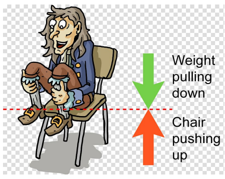
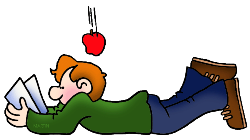


Science Grade 8
Motion & Stability



Direction - is the path along which someone or something moves.

Distance - is the amount of space between two objects or points

- must be measured in mm, cm, **m**, km, ...

Time- is the duration between two events

- measured in **seconds**, minutes or hours

Let's go out and see how much time it takes to walk 1 km

Try This
Activity Measuring by Hand

Most measurement systems originated when the human body was used to help determine distances. After all, everybody had one! This practice is still very useful when we do not have access to a ruler or tape measure.

- Use a metric ruler, metre stick, or tape measure to determine the answers to the following questions. Memorize the following answers for your own body.

(a) The width of which of your fingers or fingernails is closest to 1.0 cm?

(b) Which part of your hand (width or length) is approximately 10 cm?

(c) What is the maximum span of your spread hand (i.e., width from thumb tip to little-finger tip) in centimetres?

(d) A horizontal distance of 1.0 m is from the tip of your fingers on your outstretched arm to where on your body?

(e) How many of your foot or shoe lengths (plus a fraction, if necessary) equals 1.0 m (**Figure 3**)?

(f) What are the lengths of your natural and stretched strides in metres? Can you stride 1.0 m?

- Now use the answers to the above questions to determine the length, in centimetres or metres, of the following objects. Measure each object at least three times, using different parts of your body each time.

(g) What is the length of your pencil or pen?

(h) What is the length of a page of paper?

(i) What is the length of your desk or table?

(j) What is the length of your room?

Did you always get the same lengths for each object? Why, or why not?

(k) Repeat questions (g)–(j) using a metre stick. Compare the new measurements with those you obtained by using your body. Account for any differences. Which are likely to be more accurate?

- What are the likely maximum and minimum distances you could conveniently measure, using

(l) your finger/fingernail width?

(m) your hand span?

(n) your foot/shoe length?

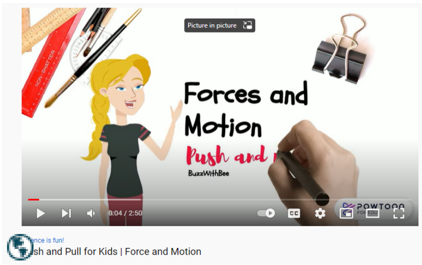
(o) your stride?

Figure 3
How many of your foot lengths make up 1.0 m?

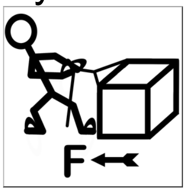
<u>Motion</u> - is when an object moves from place to place

<u>Force</u> is an interaction between two objects, which comes in the form of a push or a pull. When this interaction occurs, each object is affected by the other, and there are always two objects involved.

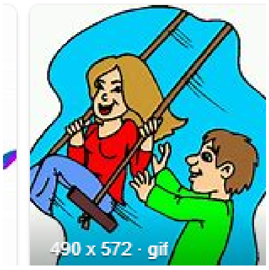
Force is measured in Newtons (N)



Pull - is a type of force where you bring an object towards you.



Push - is a type of force where you move an object away from you.



Inertia - is the property to do nothing or stay unchanged

Speed - is the amount of distance an object travels in a set time

(the rate at which an object changes position)

- measured in m/s or km/h ex) 72 km/hr

$$s = \frac{\text{distance}}{\text{time}}$$

Velocity - is your speed with a direction (vector)

- Example) 72 km/hr North

A **contact force** is a force between two objects that can only exist if these objects make direct contact with each other.

Types of contact forces include friction, air resistance, tension

Contact forces are responsible for most of the interactions we see in our daily lives. Examples include pushing a car, kicking a ball, and holding a pencil.

Non-contact forces are forces between two objects that don't require direct contact between the objects in order to exist. Non-contact forces are much more complex in nature and can be present between two objects separated by large distances.

Types of non-contact forces include gravity, magnetic forces, and electric forces.

Friction

Friction is the resistance to motion of one object moving relative to another. It is not a fundamental force, like gravity or electromagnetism. Instead, scientists believe it is the result of the electromagnetic attraction between charged particles in two touching surfaces.

Frictional forces provide the traction needed to walk without slipping, but they also present a great measure of opposition to motion.

