

Static Electricity

What is electricity?

Where have you seen or felt electricity?

Static Electricity

What is static electricity?

What does the word static mean?

What is static electricity?

What does the word static mean?

Static means stationary/not moving. So static electricity is electricity where the charges can build up and not move. When the charges do move, we feel a shock or a spark.

Static Electricity

In order to understand electricity, and static electricity, we have to understand the three types of small particles in the nucleus of an atom. We learned about these last unit.

Protons: have a positive electric charge (+)

Electrons: have a negative electric charge (-)

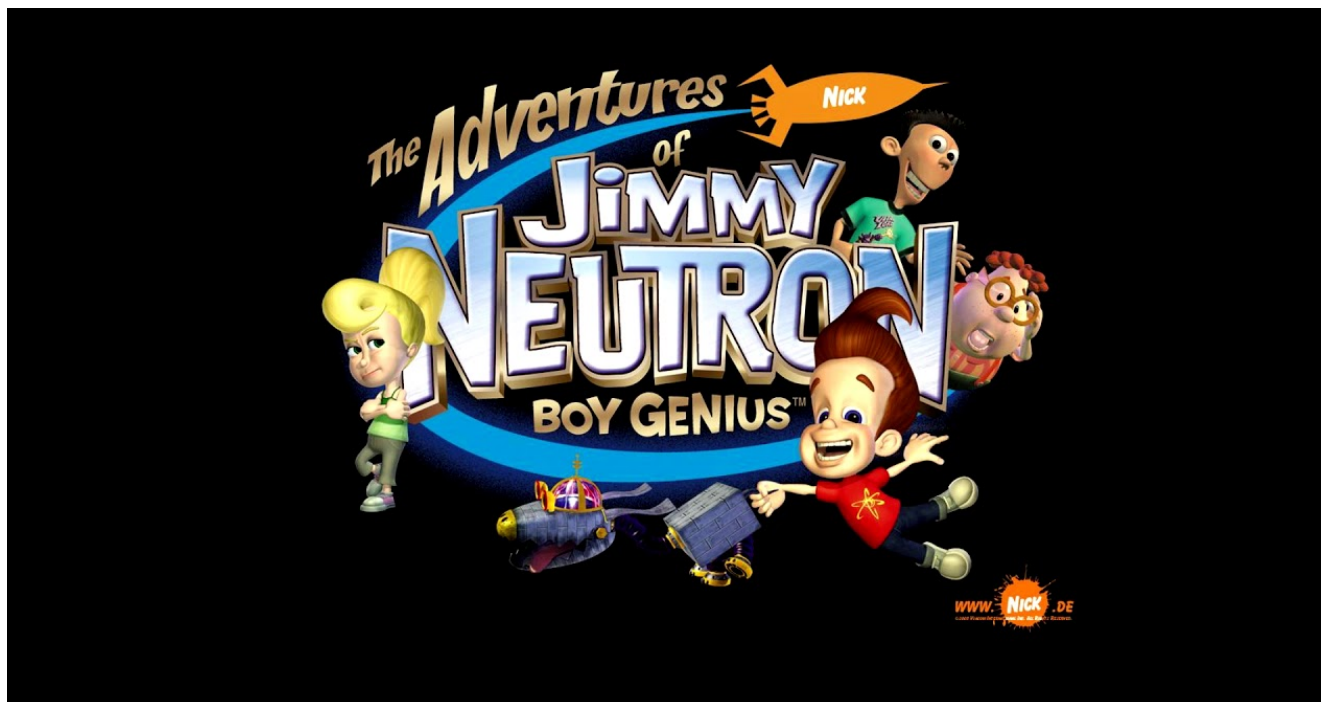
Neutrons: have no electric charge, so they are neutral.

Do you know who this is?





