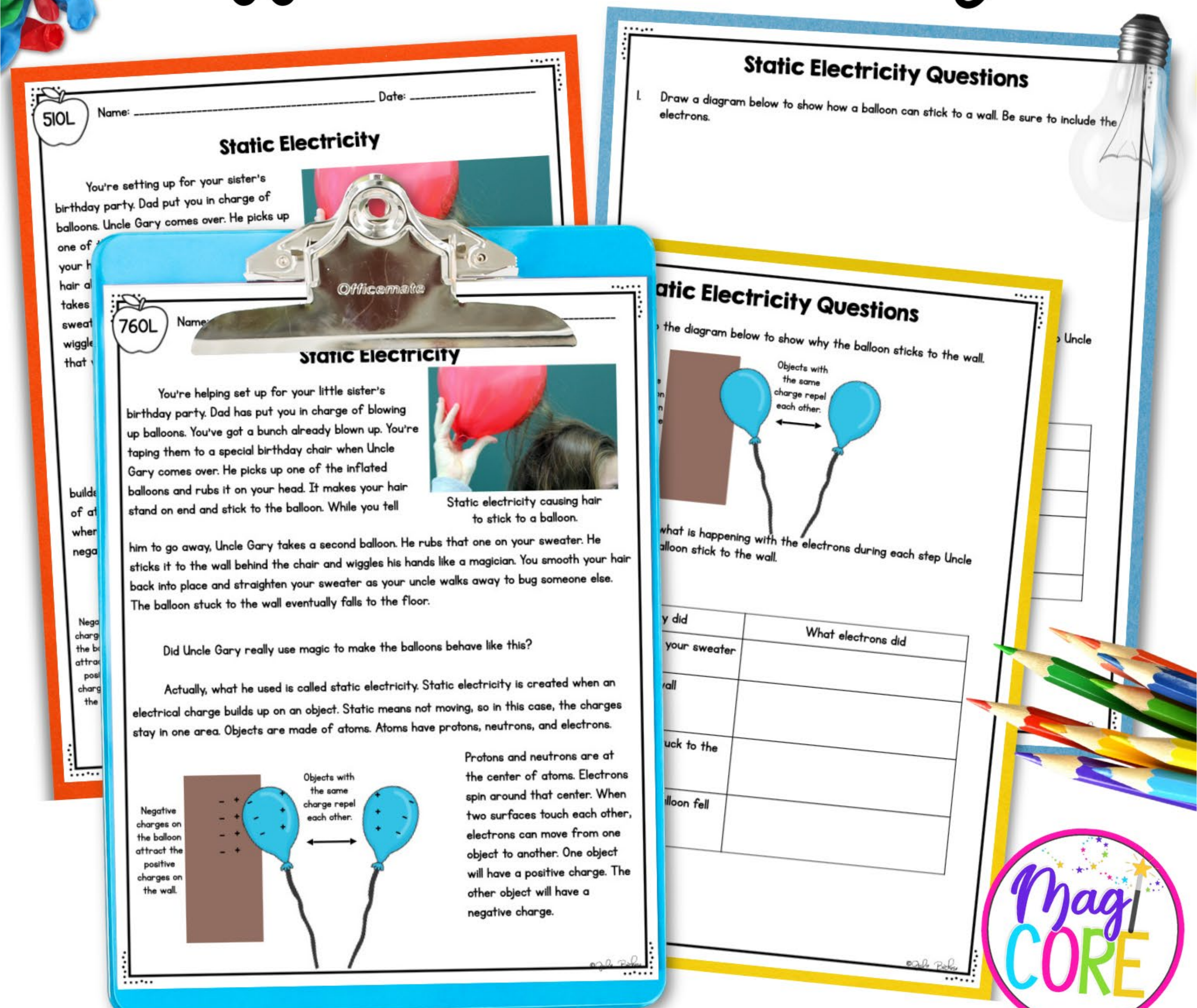
# ELECTRIC AND MAGNETIC FORCES

## differentiated passages

LEXILE




**3rd Grade NGSS 3-PS2-3**

# ABOUT LEXILE LEVELS

MagiCore Learning, LLC is a certified Lexile® Partner. These texts are officially measured and approved by Lexile and MetaMetrics® to ensure appropriate rigor and differentiation for students.

The Lexile Framework® for Reading measures are scientific, quantitative text levels. When the Lexile of a text is measured, specific, measurable attributes of the text are considered, including, but not limited to, word frequency, sentence length, and text cohesion. These are difficult attributes for humans to evaluate, so a computer measures them.

