Watch the video below. With a seat partner predict what might have happened.

https://www.youtube.com/watch?v=tuZxFL9cGkI

You may have come up with a prediction of static electricity.

Yes, static electricity played a part, but what does it actually mean?

We will find out in the next few days.

Essential Question:
How do electric charges exert force on each other?

Standard:

S8P5a. Construct an argument using evidence to support the claim that fields (i.e., magnetic fields, gravitational fields, and electric fields) exist between objects exerting forces on each other even when the objects are not in contact.

b. Plan and carry out investigations to demonstrate the distribution of charge in conductors and Insulators. (Clarification statement: Include conduction, induction, and friction.)

c. Plan and carry out investigations to identify the factors (e.g., distance between objects, magnetic force produced by an electromagnet with varying number of wire turns, varying number or size of dry cells, and varying size of iron core) that affect the strength of electric and magnetic forces. (Clarification statement: Including, but not limited to, generators or motors.)

Standard:

S8P5a. Construct an argument using evidence to support the claim that fields (i.e., magnetic fields, gravitational fields, and electric fields) exist between objects exerting forces on each other even when the objects are not in contact.

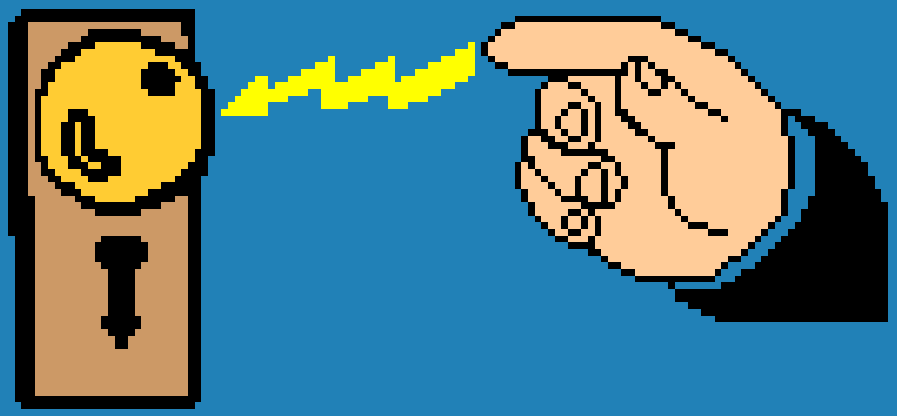
What does exert mean?

Exert simply means to apply or use.

Turn to a seat partner and define Force?

A force is a push or a pull

Have you ever reached out to open a door and received a shock from the doorknob?

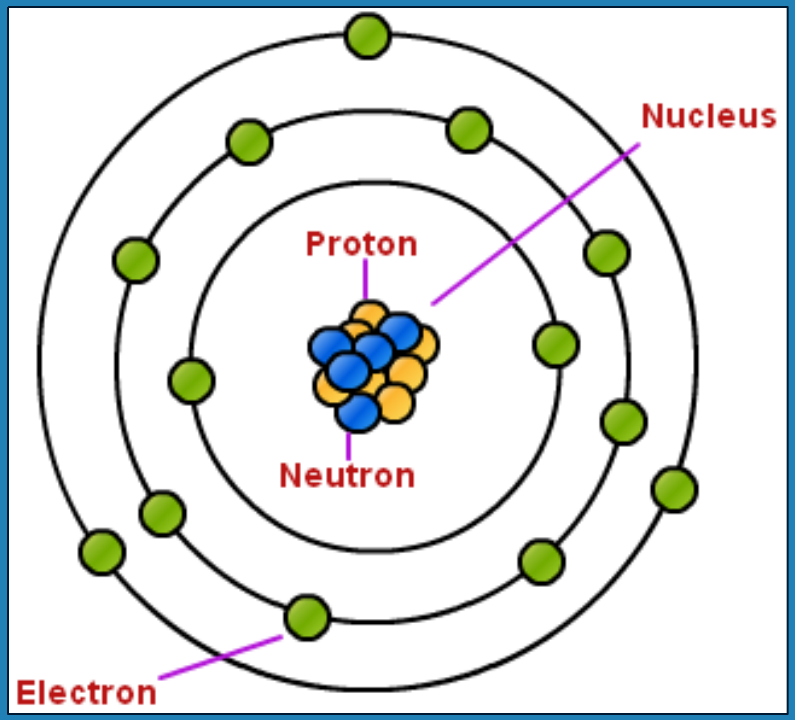


In order to understand why this happens, you have to understand electric charges.

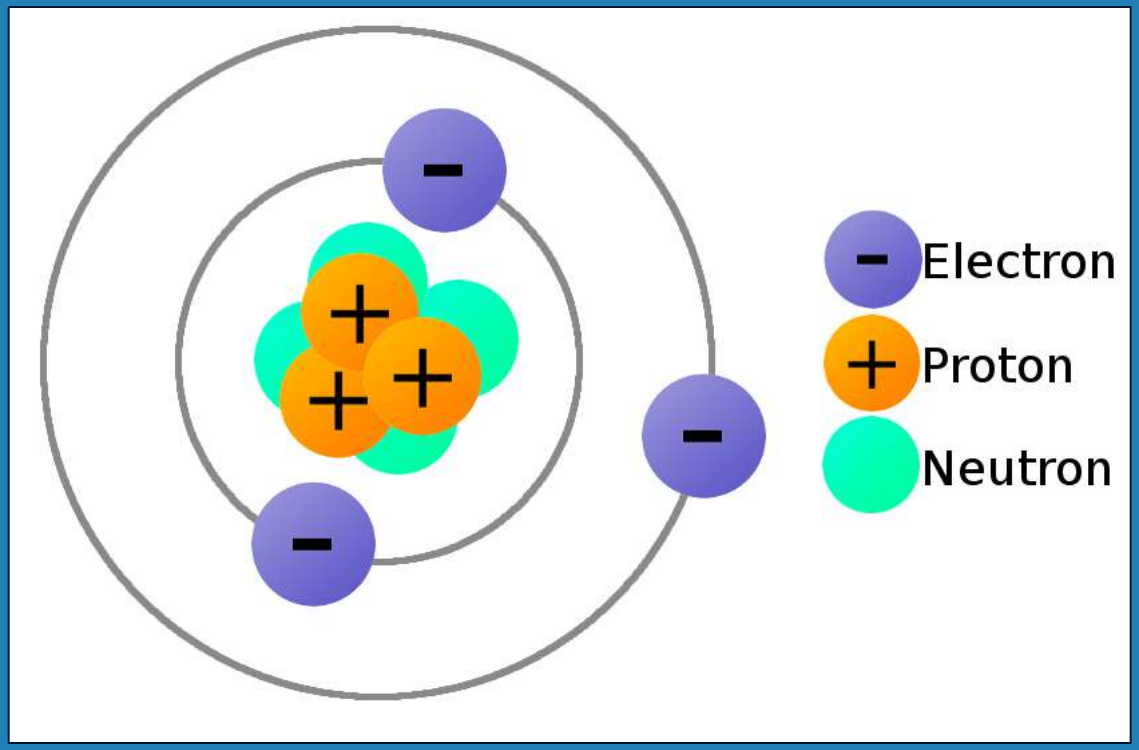
All matter is made up of very small particles called atoms

Atoms are made of even smaller particles called Protons, Neutrons, Electrons

Protons and Neutrons make up the center of the atom, the nucleus. Electrons are found outside the nucleus.