Types of friction include kinetic friction, static friction, and rolling friction.

NAME__________________________DATE__________PER________

BILL NYE: FRICTION VIDEO

electrons	knot	friction	slows down	heat	space	heat it up
pick up	less	sticky	slippery	less	water	rubbed
rough	more	on the track	reduces	track	wheels	heat
chirp	bump					

1. Friction is a force that results whenever two surfaces are ______ together.
2. Friction turns work into _________.
3. If you tie a _________. It's held together by friction.
4. Friction __________________ moving things and turns motion energy

   into ____________.
5. In ___________there is almost no friction.
6. Your fingerprints are necessary for you to ______________ things.
7. Friction comes from __________.
8. The more electrons repel each other the ___________ friction there is.
9. When skis or skates slide over ice or snow the friction creates a layer of

   ___________ which _____________friction.
10. Friction is necessary when you are on a bike to stay _____________.
11. Cleats or spikes on shoes make ________________friction because they

    provide a ________________ surface.
12. Rolling friction is ________________ than sliding friction.
13. Ball bearings purpose is to create ____________ friction.
14. In order for a train to move on the tracks there must be friction between

    the ________________________and the __________________.

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Research day

Explain the difference between: (Science definition)

Hypothesis- definition

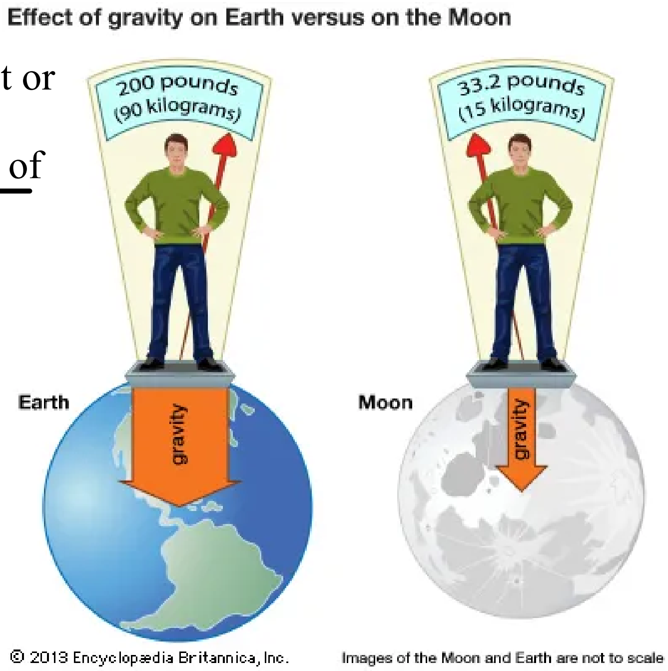
- 2 science hypothesis
- 1 math hypothesis

Theory - definition

- 2 science theories
- 1 math theory

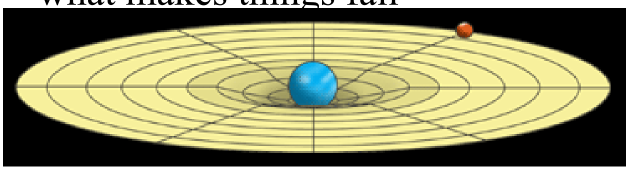
Law-definition

- 2 science laws
- 1 math law



Gravity is the force by which a planet or other body draws objects toward its center. The force of gravity keeps all of the planets in orbit around the sun.

Definition of Gravity: an invisible force that pulls objects toward the center of the earth . Earth's gravity is what keeps you on the ground and what makes things fall



Albert Einstein described gravity as a curve in space that wraps around an object—such as a star or a planet. If another object is nearby, it is pulled into the curve

22 Surprising Facts About: Albert Einstein - YouTube

Bill Nye Gravity

WS

Anything that has mass also has gravity. Objects with more mass have more gravity. Gravity also gets weaker with distance. So, the closer objects are to each other, the stronger their gravitational pull is.

Earth's gravity comes from all its mass. All its mass makes a combined gravitational pull on all the mass in your body. That's what gives you weight. And if you were on a planet with less mass than Earth, you would weigh less than you do here.