Common Core State Standards uses Lexile level bands as one measure of text complexity. Text complexity ranges ensure students are college and career ready by the end of 12th grade. Lexile measures help educators scaffold and differentiate instruction as well as monitor reading growth.

| Grade Band | Lexile® Bands Aligned to Common Core Expectations |
| --- | --- |
| K-1 | N/A |
| 2-3 | 420L-820L |
| 4-5 | 740L-1010L |
| 6-8 | 1185L-1385L |

Keep in mind when using any leveled text that many students will need scaffolding and support to reach text at the high end of their grade band. According to Appendix A of the Common Core Standards, "It is important to recognize that scaffolding often is entirely appropriate. The expectation that scaffolding will occur with particularly challenging texts is built into the Standards' grade-by-grade text complexity expectations, for example. The general movement, however, should be toward decreasing scaffolding and increasing independence both within and across the text complexity bands defined in the Standards."

# Electric and Magnetic Forces

## 3rd grade

# Table of Contents



Each passage set includes two differentiated passages on a third-grade level (one at the beginning of the band, one towards the end) and a question set geared towards comprehension and science mastery. The first question is differentiated to include a fill-in-the-blank diagram (lower complexity) or an open-ended diagram (higher complexity).

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# How to Use This Resource

This resource was created with the NGSS Science Standards in mind. It includes seven differentiated passages aligned to the following standard:

***3-PS2-3: Electric and Magnetic Forces***

Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.

**Clarification Statement:** Examples of an electric force could include the force on hair from an electrically charged balloon and the electrical forces between a charged rod and pieces of paper. Examples of a magnetic force could include the force between two permanent magnets, the force between an electromagnet and steel paperclips, and the force exerted by one magnet versus the force exerted by two magnets. Examples of cause and effect relationships could include how the distance between objects affects the strength of the force and how the orientation of magnets affects the direction of the magnetic force.

**Assessment Boundary:** Assessment is limited to forces produced by objects that can be manipulated by students, and electrical interactions are limited to static electricity.

**Here are some suggestions for using these passages:**

- Use as independent work after you have taught an overview of this standard. Assign the different levels based on the passage students can read and comprehend independently.
- Use as a reading center to reinforce key comprehension and science concepts at the same time!
- Use as a homework or review packet.
- Use as an intervention for students who need to revisit science concepts.

480L

Name: ____________________________________________ Date: ______________________

# Electricity

Do you like watching TV? Do microwaves make your life easier? You depend on electricity if you answered yes. Electricity provides energy.

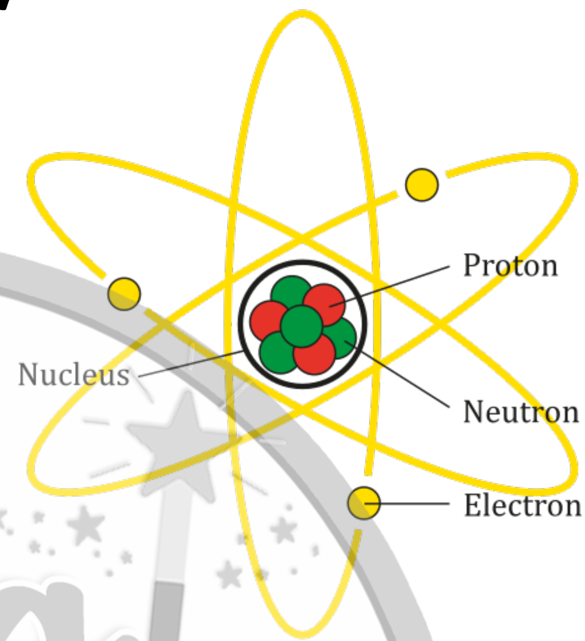


**Diagram of an atom.**

Everything is made of atoms. **Protons**, **electrons**, and **neutrons** are inside atoms. Protons have positive **charges**. Electrons are negative. Neutrons have no charge. Protons and neutrons are in the center of the atom. Electrons spin around the center. The positive charges attract the negative charges. This keeps the electrons from flying out of the atom.

Some electrons can be freed from an atom. A force releases them. The electrons then move to another atom. Electricity is made when electrons move between atoms. Moving electrons makes an electric **current**. This current travels through an electric **circuit**. A circuit is a path for electricity.