Protons and Electrons are charged particles, and neutrons are not.



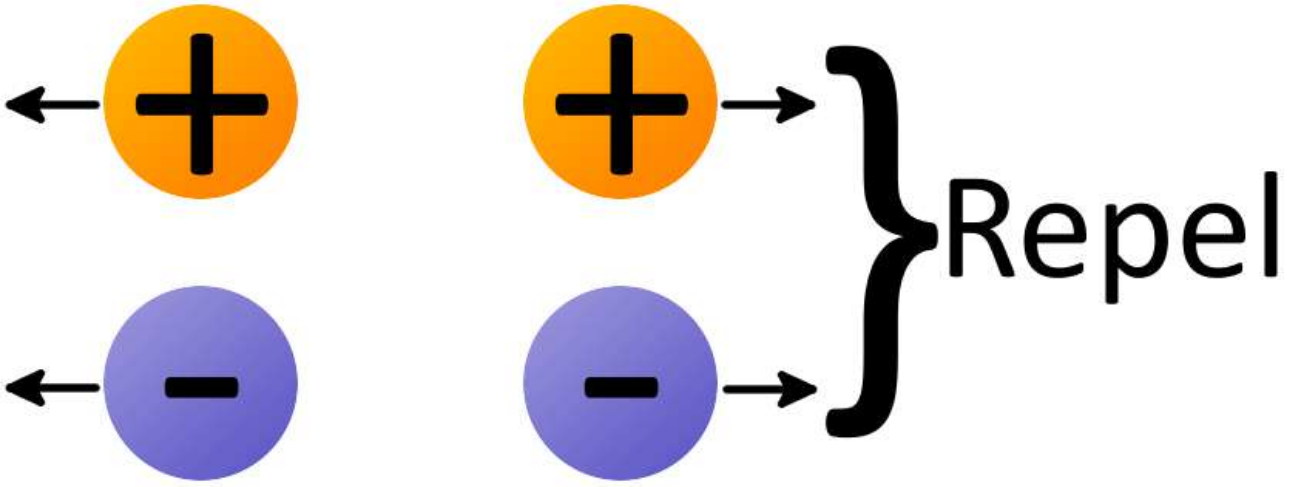
Charge is a physical property-

(an object) can be positive, negative, or neutral (no charge).

Charged objects exert a force (a push or a pull) on other charged objects.

Objects that have the same charge repel each other.

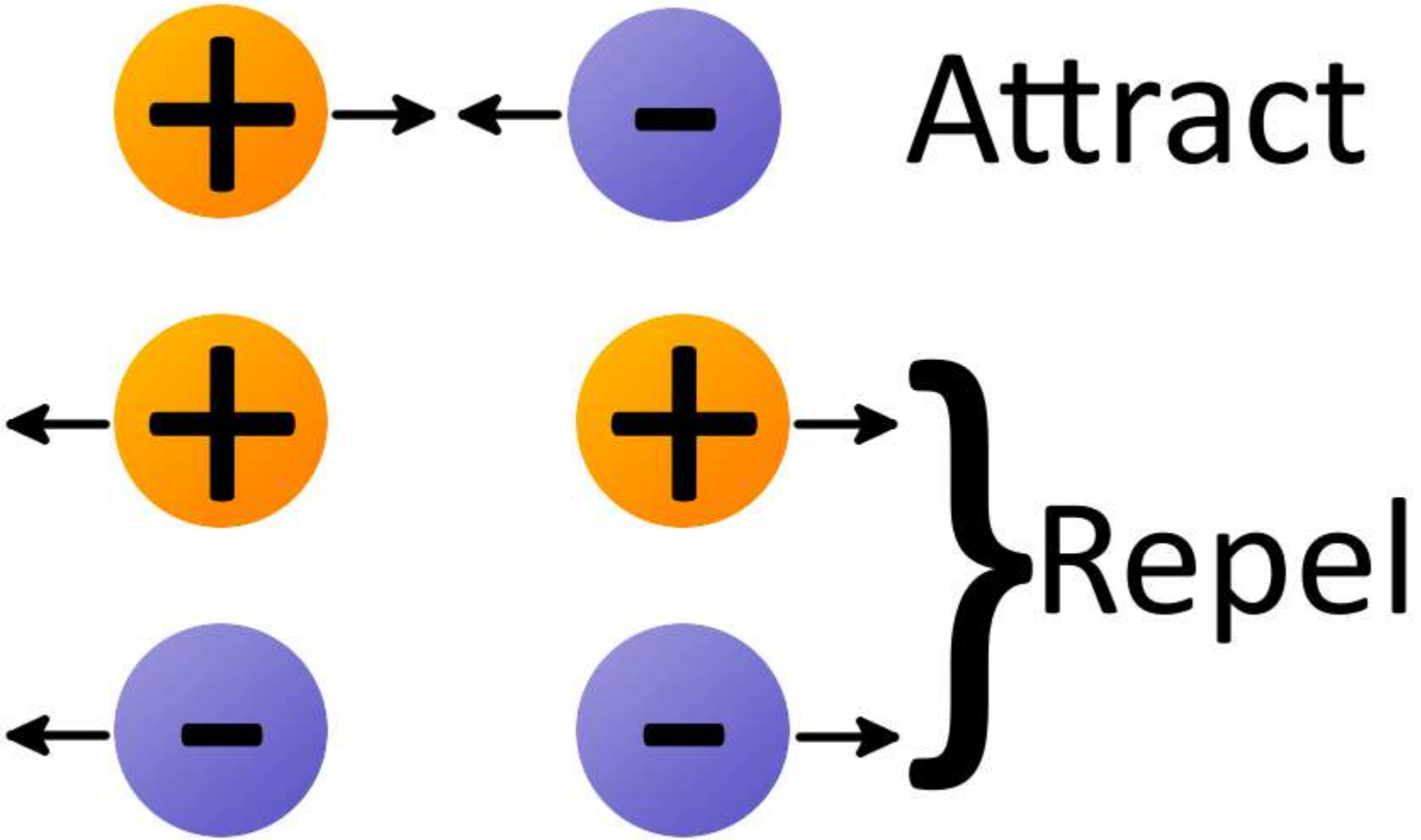
Each object exerts a force on the other object. These forces push the objects apart.