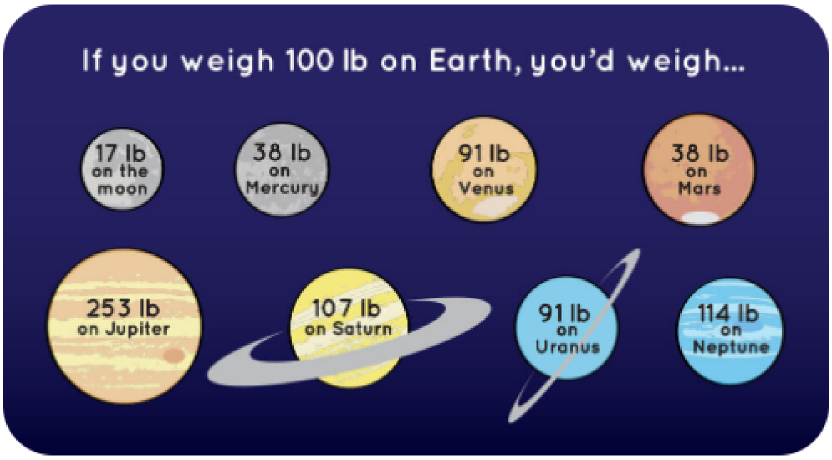


Image credit: NASA

You exert the same gravitational force on Earth that it does on you. But because Earth is so much more massive than you, your force doesn't really have an effect on our planet.

Universal Law of Gravity

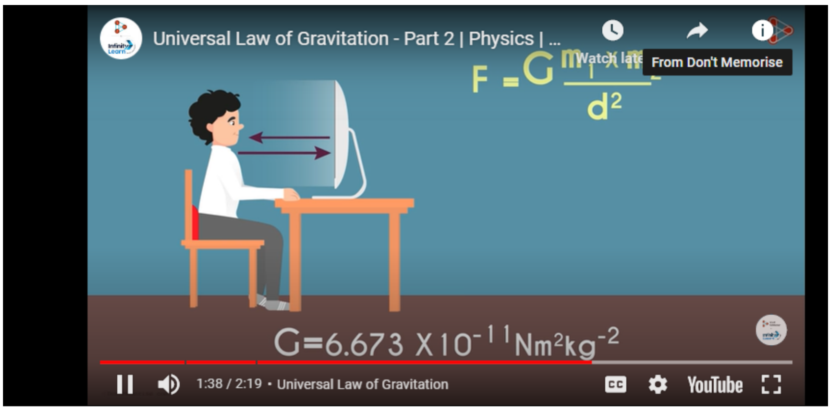
Gravitational force between masses decreases with the distance between them, according to an inverse-square law.

Basically -->Gravity also gets weaker with distance.

each particle attracts every other particle

$9.8 m/s^2$

The Universal Law of Gravitation - Part 1 | Physics | Don't Memorise - YouTube



Universal Law of Gravitation - Part 2 | Physics | Don't Memorise

Acceleration

What is Acceleration? (Physics in simple terms) - YouTube

is the rate at which velocity changes

-Measured in m/s²

-Speeding up or slowing down

-Even if you keep the same speed but change direction then you have acceleration

$$Acc = \frac{V_{final} - V_{intial}}{\text{time to change}}$$


0:16 / 10:49
FORCE and MOTION | Cool Science Experiments for KIDS | Gideon's World of Science
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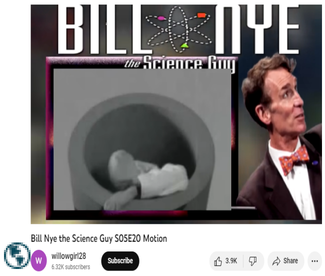
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willowgirl28
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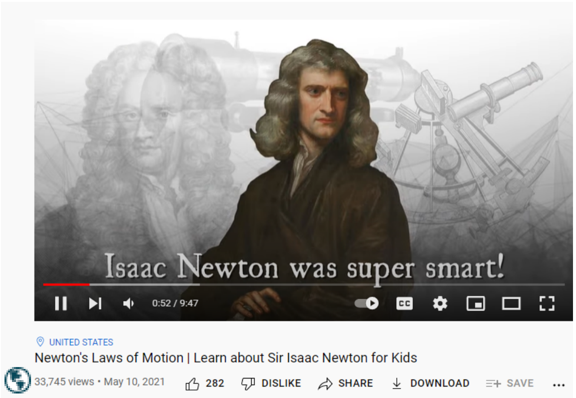
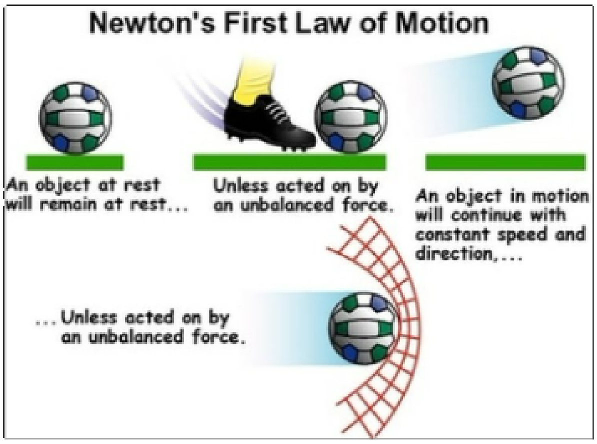
Newton's laws



