TOPICS

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Friction:

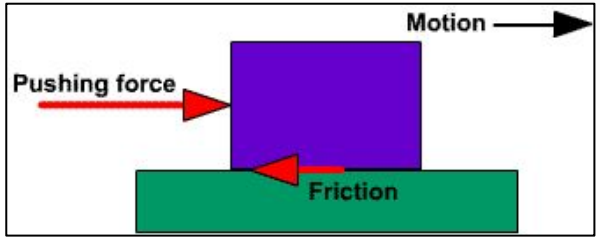
Friction is a contact force.

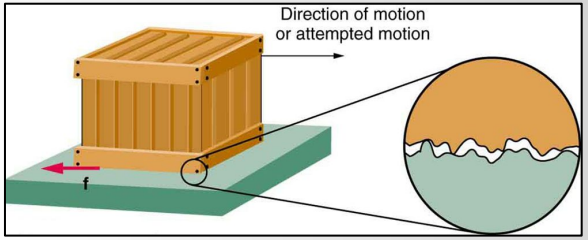
It occurs when one surface attempts to move along another.

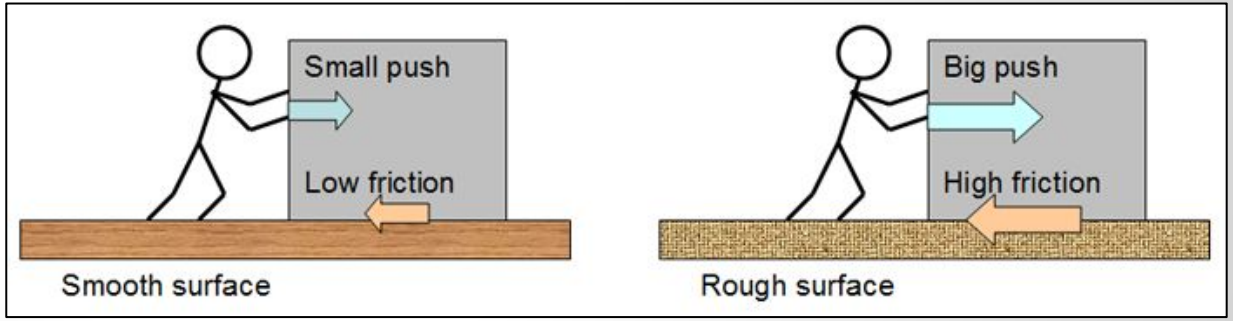
The coarseness or roughness of a surface may also affect friction.

Remember: It always opposes motion!

In other words, Friction will act in the opposite direction an object is moving in!







MORE KEY TOPICS

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Mass:

the measure of inertia of a body.

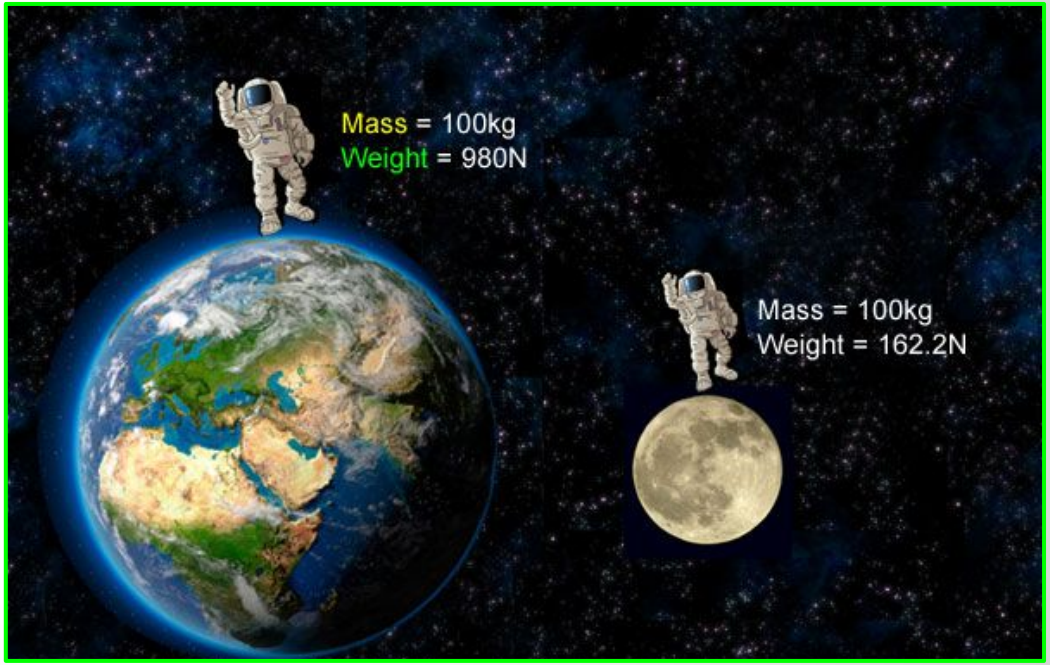
Weight:

force due to gravity.

Force of Gravity = mg

Don't forget...

Normal Force: a constant force that acts perpendicular to a common surface of contact.



KAHOOT!

Kahoot Link:

https://play.kahoot.it/#/k/451f3486-3587-450b-9fcd-d31f15526e1f