

STEAM Lab: Exploring Static Electricity

Grade Level:	Time Frame:
3rd Grade 5th Grade 8th Grade	50 Minutes
Standards (ALCOS Science):	
<p>3) Motion and Stability: Forces and Interactions Explore objects that can be manipulated in order to determine cause-and-effect relationships (e.g., distance between objects affecting strength of a force, orientation of magnets affecting direction of a magnetic force) of electric interactions between two objects not in contact with one another (e.g., force on hair from an electrically charged balloon, electrical forces between a charged rod and pieces of paper) or magnetic interactions between two objects not in contact with one another (e.g., force between two permanent magnets or between an electromagnet and steel paperclips, force exerted by one magnet versus the force exerted by two magnets).</p> <p>3) Matter and Its Interactions Examine matter through observations and measurements to identify materials (e.g., powders, metals, minerals, liquids) based on their properties (e.g., color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, solubility, density).</p> <p>12) Motion and Stability: Forces and Interactions Construct an argument from evidence explaining that fields exist between objects exerting forces on each other (e.g., interactions of magnets, electrically charged strips of tape, electrically charged pith balls, gravitational pull of the moon creating tides) even when the objects are not in contact.</p>	
Objectives:	

Made Possible By:



<http://alcse.org/education>

Students will manipulate various materials to explore the interactions between objects and how static electricity can be conducted through fields that exist between objects exerting force on each other.

Students will understand basic properties that give certain materials the ability to conduct electricity or be manipulated by static electricity because of the atomic forces within the materials itself and the cause and effect relationship between to different interacting objects.

Background Information:

All physical objects are made up of something called **atoms**. Look at a balloon. We see a balloon but what we don't see is that the balloon is made of many tiny atoms. Inside each atom are even tinier things we can't see, called **protons** and **electrons**. Protons have a **positive** charge. Electrons have a **negative** charge. Positives and negatives are **opposites**. Opposite charges are attracted to each other and cause something called **static electricity**.

Even when not physically touching, fields exist between objects exerting force on each other. For example, the **moon** has gravitational pull on the **earth** which produces tides like a balloon charged with static **electricity** has an effect on surroundings objects.

Materials:

- This lab should be set up into 4 activity stations. Each station should have 1 or 2 sets of the supplies depending on the number of students in the class. For example, when divided into groups there should not be more than 2 or 3 students to each set of supplies.
- EACH STUDENT should have a double-sided copy of the file:
 - "Lab Report A-Exploring Static Electricity"
 - Suggested for 3rd and 5th grade
 - "Lab Report B-Exploring Static Electricity"
 - Suggested for 8th grade
- EACH STATION should have a double-sided, cut-out station card
 - "Set A-Static Electricity Station Cards"
 - Has only words and is suggested for 3rd and 5th grades
 - "Set B-Static Electricity Station Cards"
 - Has diagrams and is suggested for 8th grade

Station 1:

- Printed and cut out Station 1 card from file, "Static Electricity Station Cards"
- 1 inflated balloon
- 1 piece of flannel fabric, if possible, taped to a vertical surface

Station 2:

- Printed and cut out Station 2 card from file, “Static Electricity Station Cards”
- 1 inflated balloon
- 1 piece of flannel fabric
- 1 aluminum can, empty and clean
- A few strips of aluminum foil

Station 3:

- Printed and cut out Station 3 card from file, “Static Electricity Station Cards”
- Tissue paper (like paper used to stuff gift bags) cut into 6-10 small pieces
- 1 small plastic comb

Station 4:

- Printed and cut out Station 4 card from file, “Static Electricity Station Cards”
- Tape
- Scissors
- Door Frame
- Two Balloons
- String/Thread
- Flannel fabric

Engage (5 minutes):

Version 1 (3rd Grade):

1. Students should be given a printed double-sided copy of the “Lab Report A-Static Electricity.”
2. Students should use prior knowledge to read and discuss aloud the fill-in-the-blanks to the “Background Information Section.” Use the [Background Information](#): above to complete the answers and the teacher may want to write answers on the board.
3. Students should color the protons (+’s) one color and the electrons (-’s) another color on the diagrams including the proton and electron in the “Atom” diagram.