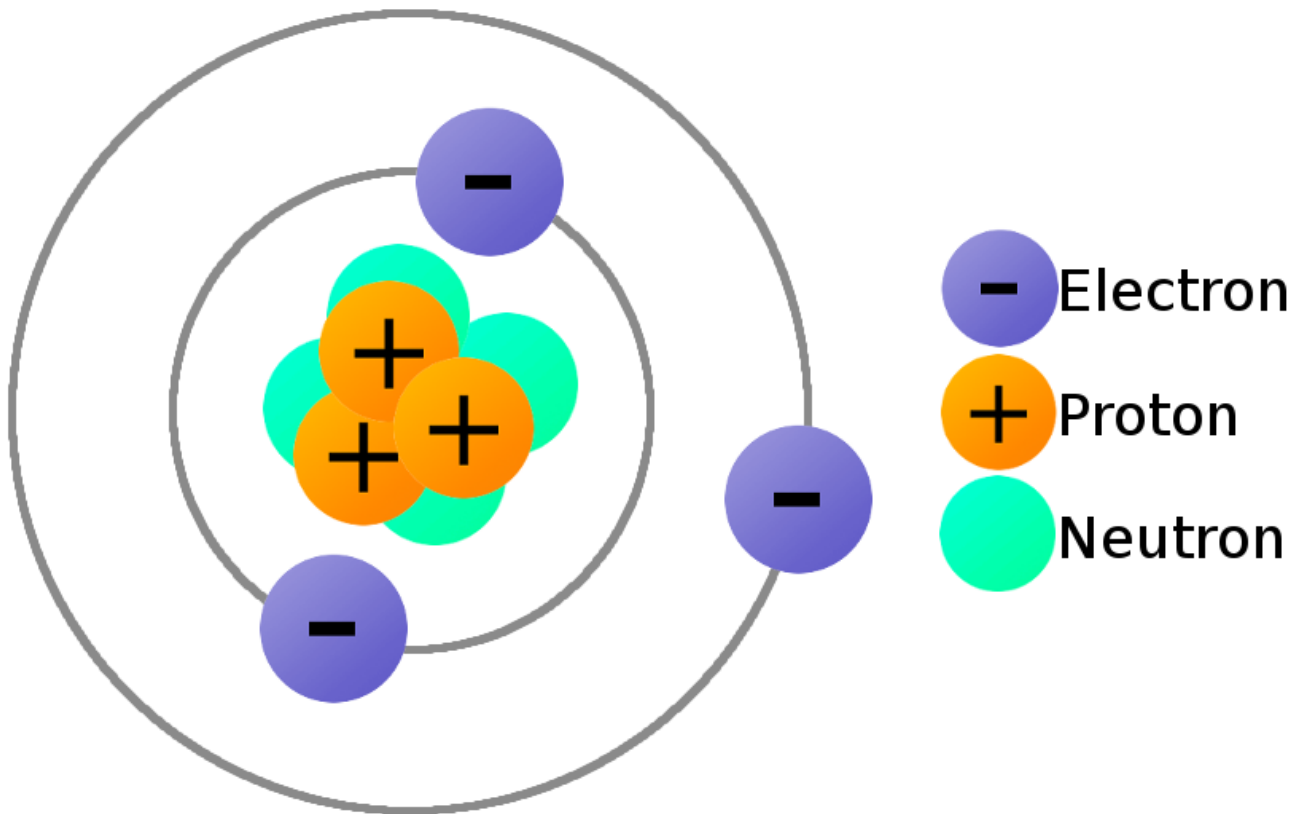
Why was he named Jimmy Neutron?



Why was he named Jimmy Neutron?

Jimmy is named after James Chadwick, who is a physicist who won the Nobel Prize for describing the particle named the neutron.

Static Electricity



Static Electricity

In an atom, the number of protons=the number of electrons. So atoms have an overall neutral charge. If an atom has gained or lost electrons, it will have a positive or negative charge and then it is called an ion.

How do atoms lose or gain electrons? Friction is a common cause.

Friction occurs when objects rub against each other.

Just like atoms, objects become charged when electrons move from one object to another.

If something loses electrons, it'll have more positives than negatives, so it'll be positively charged.

If something gains electrons, it'll have more negatives than positives so it'll be negatively charged.