Newton's First Law

Newton's first law of motion | Forces and Newton's laws of motion | Physics | Khan Academy - YouTube

An object in motion tends to stay in motion while an object at rest tends to stay at rest unless acted on by some force. This is Inertia



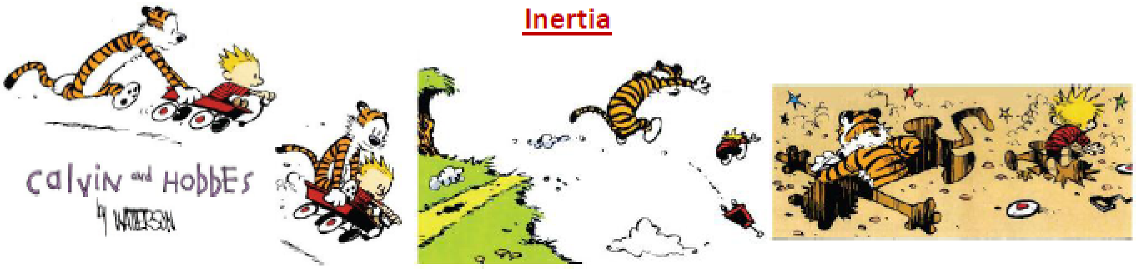
Newton's first law of motion states that an object won't move by itself and that, once in motion, it won't stop unless some force acts upon it.

-Ball on a table will not move

3 Types of Inertia

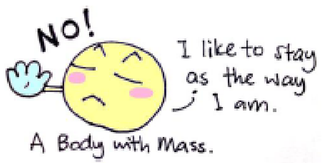
1. Inertia of rest: The inability of a body to change by itself its state of rest is called inertia of rest.
2. Inertia of direction: The inability of a body to change by itself its direction of motion.
3. Inertia of motion: The inability of the body to change by itself its state of motion is called inertia of motion.

Inertia

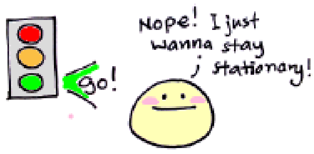


Why did Calvin, Hobbes and the cart continue to move forward when they fell off the cliff?

All objects have this **tendency** to oppose **any change in motion.**



If it is **stationary**, it likes to remain **stationary**.



If it is **moving**, it likes to remain **moving**.

This **tendency** is called the **inertia** of an object.

Inertia is the tendency of an object to remain in its state of rest or constant speed in a straight line.

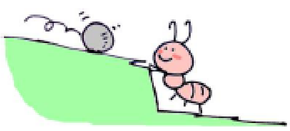
Imagine a **stationary pebble** and a **stationary large rock**. Which do you think is easier for you to move?

☐ Stationary pebble

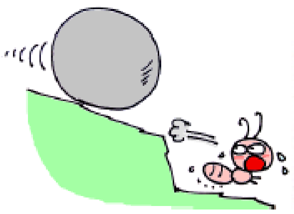
☐ Stationary large rock

If the pebble and the large rock are both moving, which do you think is easier for you to stop?

☐ Moving pebble



☐ Moving large rock



An object with smaller mass is easier to move and easier to stop. An object of **smaller mass** has **smaller inertia**.

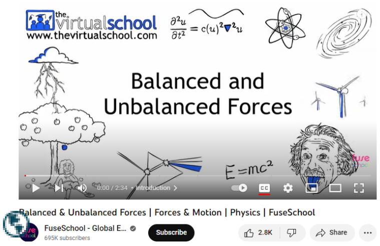
The inertia of an object depends on its mass.
A bigger mass has greater inertia.

By Esther

Newtons 2nd Law of Motion

Newton's second law of motion for kids straightforwardly states that the rate of momentum is directly and proportional to the force applied to the object and takes place in the direction in which force is applied.

-add force moves farther



Newton's second law states that when you push an object with more force it will move faster and farther away.