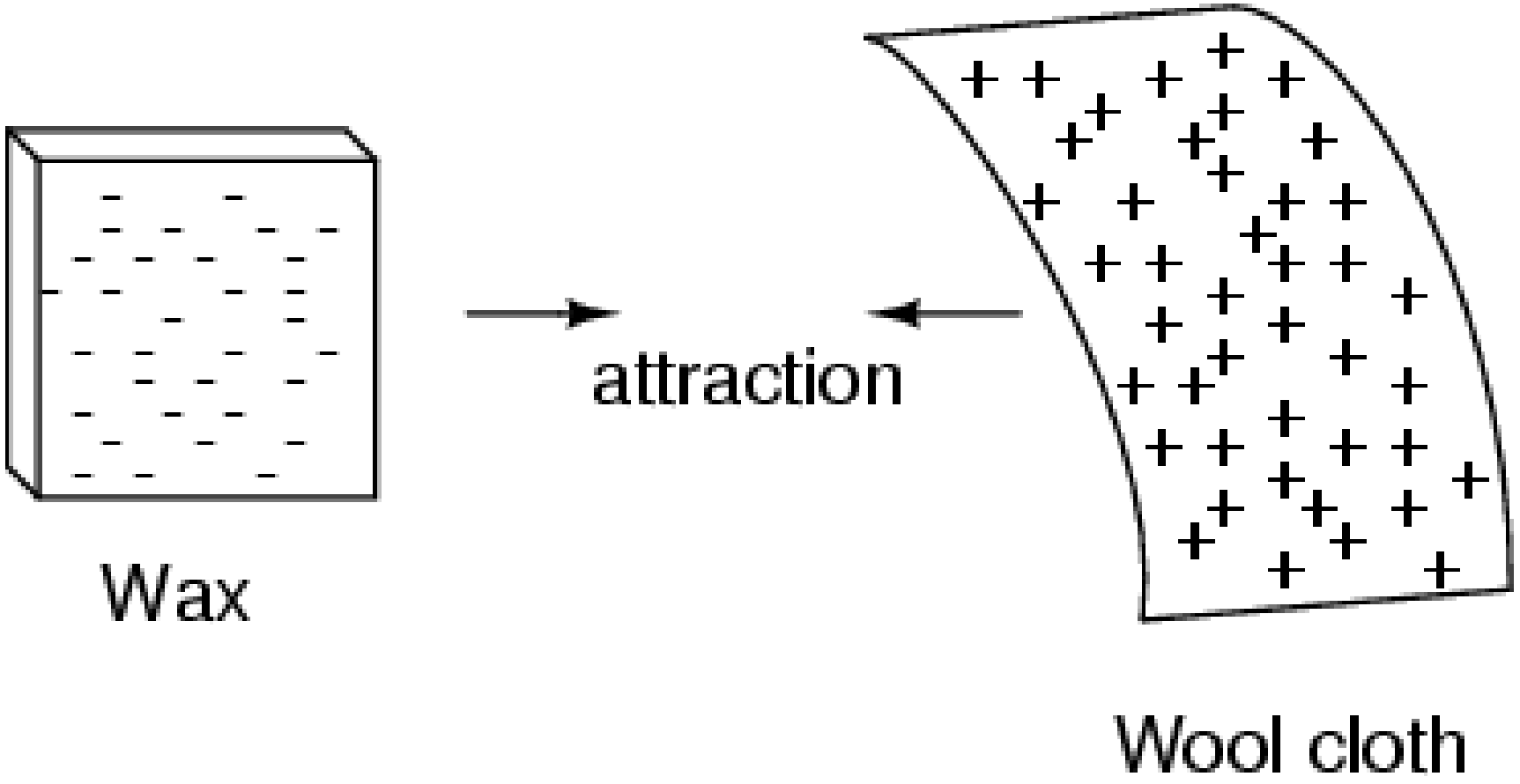


Objects that have opposite charges are attracted to each other.

Each object exerts a force on the other object. These forces pull the objects together.

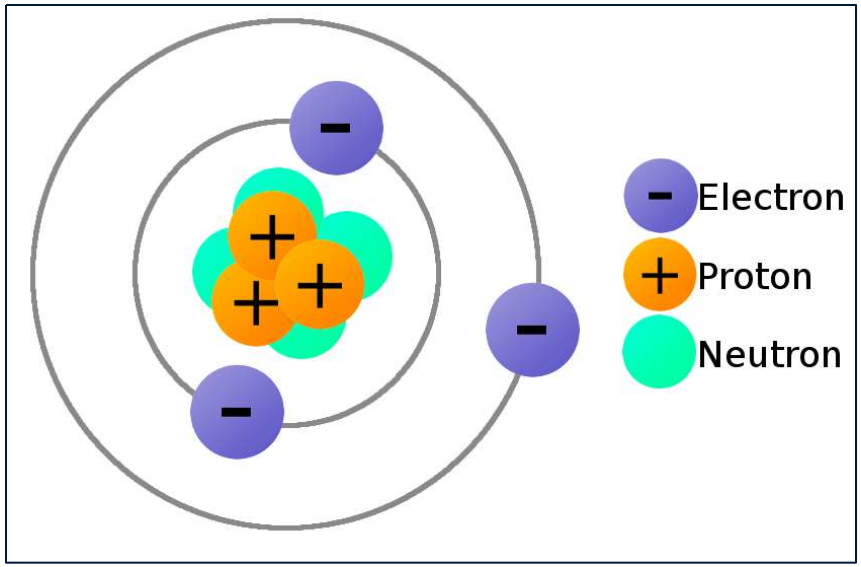
Charges Exert Forces



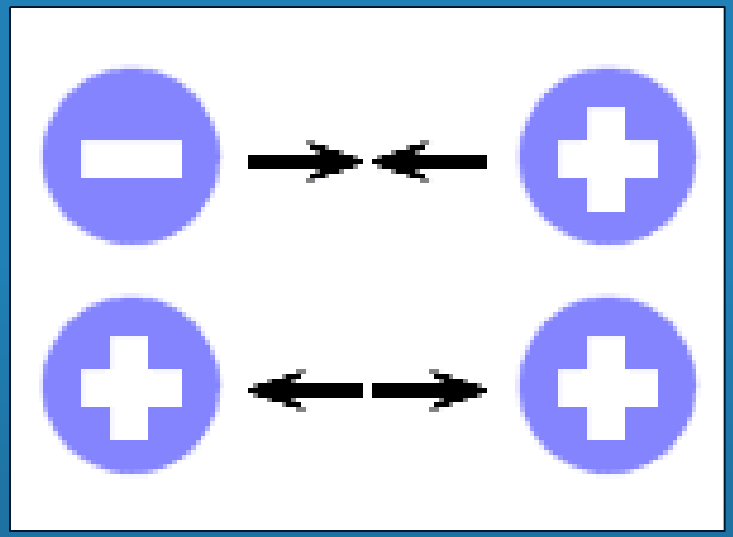

attraction
Wax
Wool cloth

In atoms, protons are positively charged.
Electrons are negatively charged.

Because protons and electrons have opposite charges, they are attracted to each other. Without this attraction, electrons would fly away from the nucleus of an atom.



Attract or Repel Activity



Make an Electroscope

[optional: see resources]

An electroscope is a device used to see if an object is charged. However, it cannot show whether the charge is positive or negative.