Electric current can be measured. Ohm's Law is used. Georg Simon Ohm was a German scientist. He studied current. He examined the force creating the flow of electrons. He also looked at the force working to stop the flow. Ohm figured out how these are related. He said the **voltage** of the power source equals the current multiplied by the **resistance**. Ohm's Law is a part of many devices. Ceiling fans use Ohm's law. Electric heaters also use Ohm's Law. This law allows people to better understand electricity.

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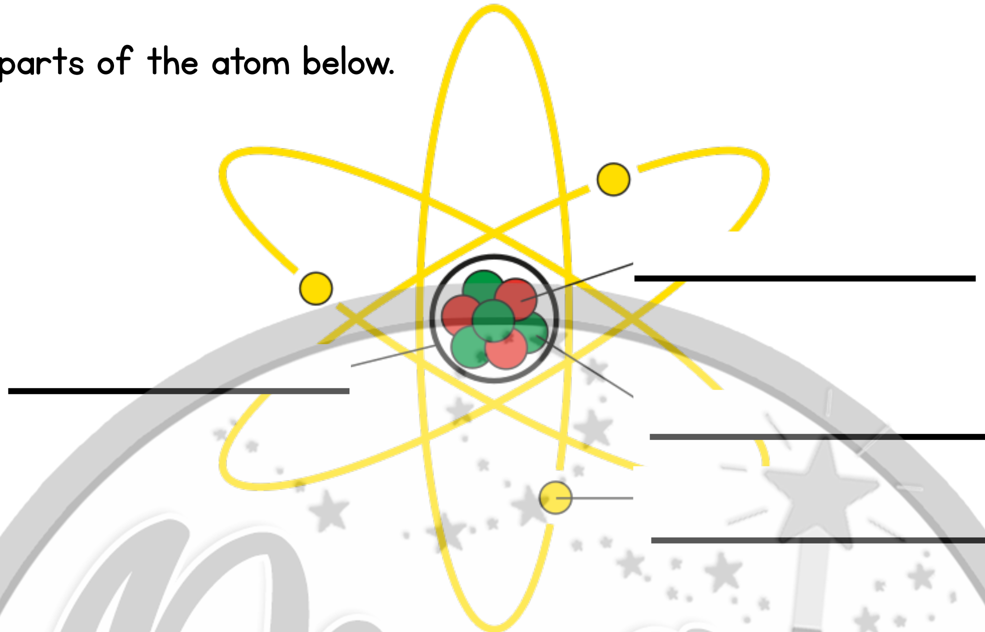
# Electricity Questions

1. Label the parts of the atom below.



2. Describe how protons, neutrons, and electrons work together to keep electrons from flying out of the atom.

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3. What happens with electrons to make electricity?

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4. Describe Ohm's Law. List 3 household items that use Ohm's Law.

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790L

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# Electricity

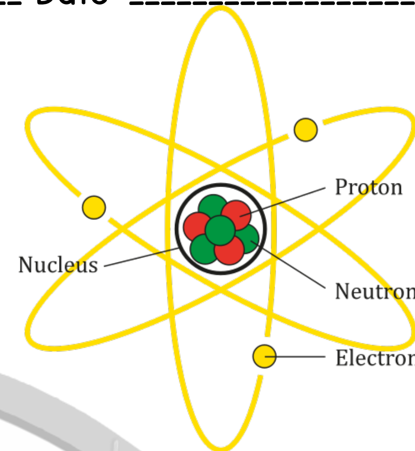

**Diagram of an atom.**

Do you enjoy watching TV? How much fun do you have playing games or learning on a computer? Do machines like microwaves make your life easier? If you answered yes to these questions, you depend on **electricity** in your life. Electricity provides energy.

Everything in the world is made of **atoms**. Tiny particles called **protons**, **electrons**, and **neutrons** are inside atoms. Protons have positive **charges**, while electrons are negative. Neutrons have no charge. Protons and neutrons are in the center of the atom. Electrons, however, spin around the center. The protons' positive charges attract the electrons' negative charges. This keeps the electrons from flying out of the atom.

If a force is applied to the atoms, though, some electrons can be released from it. These electrons then move to another atom. When electrons are moving from atom to atom, electricity is created. Many moving electrons make an electric **current**. This current travels through an electric **circuit**. A circuit creates a path for electricity. Circuits have a power source, such as a battery. They also have wires that carry the current from the power source to the item being powered, such as a light bulb. A switch controls the flow of electric current in a circuit.