Balanced vs. Unbalanced

- Balanced forces- When two or more forces acting on an object are equal in all directions.
  - Results in no movement

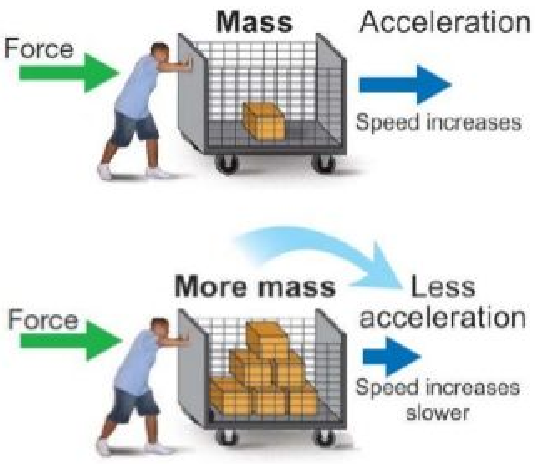
300
-300
0N
Balanced

- Unbalanced forces- When two or more unequal forces act on an object.
  - Moves in the direction with more force.
  - Net force is the difference between these forces.

400
-300
← 100N

Newton's Second Law

- If the same force is applied to an object with greater mass, the object accelerates at a slower rate because mass adds inertia.



This is why this law has a formula:

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

So if you increase mass then acceleration decreases.

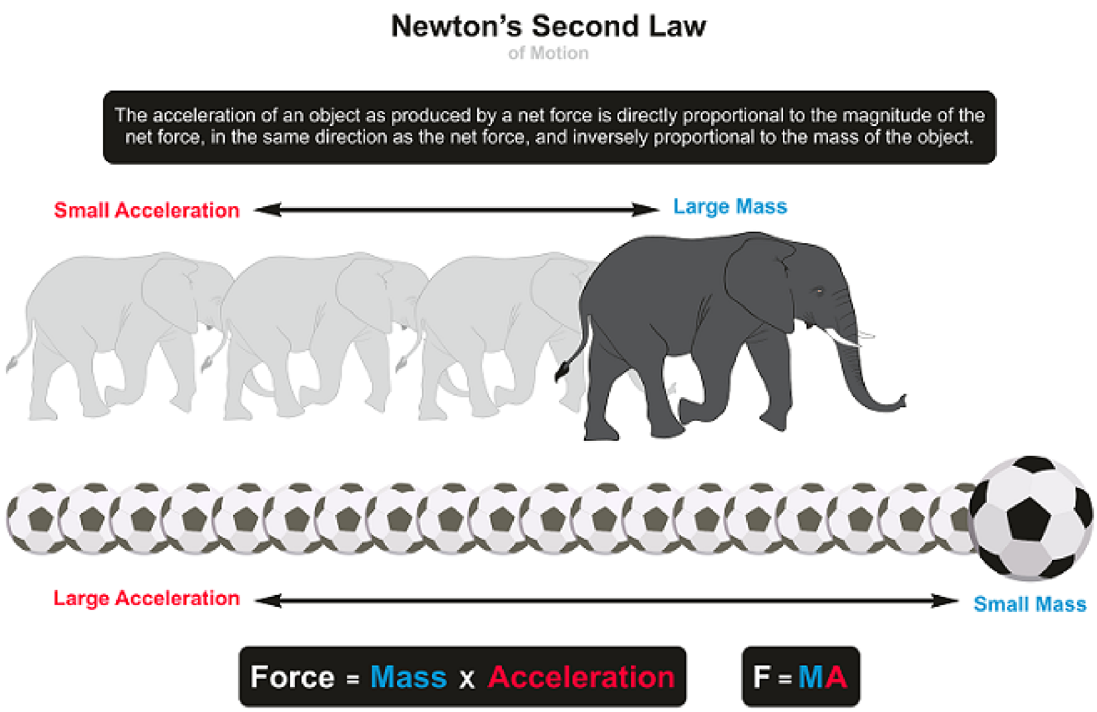
If you decrease mass the acceleration increases.

> a is the acceleration that is measured in meters per second squared (m/s^2). It means that if an object accelerates at 1 m/s^2, its speed is increasing by 1 meter per second every second.

> F is a force that is measured in newtons

> m is an object's mass that is measured in kilograms.

Imagine you need to hit two different balls with a baseball bat: one is an ordinary baseball, and the other is heavier and bigger. Since balls have different masses, they will travel different distances and at different speeds when hit with the same force. If you increase the force of hitting, the less heavy ball will fly farther away. So the results will be different anyway.