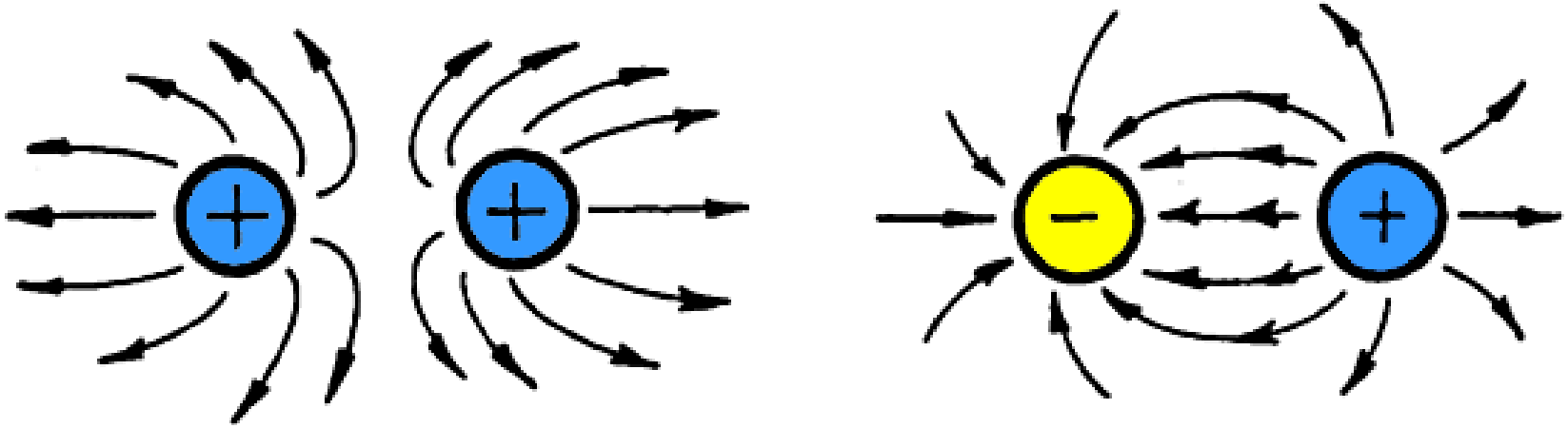
The force between charged objects is an electric force.

*The greater the charges are, the greater the electric force is between objects.

*The closer together the charges are, the greater the electric force is between objects.

Charged things have an electric field around them.

A charged object in the electric field of another charged object is attracted or repelled by the electric force acting on it.

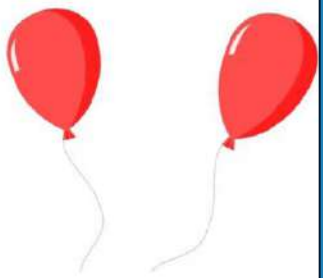


Electricity is simply the presence and/or flow of electric charges.

Formative Assessment Check

Electric Charges Formative Assessment Check #1 Name _____ Date ____

Use the image to the right to answer questions 1-2.



1. Do the balloons have the same charge or opposite charges? Explain.

_____

_____

2. How would the image look if each balloon were given the charge opposite to the charge it has now? Explain.

_____

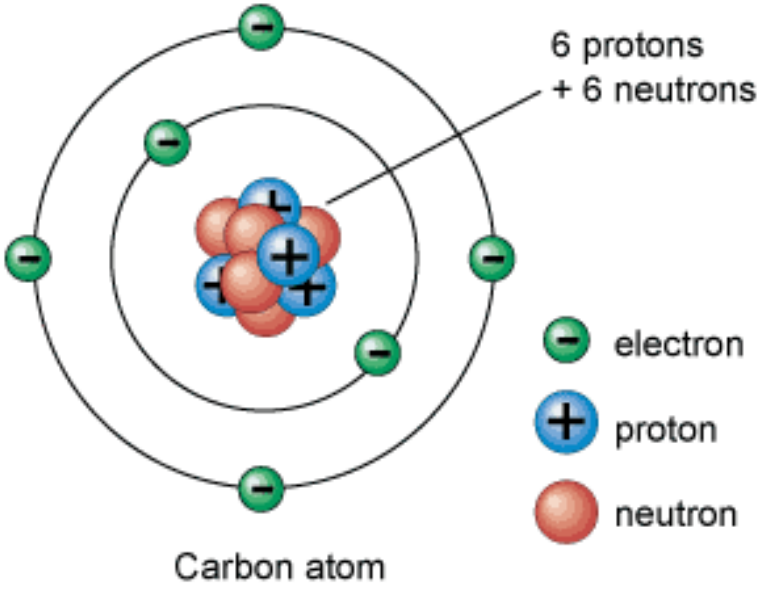
_____

3. Briefly explain the relationship between charge and force.

_____

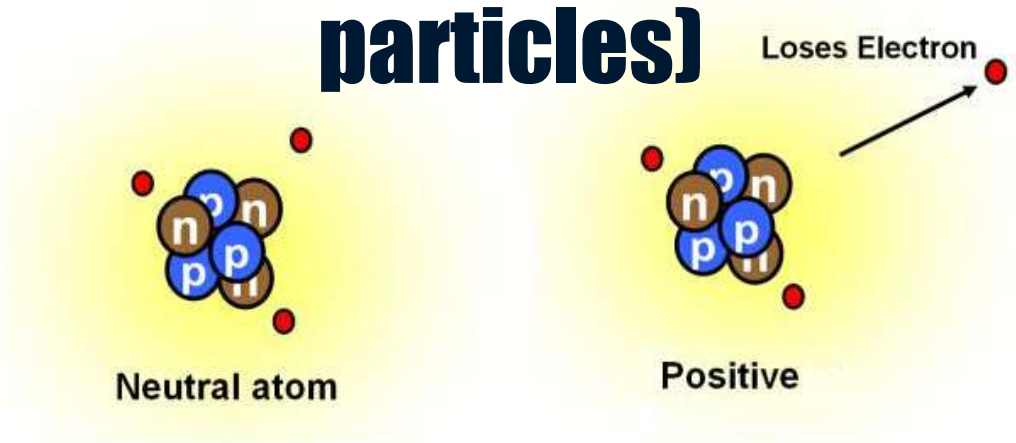
_____

Atoms have equal numbers of protons and electrons. Because an atom's positive and negative charges cancel each other out, atoms do not have a charge.

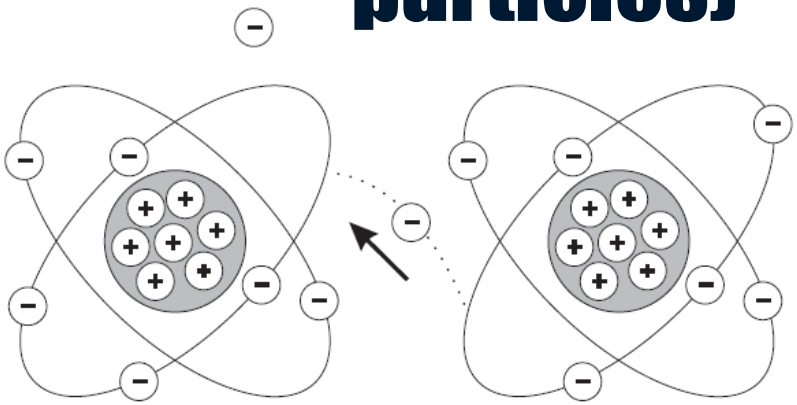


So, how can anything made of atoms be charged?

An object becomes positively charged when it loses electrons (more positive particles)



An object becomes negatively charged when it gains electrons (more negative particles)



Electrical Charges Worksheet

Name: _____

Electrical Charges

If an object has more positive charges (⊕) than negative charges (⊖), its electrical charge is positive (⊕).

If an object has more negative charges (⊖) than positive charges (⊕), its electrical charge is negative (⊖).

If an object has the same number of positive (⊕) and negative (⊖) charges, it has no electrical charge or is neutral.