Electric current can be measured using Ohm's Law. Georg Simon Ohm was a German scientist. In 1827, he figured out how current, the force creating the flow of electrons, and the force working to stop the flow are related. Ohm discovered that the **voltage** of the power source equals the current multiplied by the **resistance**. Ohm's Law is at work in devices such as ceiling fans, electric heaters, and cell phones. This law allows people to better understand and use electricity.

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# Electricity Questions

1. Draw and label the parts of an atom below.

2. Describe how protons, neutrons, and electrons work together to keep electrons from flying out of the atom.

______________________________________________________________________________

______________________________________________________________________________

______________________________________________________________________________

3. What happens with electrons to make electricity?

______________________________________________________________________________

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4. Describe Ohm's Law. List 3 household items that use Ohm's Law.

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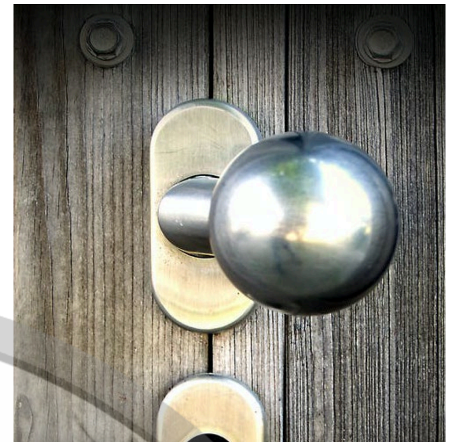
# Shocking!


Metal doorknob.

It's a cold Saturday morning during winter. You've been scuffling across the carpets in the house while wearing your cozy wool socks. What happens when you touch a doorknob?

*ZAP!*

You get a sudden shock when your hand makes contact with the metal doorknob. This doesn't seriously hurt you. It can be surprising and a little annoying, though. The reason this happens is because of **electrons**. Electrons, along with **protons** and **neutrons**, are found in **atoms**, the building blocks of everything in the world. Electrons are negatively charged, while protons have a positive **charge**. Neutrons have no charge. Protons and neutrons hang out at the center of atoms. Electrons circle the atom's center. They stay in the atom because they are attracted to the protons' positive charges. The atom has the same number of protons and electrons in this case. It's not positively or negatively charged.

When you travel across that carpet, however, your wool socks act as a **conductor**. Conductors allow electrons to move easily through them. You pick up extra electrons on your journey. You now have a negative charge. The doorknob you touch has a positive charge. This makes the extra electrons you've collected want to hop to the metal knob. Metal is also a good conductor. The small zap you feel is because of the quick movement of those electrons.

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There are a few conditions that made this "shocking" experience possible. First, the winter air is dry. Dry air makes it easier to build up electrons on your skin. Running a humidifier that will add moisture to the air can help lower the risk of getting shocked. Next, you're wearing wool, a material that conducts electricity. You can avoid shocks if you wear cotton socks or leather-soled shoes instead. Carrying around something metal can release the energy before it builds up, too. Dryer sheets can also collect the extra electrons, so they don't stick to you. These tips can help you stay zap-free.

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# Shocking! Questions

1. Draw the electrons to show why the girl was shocked in the diagram below:

2. What is a conductor?

________________________________________________

________________________________________________

________________________________________________

________________________________________________

3. What are some ways to prevent getting shocked by extra electrons? Explain how these solutions work.

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# William Gilbert

Painting of William Gilbert.

William Gilbert was born in England in 1544. He went to college at age 14. He earned three college degrees. He was the royal doctor for Queen Elizabeth I. Later, he was the doctor for King James I. Gilbert died in 1603.

Gilbert wasn't only a doctor, though. He was also a scientist. He didn't believe many of the ideas of his time. Most people thought Earth was at the center of the universe. They also thought it didn't move. Gilbert thought these ideas weren't true. His doubts caused him to experiment. He studied **magnetism** and **electricity**. He developed a tool. It used a metal needle and a magnetic rock. In his experiments, he made an important discovery. He found that Earth was really a giant magnet. He said that Earth turned. He also thought **magnetic forces** were what kept planets in their orbits.

Magnetic lodestone attracting paper clips.

Gilbert shared his work in his book. The book is called De Magnete. This book interested scientists. He was the first to study magnets using scientific methods. Some words we use today to describe magnets and electricity came from Gilbert.