What will happen when I rub a balloon on my hair?

Why?

What will happen if I hold that balloon above paper?

Why?

What will happen when I rub a balloon on my hair?

Why?

The balloon takes electrons from my hair strands and becomes negatively charged. My hair lost electrons and is positively charged so it sticks to the balloon. My hair strands are all positively charged and like charges repel, so my hair strands are trying to get away from each other.

What will happen if I hold that balloon above paper?

That negatively charged balloon comes into contact with my neutral paper and is attracted to the positives in it.

Why?

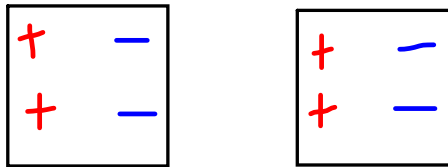
Static Electricity

We first need to understand charges.

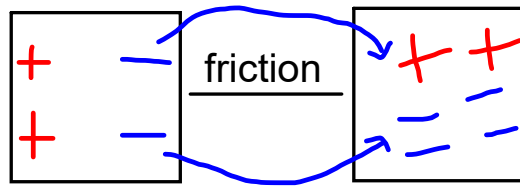
Protons: +

Electrons: -

Neutrons: No charge

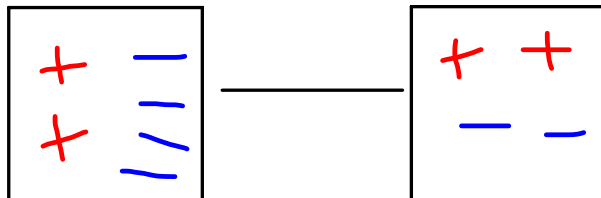


Most objects start off neutral. Meaning their + and - are balanced.

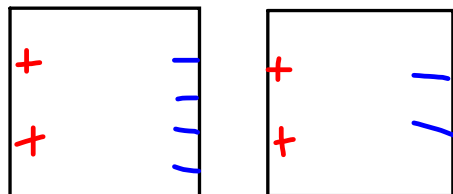


Now these objects are not neutral.

The one on the left is more + and the object on the right is more -. Because opposites attract, the two objects are attracted to each other.



Now if I bring my negatively charged object toward a neutral object, the negatives are attracted to the positives.



Static Electricity

How do you think lightning works? (Think about the charges.)

How do you think lightning works? (Think about the charges.)

Before a storm, the clouds move faster and build up a charge. Once the charge is big enough, the cloud is attracted to the ground and the negative charges move to the ground. So the lightning you see is just the charge moving from cloud to cloud or cloud to the ground.

Static Electricity

When we rub objects together, how do we know which object will lose electrons and which object will gain electrons?

Different substances have different abilities to hold on to electrons, called **electron affinity**. If something has a higher electron affinity, it will gain electrons.

(electron affinity is like a love for electrons)

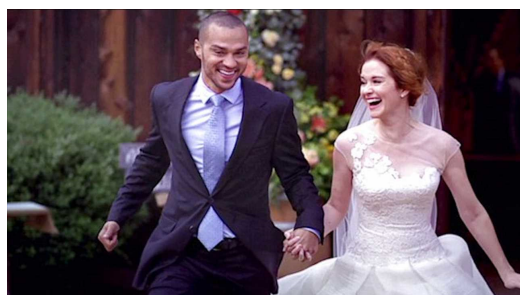
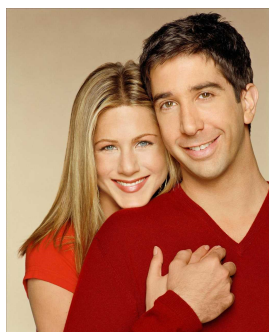
For example, with the balloon and hair, rubber has a higher electron affinity than my hair, so the rubber takes the electrons.

Static Electricity

Laws of Attraction and Repulsion:

Opposites **Attract**

Like Charges **Repel**



Static Electricity

What makes you choose certain materials to keep something hot or cold?