Example:

Electrical charge: positive charge

Count the positive and negative charges in each picture. Write *positive charge*, *negative charge*, or *no charge* on each line.

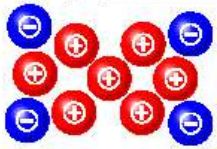
1.

electrical charge: _____

2.

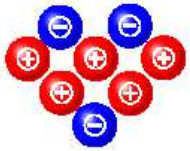
electrical charge: _____

3.



electrical charge: _____

4.



electrical charge: _____

5.

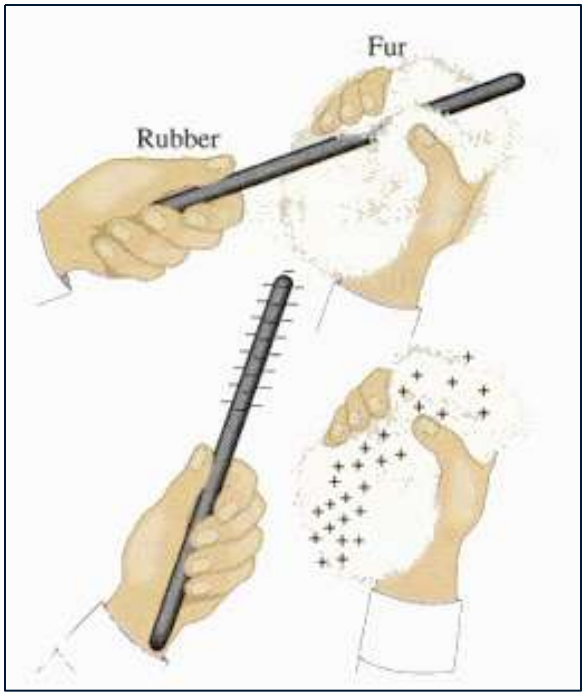
electrical charge: _____

6.

electrical charge: _____

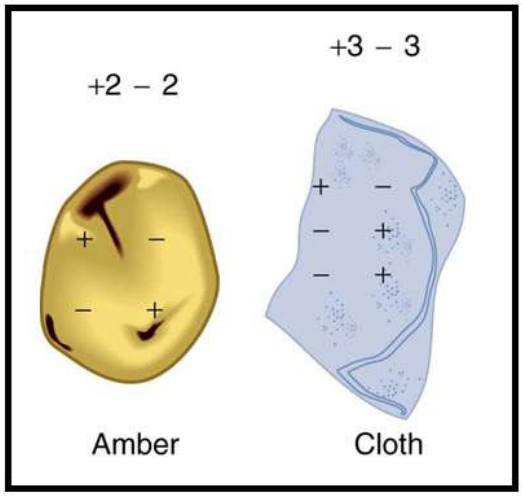
Super Teacher Worksheets - *www.superteacherworksheets.com*

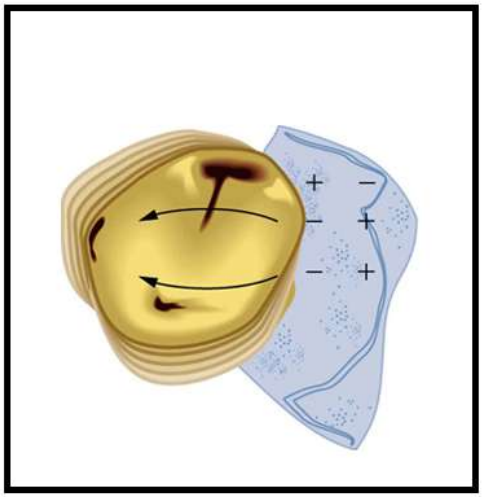
(a) Objects can be charged when electrons are "wiped" from one object onto another (friction).

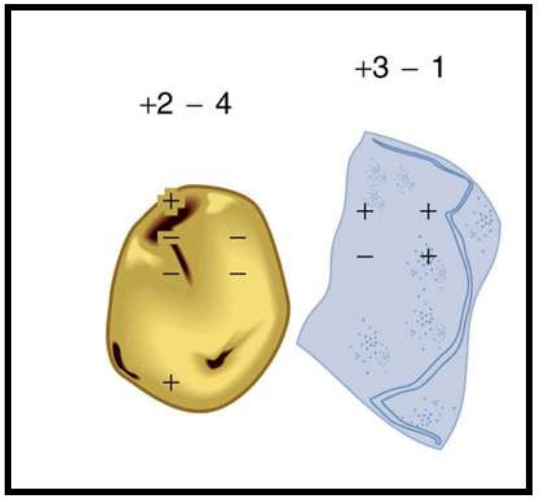


http://phet.colorado.edu/sims/html/balloons-and-static-electricity/latest/balloons-and-static-electricity_en.html

Charge by Friction

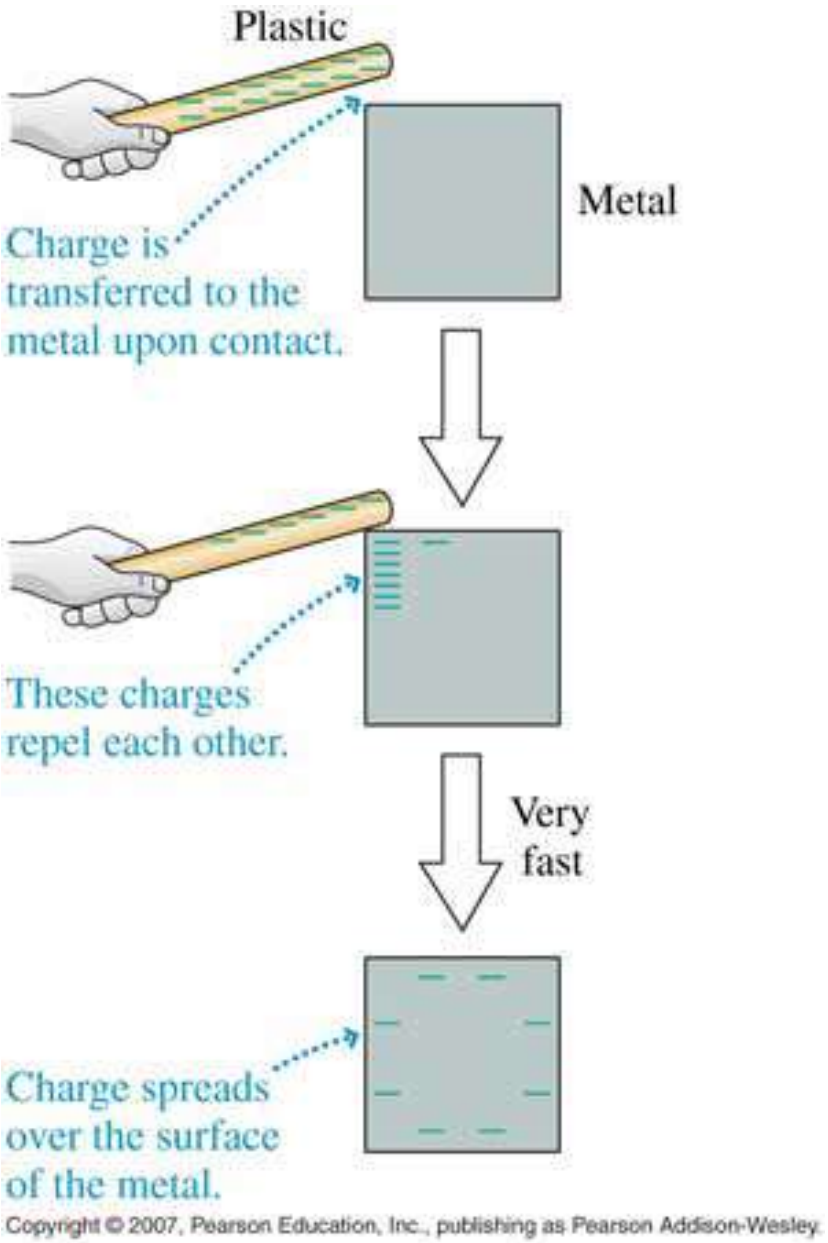






What's the electric charge of the amber after being rubbed by the cloth? What about the cloth?