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# William Gilbert Questions

1. Describe the jobs that William Gilbert had. What made him different from other people of his time? What did he disagree about?

2. Describe the tool William Gilbert made. What did he discover with his tool?

3. Why is it important to remember William Gilbert? What can we learn from him?

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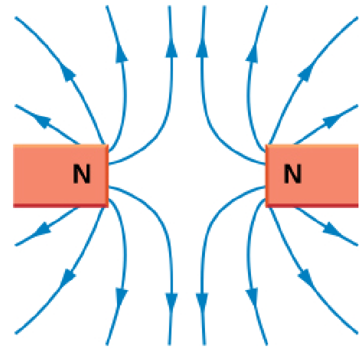
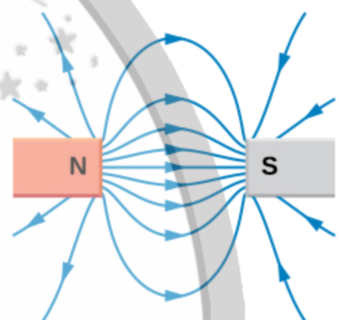
# Magnetism




Magnetic field lines between like poles

**Magnetism** is an invisible force. **Magnets** attract or push each other away. They don't have to touch other objects to pull them. Electrons spin in different directions in most objects. Magnets are different. The electrons in magnets spin in the same direction. This makes two **poles**. There is a north pole. There is a south pole. Opposite poles attract each other. Same poles push each other away. The magnetic force flows from the north to the south. This creates a magnetic field.




Magnetic field lines between unlike poles

Magnets are made in different ways. Some magnets are rocks. You can make magnets, too. Rubbing metal with a magnet in the same direction will make a magnet. Iron and steel are good metals to use. Magnets can also be made with electricity. Wrap an iron bar with wire. Run an electric current through the wire. This will create a **magnetic field**.

**Compass**

Earth is a giant magnet. That's why magnets work in **compasses**. A compass has a magnetic needle. That needle can turn. The south pole of the magnet is attracted to the north pole of Earth. The needle will always point north.

Magnets are often seen in offices. They hold papers in place. Magnets can keep paper clips from making a mess of a desk. Paper clips are made of steel wire. Magnets attract steel. Paper clips stick to either pole of a magnet. This is because the atoms in the paper clips can adjust themselves.

Our lives are affected by magnets. Electric motors have magnets. Magnets hold doors shut. Electronics use magnets to work. It's safe to say that you meet magnets every day.

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# Magnetism Questions

1. Draw arrows to show the direction of the magnetic force between the poles.


2. Describe 2 ways to make a magnet.

   1. ______________________________________________

   ______________________________________________

   2. ______________________________________________

   ______________________________________________

3. List 3 places you have seen magnets working:

   1. ______________________________________________

   2. ______________________________________________

   3. ______________________________________________

Now, describe how the magnet attracts the item in one of your examples:

______________________________________________

______________________________________________

______________________________________________

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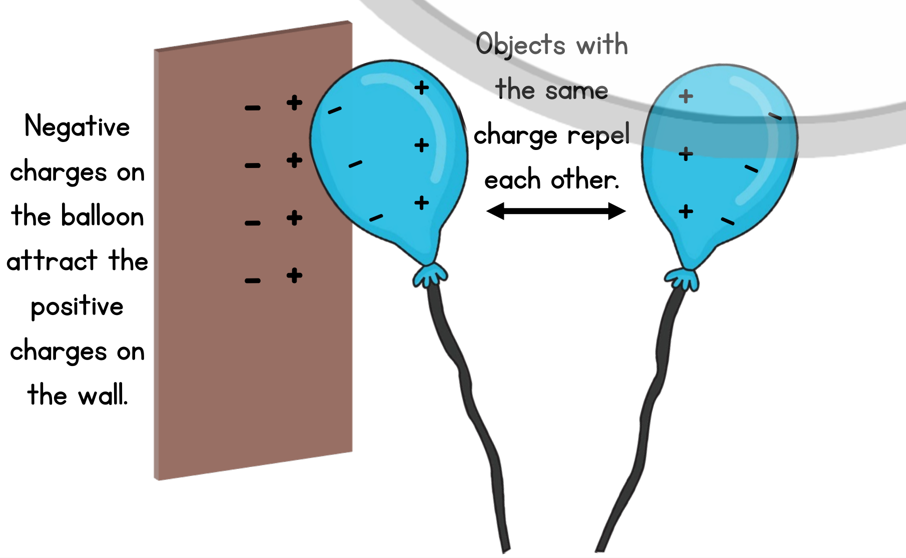
# Static Electricity

Static electricity causing hair to stick to a balloon.