Static Electricity

What is conductivity?

Think about what you know about conductors and insulators.

Conductivity is the ability of materials to allow electrons to move freely in them.

An **insulator** is a material that holds onto their electrons and do not allow them to move easily. Therefore they have low conductivity.

example: rubber, wood, plastic,

Conductors are materials that allow electrons to change positions.

example: aluminum

Some materials allow only some movement of electrons, these are called **fair conductors**.

example: human body, soil

Static Electricity

Have you ever touched a metal spoon that was in a pot on the stove? Or a metal pan from the oven? What happens? Why do you think this is?

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The part of the metal touching the heat source (bottom of pot) gets warm. This causes the particles inside (the electrons) to move faster. This increase of kinetic energy causes the particles to bump against other particles in the pot, causing those to move as well.

This continues until all the particles move faster in the entire pot, thus the kinetic energy increases and the temperature increases.

Because my hand is touching the pot, the heat energy, or the electrons, are transferred to my hand.

The transfer of heat energy between substances that are in contact (touching) is called conduction.

Static Electricity

If a pot on the stove has a metal handle, you will burn yourself. What if the handle is covered with plastic? What does this say about plastic?



Do you think water is a conductor, an insulator or a fair conductor?

Do you think water is a conductor, an insulator or a fair conductor?

Pure water is an insulator but because most water has dissolved minerals in it, that makes it a fair conductor.

This is one reason why you do not want to be in a lake during a thunderstorm. If lightning strikes the lake, the static electric charges from the lightning will be conducted through the water and could injure or kill you.

This is the same reason why you should not use water to try to put out an electrical fire, and should not operate electrical appliances near water or with wet hands.

Static Electricity

Fire walkers walk across red-hot coals with bare feet and don't burn themselves. Can you figure out how they do it?



1. Questions on Handout

-you may use your notes!

This is for marks so I'd like you to do it individually please!

2. Passion Project

-If anyone is close to being ready to present please let me know!

There are three ways to transfer electrons.

1. Charging by Friction

-balloon vs hair

2. Charging by Contact

-objects must be touching to transfer charges

3. Charging by Induction

-attraction and repulsion when objects aren't touching.

Static Electricity

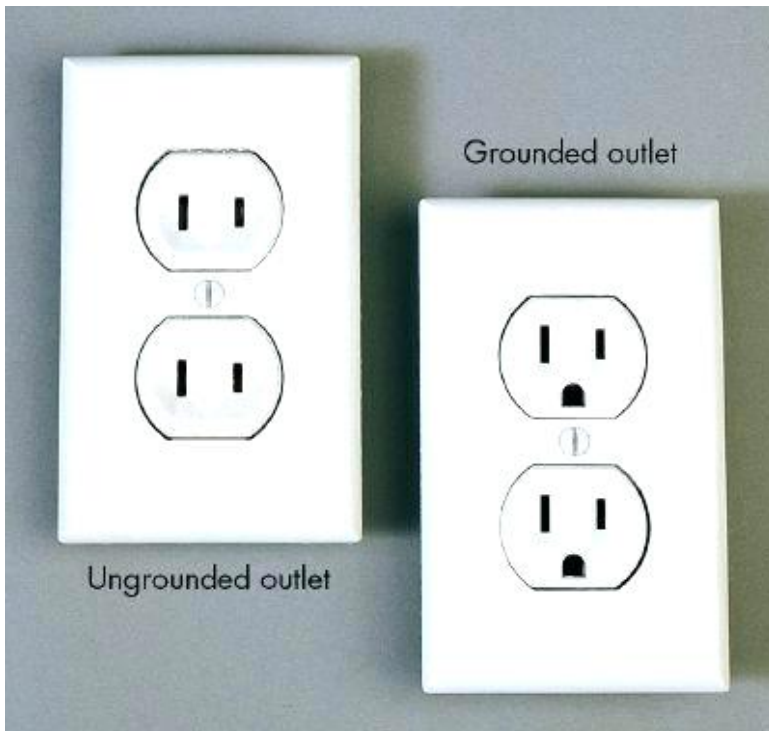
Electrical Discharge is the process of electric charges being transferred very quickly. This is what causes the spark or the shock.