(b) Objects can be charged when electrons move from one object to another by direct contact (conduction).

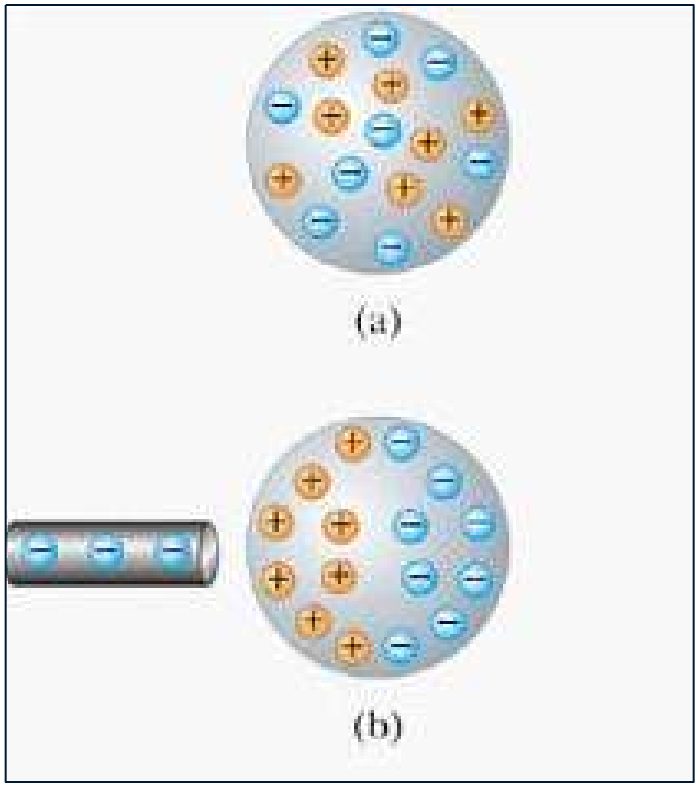


A Van de Graaff generator is a machine that continuously produces a charge on its domed metal surface.

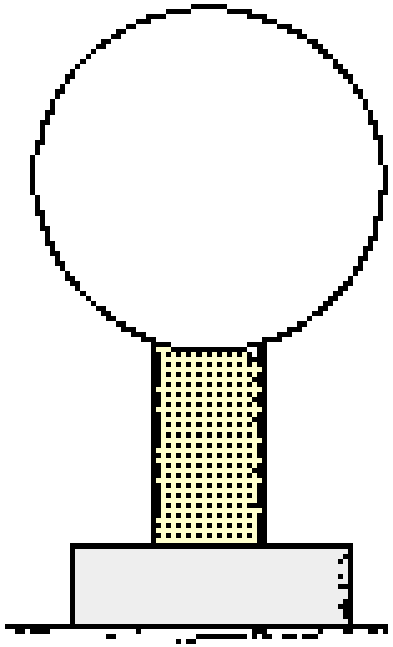
If you have your hands on the dome, electrons will transfer between you and the dome by conduction, causing your hair to stand on end! Your hair becomes charged, and the like-charged strands of hair repel each other.

https://www.youtube.com/watch?v=jZEFuCxD7BE

(c) Objects can be charged when charges in an uncharged metal object are rearranged without direct contact with a charged object (induction).

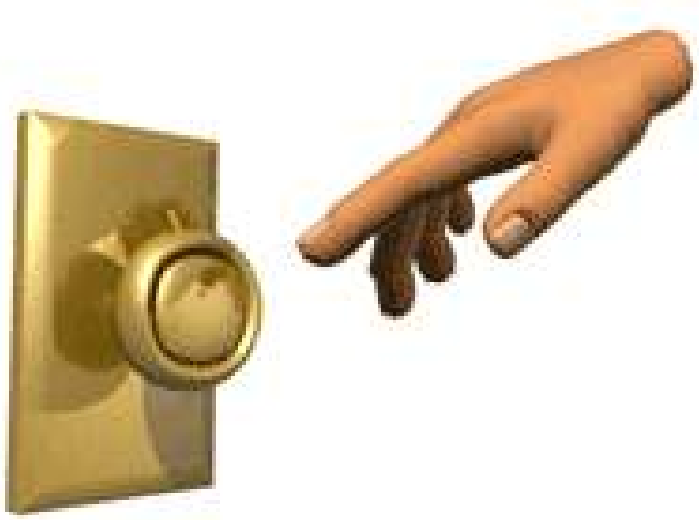


https://www.youtube.com/watch?v=VhWQ-r1LYXY



A negatively charged object is brought near to a neutral, conducting sphere. Electrons in the sphere are forced from the left side of the sphere to the right side.

Remember our question earlier about reaching out to open a door and getting shocked? What about the “fire starting” activator?