Newton's Second Law
of Motion
The acceleration of an object as produced by a net force is directly proportional to the magnitude of the net force, in the same direction as the net force, and inversely proportional to the mass of the object.
Small Acceleration
Large Mass
Large Acceleration
Small Mass
Force = Mass x Acceleration
F = MA

Newton's 3rd Law Of Motion

If we want to use one word to describe this law, it is Karma. You get back as much as you give, and apparently, it is a physical law and not just a philosophical concept.

Newton's Third Law declares:

For every external force, there is an equal force acting in the opposite direction.

What Newton means by it is that there are always two forces acting on each other at the same time in the opposite directions. And there are no isolated forces — it is a package deal. The first force comes from outside. The second one is the reaction on the first one, which acts back on the object exerting that force. These two forces are always equal, and in the end, they compensate each other.

This is the formula expressing Newton's third law:

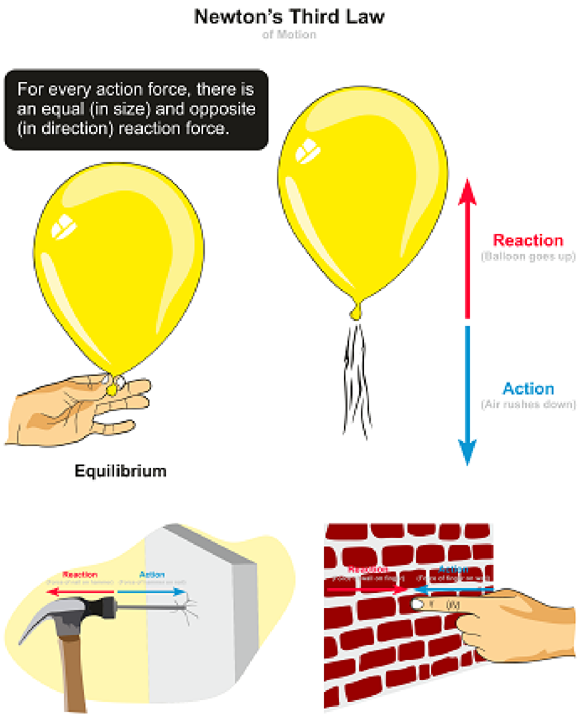
$F1 = -F2$,

where:

F1 – is the force of the first object that acts upon the second object.

F2 – is the force of the second object that acts upon the first object.

You will be surprised to know, but without this physical law, we will not be able to walk on the ground. Each step we make comes with force towards the ground. At the same time, there is a counter-force of the same size coming from the ground and pushing our feet upward. It helps us walk, run and jump.



Example of 3rd law)

The counter-force remains invisible. You probably do not even feel it as we are not used to paying attention to it. But if you know someone who has ever jumped off a tree or other higher ground, you probably heard him complaining about his foot pain afterward. That is exactly the result of the counter-force. If you hit the ground hard, it will hit you back as much. (So don't jump off a tree.) It is the same reason why it hurts when you punch a punching bag, even though it feels quite soft when you just touch it.

Example

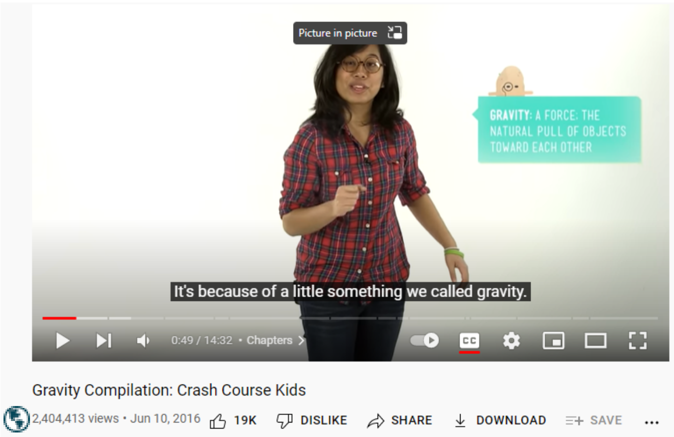
7.2 Newton's Third Law

When the girl jumps to shore, the boat moves backward.

-Playing pool (one ball hits another and makes it move)

[Newton's Laws: Crash Course Physics #5 - YouTube]

Gravity


Picture in picture
GRAVITY: A FORCE: THE NATURAL PULL OF OBJECTS TOWARD EACH OTHER
It's because of a little something we called gravity.
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