Version 2 (5th Grade):

1. Students should be given a printed double-sided copy of the “Lab Report A-Static Electricity.”
2. Students should use prior knowledge to read and discuss aloud the fill-in-the-blanks to the “Background Information Section.” Use the [Background Information](#): above to complete the answers and the teacher may want to write answers on the board.
3. Students should color the protons (+’s) one color and the electrons (-’s) another color on the diagrams including the proton and electron in the “Atom” diagram.

Version 3 (8th Grade):

1. Students should be given a printed double-sided copy of the “Lab Report B-Static Electricity.”
2. Students should use prior knowledge to read and discuss aloud the fill-in-the-blanks to the “Background Information Section.” Use the **Background Information:** above to complete the answers and the teacher may want to write answers on the board.
3. Students should color the protons (+’s) one color and the electrons (-’s) another color on the diagrams including the proton and electron in the “Atom” diagram.
4. Students should draw arrows on the same diagrams to show forces being exerted on the protons and electrons.

Explore (35 minutes):

Version 1 (3rd Grade):

- Students should view various materials that they will use during their 4 station experiments and consider their prior knowledge on these items and the “Background Information” they have completed in their lab report.
- Students should develop an “Essential Question” stating what they want to learn from the experiments and record in their Lab Report. (Consider **cause and effect relationships** as listed in ALCOS science standard 3).
- Students should develop a “Hypothesis” based on the materials and their Essential Question.
- Students should rotate to each station following the instructions on each of the “Static Electricity Station Cards.” They should have about 5-6 minutes at each station.
- Students should record their observations at each station by drawing/writing in the “Data” section of their Lab Report.

Version 2 (5th Grade):

1. Students should view various materials that they will use during their 4 station experiments and consider their prior knowledge on these items and the “Background Information” they have completed in their lab report.
2. Students should develop an “Essential Question” stating what they want to learn from the experiments and record in their Lab Report. (Consider **materials based on their properties such as electrical conductivity** as listed in ALCOS science standard 3).
3. Students should develop a “Hypothesis” based on the materials and their Essential Question.
4. Students should rotate to each station following the instructions on each of the “Static Electricity Station Cards.” They should have about 5-6 minutes at each station.
5. Students should record their observations at each station by drawing/writing in the “Data” section of their Lab Report.

Version 3 (8th Grade):

1. Students should view various materials that they will use during their 4 station experiments and consider their prior knowledge on these items and the “Background Information” they have completed in their lab report.

2. Students should develop an “Essential Question” stating what they want to learn from the experiments and record in their Lab Report. (Consider **fields that exist between objects that exert forces on each other** as listed in ALCOS science standard 12).
3. Students should develop a “Hypothesis” based on the materials and their Essential Question.
4. Students should rotate to each station following the instructions on each of the “Static Electricity Station Cards.” They should have about 5-6 minutes at each station.
5. Students should record their observations at each station by drawing/writing in the “Data” section of their Lab Report.

Evaluate (10 minutes):

Version 1 (3rd Grade):

1. Students should discuss aloud the **cause and effect relationships** of the materials and procedures of their experiments.
2. Students should review their Essential Question and their Hypothesis.
3. Students should record their results and concluding thoughts in the “Results/Conclusion” section of their Lab Report.

Version 2 (5th Grade):

1. Students should discuss aloud the details of **materials based on their properties such as electrical conductivity** applied to the materials and procedures of their experiments.
2. Students should review their Essential Question and their Hypothesis.
3. Students should record their results and concluding thoughts in the “Results/Conclusion” section of their Lab Report.

Version 3 (8th Grade):

1. Students should discuss aloud the details of **fields that exist between objects that exert forces on each other** applied to the materials and procedures of their experiments.
2. Students should review their Essential Question and their Hypothesis.
3. Students should construct an argument that uses evidence to explain that fields exist between objects even when they are not physically touching and record in the “Results/Conclusion” section of their Lab Report.