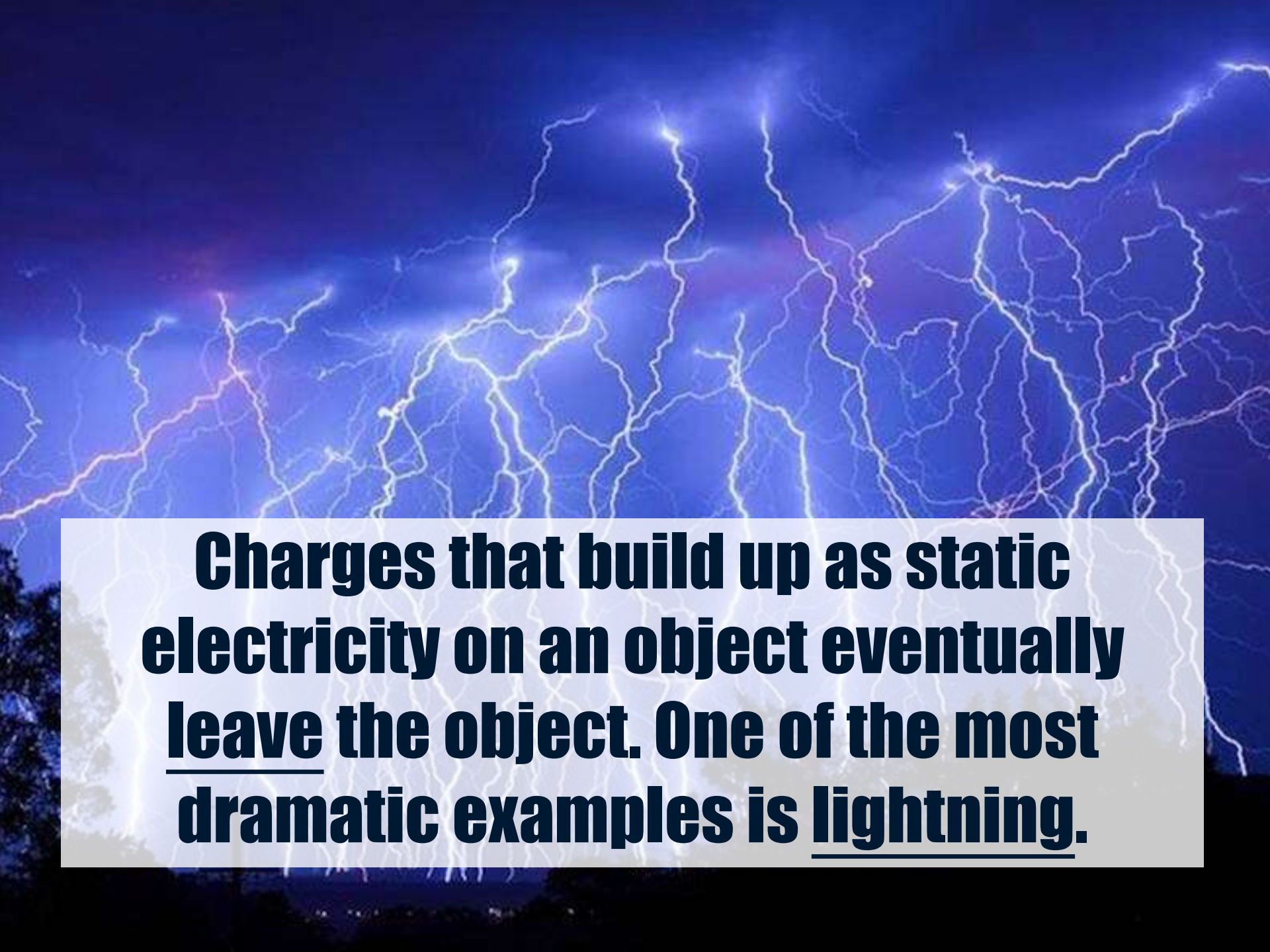


It all goes back to electrical charges and something called static electricity.

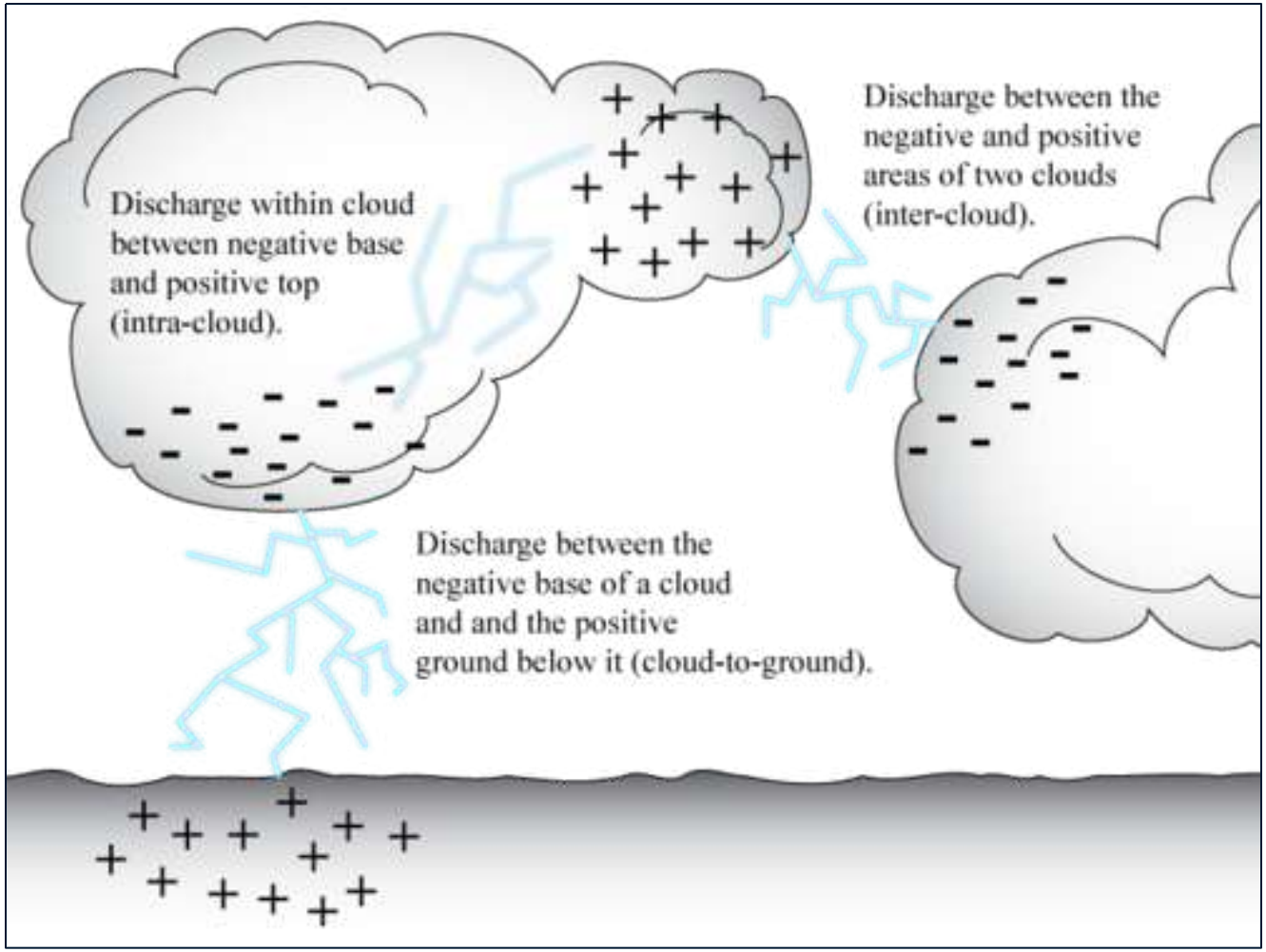
Static Electricity is an electric charge at rest; generally produced by friction or induction.

The charges of static electricity do not move away from the object that they are in. So, the object keeps its charge.

Your clothes are charged by friction as they rub against each other inside a dryer. As the clothes tumble, negative charges are lost by some clothes and build up on other clothes.



Charges that build up as static electricity on an object eventually leave the object. One of the most dramatic examples is lightning.


Discharge within cloud between negative base and positive top (intra-cloud).
Discharge between the negative and positive areas of two clouds (inter-cloud).
Discharge between the negative base of a cloud and and the positive ground below it (cloud-to-ground).

Shocking yourself on a door knob is a smaller example of built up static electricity being released.

http://phet.colorado.edu/sims/html/john-travoltage/latest/john-travoltage_en.html

http://www.classzone.com/books/ml_science_share/vis_sim/emm05_pg7_charge/emm05_pg7_charge.html

Review of Big Concepts:

- Like charges repel and opposite charges attract.
- The size of the electric force between two objects depends on the size of the charges exerting the force and the distance between the objects.
- Charged objects exert a force on each other and can cause each other to move.

