Educator Guide: Electromagnetism

This document is a resource for teachers whose classes are participating in the Museum of Science’s Electromagnetism Traveling Program. The information in this document may be used as a classroom resource and/or as background information for the teacher concerning the subjects of electricity and magnetism.

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Vocabulary List

This is a list of common terms used in electromagnetism that teachers may wish to be familiar with for the program. This list is also a suggestion of vocabulary for students participating in the Electromagnetism program to learn, though prior study of these words is not required for student participation.

**Atoms** – tiny particles that make up the world around us and are far too small to see. Atoms are made up of a positively charged nucleus in the middle surrounded by negatively charged electrons.

**Battery** – an object that creates an electric force which can make a current flow. The negative end of a battery repels negative charges, and the positive end attracts them.

**Circuit** – a loop through which charges can flow. For charges to flow and make a current there needs to be a complete loop. This loop is called a closed circuit. A basic circuit can be made out of a battery, light bulb, and wires. When connected together in a loop with no gaps, charges are able to flow from the battery, through the light bulb, and back to the other side of the battery. This lights up the bulb. If there is a gap, though, the charges will get stuck with nowhere to go. This is called an open circuit.

**Conductor** – a material through which electric charges can flow easily. These are materials with low resistance.

**Current** – moving electric charges

**Electric Charge** – a basic property of all matter that gives rise to the electric force. Everything in the world that we can see and touch is built out of electric charges. There are two types of charges: positive and negative. In atoms, the electrons are negative and the protons are positive. Objects that have an electric charge create and feel the electric force.

**Electrons** – particles often found around the nucleus of atoms that have a negative charge
**Electric Force** – the force that causes electric charges to either attract one (pull together) another or repel apart (push apart)

**Electromagnet** – a magnet created by running an electric current through a coil of wire. The moving charges create a magnetic force. Unlike a permanent magnet, you can turn this on and off.

**Electromagnetism** – a subject in science that deals with the electric force, magnetic force, and how the two are connected

**Energy** – the ability to do work. There are many different types of energy, and they can change into one another. Some examples are light, sound, heat, electric, and magnetic energy.

**Force** – a push or a pull. Some examples of forces are wind, gravity, and pushes from our muscles.

**Insulator** – a material through which electric charges can barely flow, if at all. These are materials with high resistance.

**Magnetic Force** – a force created and felt by magnets. Magnets have north and south poles which attract and repel due to this force.

**Permanent Magnet** – like on our refrigerator, these magnets stick around

**Protons** – a particle inside the nucleus of atoms that has a positive charge

**Resistance** – a measure of how hard it is for electric charges to flow through a material. High resistance means it is difficult for charges to flow, and low resistance means they can flow easily.

**Spark** – the effect we can see, hear, and (sometimes) feel when charges are pushed with enough electric force to make it through an insulator

**Static Electricity** – the noticeable electric force when charges are unbalanced. For instance, if you rub a balloon in your hair, you will notice a force between the balloon and your hair.

**Voltage** – a measure of the amount of energy each electric charge has
Further Background Reading

This is a suggested reading list for teachers looking to improve their understanding of electromagnetism.

**Books**


*Electricity And Magnetism: Stop Faking It! Finally Understanding Science So You Can Teach It* by William C. Robertson. NSTA. 2004.


**Links**

*Electricity and Magnetism*, a good linear introduction to the concepts – [http://theory.uwinnipeg.ca/mod_tech/node83.html](http://theory.uwinnipeg.ca/mod_tech/node83.html)

*HyperPhysics Concepts*, a good reference for concepts and definitions – [http://hyperphysics.phy-astr.gsu.edu/hbase/emcon.html#emcon](http://hyperphysics.phy-astr.gsu.edu/hbase/emcon.html#emcon)

Classroom Materials

Below are some suggestions for books, videos, and websites to help students increase their understanding of electricity and magnetism.

Books


*Electricity.* Steve Parker and Laura Buller. DK Children. 2005.


Videos


Links

Physics4Kids: Electricity & Magnetism –  

Static Electricity: Learn about static charge and static shock –  

Science Snacks – Exploratorium’s list of experiments about electricity:  
[http://www.exploratorium.edu/snacks/iconelectricity.html](http://www.exploratorium.edu/snacks/iconelectricity.html)

about magnetism:  
[http://www.exploratorium.edu/snacks/iconmagnetism.html](http://www.exploratorium.edu/snacks/iconmagnetism.html)
Activity Descriptions

See the “Documents” section on the website to download these activities.

Build an Electrophorus

An electrophorus uses static electricity, just like rubbing a balloon in your hair. What makes an electrophorus special, though, is that the design lets you make sparks and recreate a small version of the classic electricity experiment. This activity is simple, straightforward, and uses common materials.

Build a Motor

Basic motors work just using well-timed electromagnets. In this experiment, your students will be able to build their own. By building an electromagnet that can turn, and setting it up with a clever trick to the design, they can use electricity to get their motor spinning. It just requires a few common and accessible materials.
Video Descriptions

See the “Media” section on the website to download these videos.

Balloon and Hair

This video shows what is happening when we rub a balloon in our hair. Since electric charges are far too small to see, in this video we’ve drawn in the charges. We can see that extra negative charges move into the balloon, and the opposite charges in the balloon and the hair will attract.

Van de Graaff Generator

This video shows what happens when we hook someone up to a Van de Graaff generator. Again, we’ve drawn in the charges to make them visible. In this case, extra negative charges move into the metal dome and then our volunteer. The extra negative charges repel from one another. At the end of the video, another person reaches in from the side and gives our volunteer a shock.