You're helping set up for your little sister's birthday party. Dad has put you in charge of blowing up balloons. You've got a bunch already blown up. You're taping them to a special birthday chair when Uncle Gary comes over. He picks up one of the inflated balloons and rubs it on your head. It makes your hair stand on end and stick to the balloon. While you tell him to go away, Uncle Gary takes a second balloon. He rubs that one on your sweater. He sticks it to the wall behind the chair and wiggles his hands like a magician. You smooth your hair back into place and straighten your sweater as your uncle walks away to bug someone else. The balloon stuck to the wall eventually falls to the floor.

Did Uncle Gary really use magic to make the balloons behave like this?

Actually, what he used is called **static electricity**. Static electricity is created when an electrical **charge** builds up on an object. *Static* means not moving, so in this case, the charges stay in one area. Objects are made of **atoms**. Atoms have **protons, neutrons,** and **electrons**. Protons and neutrons are at the center of atoms. Electrons spin around that center. When two surfaces touch each other, electrons can move from one object to another. One object will have a positive charge. The other object will have a negative charge.




When Uncle Gary quickly rubs that balloon against your head, he

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caused electrons to jump from your hair to the balloon. Your hair then had a positive charge. The balloon had a negative charge. Opposite charges attract each other. This is why your hair stuck to the balloon. The individual strands of your hair will push away from each other because they are all positively charged. Same charges **repel** each other.

The balloon Uncle Gary rubbed on your sweater and stuck to the wall is also an example of static electricity. The balloon stole electrons from your sweater. It became negatively charged. Holding the balloon up to the wall pushed away the wall's negative electrons. The surface of the wall became positively charged then. The negative charges of the balloon were attracted to the positive charges of the wall. This made the balloon stick to the wall. The build-up of charges is temporary, though. That's why the balloon will eventually no longer stick and fall to the ground.

Static electricity is seen in other examples. too. Getting zapped touching a doorknob after walking across a carpet is static electricity. Lightning is static electricity in nature. Printers and copiers use static electricity to attract ink to the paper. Static electricity can also damage electronic chips found in computers. Workers who assemble these chips have to wear special equipment, so they don't build up a static charge.

Uncle Gary pretended to be a magician with his balloon silliness. He was really being a scientist, playing with static electricity… and messing up your hair.

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# Static Electricity Questions

1. Draw a diagram below to show how a balloon can stick to a wall. Be sure to include the electrons.

2. Describe how protons, neutrons, and electrons work together to create static electricity in one of the examples you read about.

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3. What are some other examples of static electricity? Can you think of any that aren't listed in the article?

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# How Does a Compass Work?

**Compass**

A **compass** is a tool that finds direction. Compasses are made with **magnetic** needles. These needles spin. They are attached to a compass rose. A **compass rose** marks the directions. Compass needles always point north. The other directions can be figured out once north is found.

How does a compass work? A compass works because Earth is a big magnet. Earth has an iron core. This core is part liquid and part solid. The liquid in the core moves. Scientists believe this is what makes Earth's **magnetic field**. The planet has two **poles**. **Magnetic force** connects the poles. A compass reacts to the Earth's **magnetism**. This makes its needle point north. A compass doesn't show true north, though. It shows magnetic north. This is close enough to true north.

Compasses make traveling in new places easier. They were first used in China. They were an important tool for sailors. Compasses are used by many groups of people today. This includes hikers, scientists, and soldiers.

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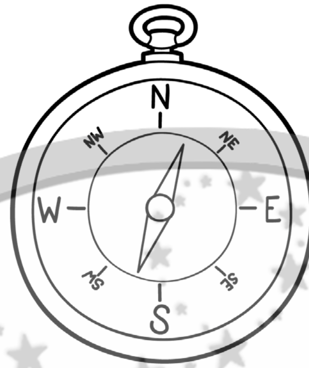
# How Does a Compass Work? Questions

1. Describe how the compass below can be pointing north even though the arrow is not pointing straight to the N on the compass.

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2. How does the Earth's core affect the way a compass points?

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3. Have you ever used a compass? Describe how you used it. If you haven't, describe a situation you would want to use a compass for.

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