Review of Big Concepts:

- Objects become charged when they gain or lose electrons.
- Objects may become charged by friction (rubbing), conduction (direct contact), or by the rearrangement of charges without direct contact (induction).
- Static electricity is the buildup of electric charges on an object that are eventually released.

Study Jams: Electricity

Activities to demonstrate Electric Charges [see resources]

- Bend Water with Static Electricity or watch the video clip: https://www.youtube.com/watch?v=dr1mBPySz7U
- Electric Gelatin
- Static Roll
- Electrical Fleas or Snap Crackle Jump
- Charge and Carry

In the Energy unit, you learned that electricity is a form of energy. You also learned that some materials transfer energy more easily than others.

Turn to a seat partner and identify the types of material that transfer energy easily and their name; as well as, the types of material that do not transfer energy easily and their name.

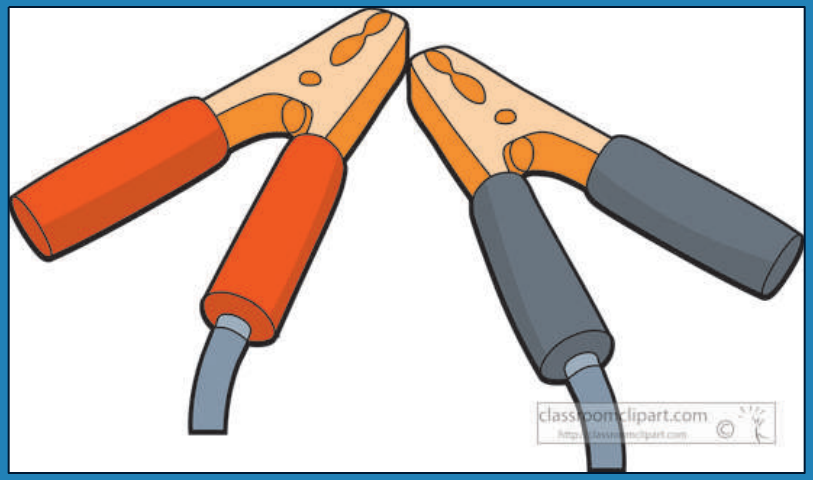
Electrical Conductors

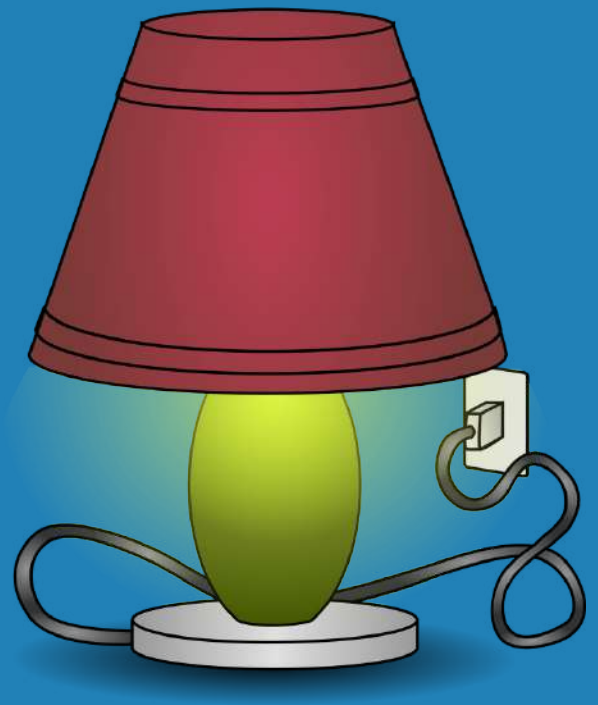
- An electrical conductor is a material in which charges can move easily.
- Most metals are good conductors because some of their electrons are free to move.
- Copper, aluminum, and mercury are good conductors.

Electrical Insulators

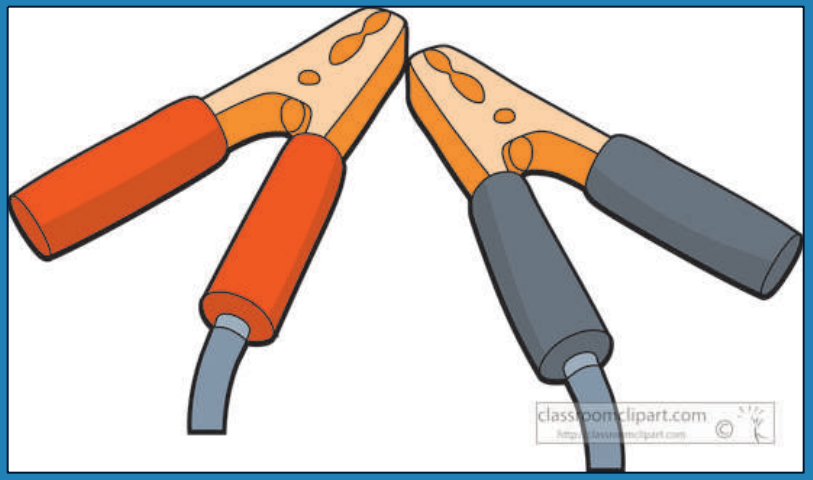
- An electrical insulator is a material in which charges cannot move easily (their electrons cannot flow freely).
- Plastic, rubber, glass, wood, and air are good insulators.

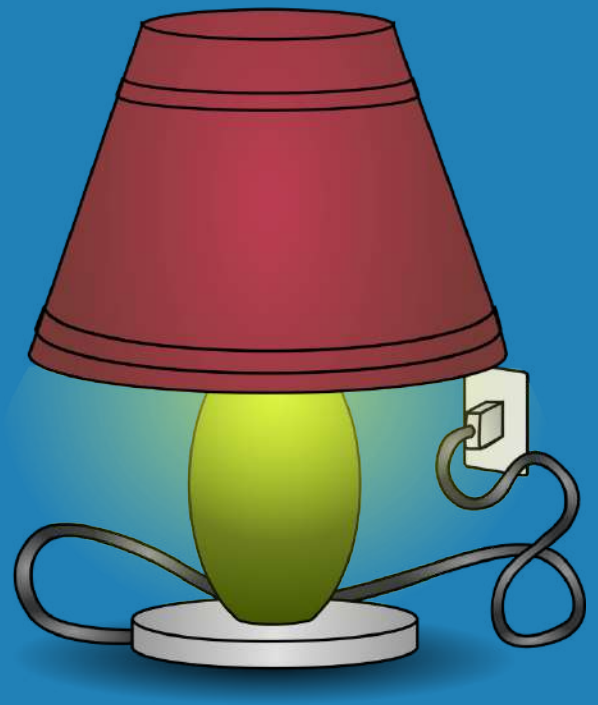
Explain why jumper cables and a lamp cord are made of both metal, a conductor, and plastic, an insulator.





The metal easily carries the electric charges while the plastic keeps the charges away from your hands.





Electron Interview

[if time allows]

Electric Ilustrations

[if time allows]

Electric Charge Summarizer

Name _____ Date _____

Use the following words to write at least four sentences describing how electric charges exert force on each other: electric charge, electron, positive charge, negative charge, attract, repel, conductor, insulator.

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____