Resources

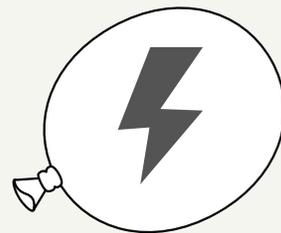
<https://byjus.com/physics/electric-charge-and-static-electricity/>

<https://www.science-sparks.com/what-is-static-electricity/>

<https://www.fizzicseducation.com.au/150-science-experiments/electricity-experiments/electrostatic-socks-can-attract/>

<https://www.superteacherworksheets.com/electricity/static-balloons.pdf>

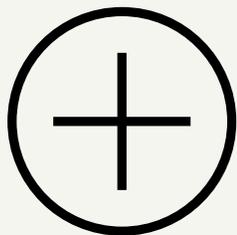
Lab Report: Exploring Static Electricity



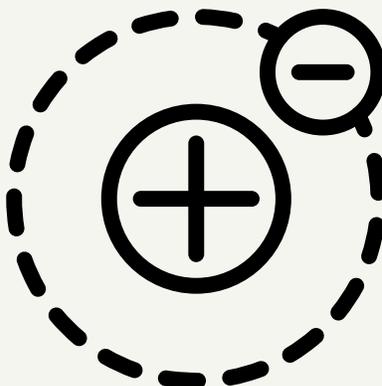
Background Information:

All physical objects are made up of something called _____. Look at a balloon. We see a balloon but what we don't see is that the balloon is made of many tiny atoms. Inside each atom are even tinier things we can't see, called _____ and _____. Protons have a _____ charge. Electrons have a _____ charge. Positives and negatives are _____. Opposite charges are attracted to each other and cause something called _____.

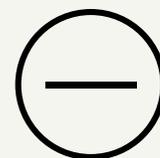
Proton



Atom



Electron



Essential Question:

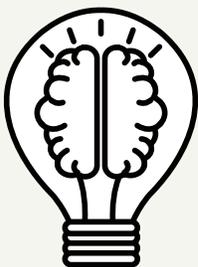
(What do we want to learn from our experiment?)



Hypothesis:

I think _____ will _____

because _____



Scientist Name: _____ Date of Data Collection: _____

Data:

(Record your observations for each experiment.)

Station 1

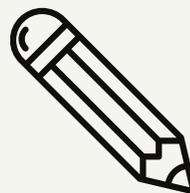
Station 2

Station 3

Station 4

Results/Conclusion:

(What did you learn from your experiments?)



Station 1

1. Rub the balloon against the piece of fabric about ten times.
2. Hold the balloon against the fabric.
3. Let go of the balloon. What happens? Does it stick?
4. Try the same thing rubbing the balloon against your shirt. Let go and see what happens.
5. Record your observations.

Station 2

1. Rub the balloon against the fabric or against your shirt around ten times.
2. Hold the balloon close to the aluminum can and watch what happens.
3. Move the balloon slowly away from the can and watch what happens.
4. Record your observations.

Station 3

1. Put the pieces of tissue paper on the table in front of you.
2. Charge up the comb by rubbing it against the fabric or your shirt about ten times.
3. Hold the comb over the small pieces of tissue paper.
4. Record your observations.

Station 4

1. Cut two equal lengths of thread/string and tape them to the top of a door frame in the middle about 1 inch or 2.5 cm apart.
2. Tie each of the balloons to the end of each thread/string so that they are hanging at the same height and are resting next to each other.
3. Rub each of the balloons with the fabric to charge them (one at a time).
4. Let each balloon go and record your observations.
5. Put your hand between the balloons and record your observations.

Fact Check!

When a balloon and a wool or nylon fabric are rubbed together; each will get a different type of electrical charge.

The balloon becomes a negative charge and the fabric becomes a positive charge.

Opposite charges are attracted to each other.

Fact Check!

The can moves toward the balloon.

This is because the balloon has been charged and pulls on the can; which is uncharged.

Opposite charges are attracted to each other.

Fact Check!

The tissue paper was pulled up by the comb.

The comb was charged and the paper was uncharged.

Opposite charges are attracted to each other.

Fact Check!

Both of the balloons became negatively charged once they were rubbed with the fabric.

Because they are both negatively charged, instead of being attracted to each other, they pushed each other away.

Items that are made up of the same material will always take on the same charge.