For example:

John Travoltage!



Static Electricity



What's the difference?

Grounding:

As we've seen, all these electrons need to go somewhere. When an object gets charged, these electrons are trapped until they are given a path to escape.

In your home, there are continuous wires for electrons to travel through. But what happens when there is too much voltage, or too many charges flowing through? This can cause short circuits or other problems.

The purpose of the third hole in the outlet is for grounding. It provides another path for the electrons to follow that travels to the ground.

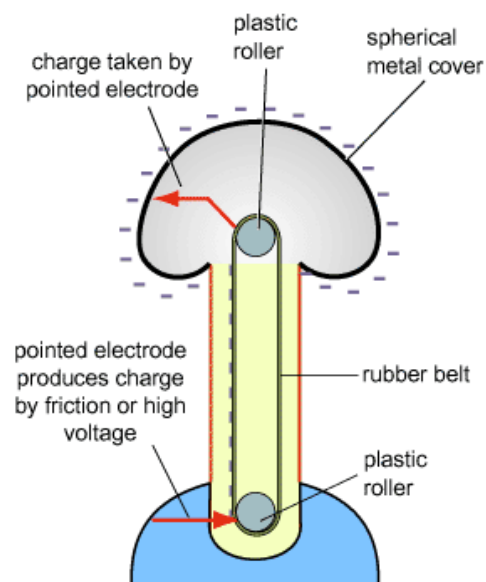
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Electrostatic Generators

Example: Van de Graaff generator

How does it work?

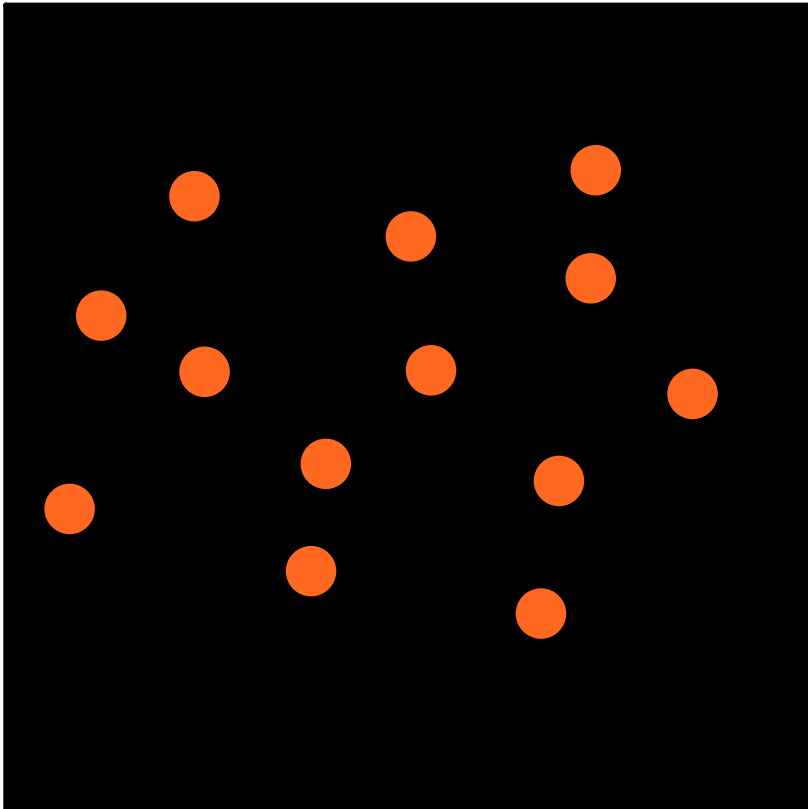
-There is a roller and a belt moving and rubbing against each other, creating _____. They transfer the electrons to the metal sphere.



Assignment:

EX-STATIC About Electricity

2.



1.

3.

4.

5.

6.