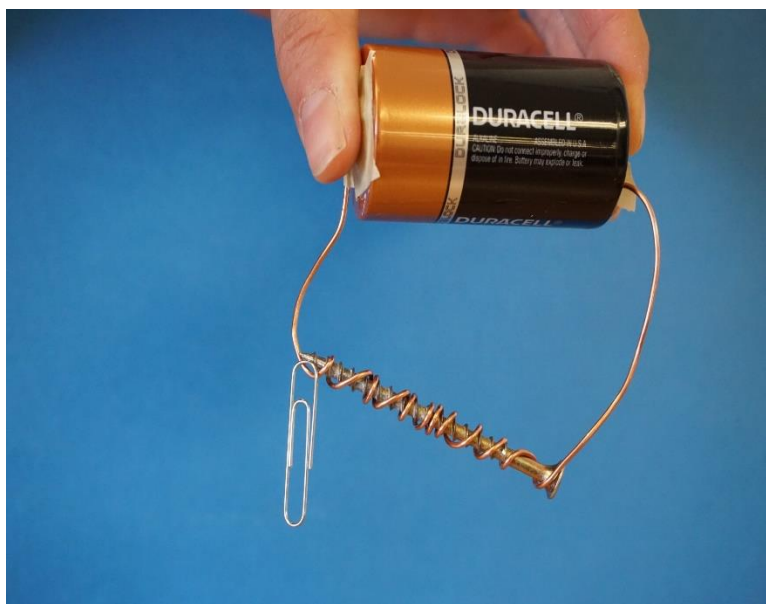




STEM on Site Summer Program

Build an Electromagnet



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Recommended for Grade Levels: 3-5

Content Notice

This activity has been put together as a free, open source resource from the Milwaukee School of Engineering STEM team for self-guided, at home learning. Unless otherwise noted, in person or live instruction is not provided and questions should be directed to stem@msoe.edu.

Curriculum has been adapted from [UC Boulder](#).

Safety Notice

Parents or guardians should review activity materials before students begin the activity. Some activities from MSOE may require cutting, hot gluing, electricity, manipulating sharp objects, and other tasks that may warrant adult supervision. MSOE is not liable or responsible for any injury, property damage, or other incidents that arise from completing these activities at home. If you have questions or concerns about any activities, please contact stem@msoe.edu

Notes

Welcome to your Build an Electromagnet kit! Below you will find a few links to learn a little bit about Electromagnets. We encourage you to watch the videos and review the vocabulary before starting your project.

This activity has been adapted from Teach Engineering's curriculum. MSOE has added videos and questions to consider along with post activities to adapt this activity to fit the at-home learning models currently being used during the pandemic.

Goals

- Build an electromagnet.
- Investigate ways to change the strength of an electromagnet.

Learning at Home

While we have tried to select activities that utilize materials you might have around your home or able to procure without too much difficulty, we know that may not be the case for everyone.

One of our favorite parts of engineering is the problem solving and critical thinking skills required, and we encourage you to consider the following question when looking at the materials list for this activity:

If I don't have a certain material, what is the material being used for in this activity? Is there something else I could substitute that serves the same or a similar purpose? How can I modify this activity with what I have at home?

Materials List

	NAME
	Nail- made of zinc, iron, or steel
	2 feet of copper wire with ends stripped
	D cell Battery
	Wide Rubber Band
	Several paperclips

REQUIRED TOOLS

	Wire Stripper (*) Not required but helpful
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Background Knowledge

What is an electromagnet and how does it work?

<https://youtu.be/cxELqN7wjS0>

<https://youtu.be/raq6pjafNKQ>

battery: A cell that carries a charge that can power an electric current.

current: A flow of electrons.

electromagnet: A magnet made of an insulated wire coiled around an iron core (or any magnetic material such as iron, steel, nickel, cobalt) with electric current flowing through it to produce magnetism. The electric current magnetizes the core material.

electromagnetism: Magnetism created by an electric current.

magnet: An object that generates a magnetic field.

magnetic field: The space around a magnet in which the magnet's magnetic force is present.

motor: An electrical device that converts electrical energy into mechanical energy.

permanent magnet: An object that generates a magnetic field on its own (without the help of a current).

solenoid: A coil of wire.

Optional [worksheet](#) to complete as students go through the activity.

https://www.teachengineering.org/content/cub/_activities/cub_mag/cub_mag_lesson2_activity1_electromagnet_worksheet_v1_sas.pdf

Building an Electromagnet

1. Start by wrapping the wire around a nail at least 20 times. Make sure the nail is wrapped tightly, leaving no gaps between the wires and not overlapping the wraps.
2. Next, connect the ends of the coiled wire to each end of the battery using the rubber band to hold the wires in place. See picture below.



Image Source: [Teach Engineering](#)

3. Your electromagnet is assembled. Now, move the electromagnet near or above the paperclips. What happens?
4. Record the number of paperclips you were able to pick up here or on the linked worksheet.
 - Number of Paperclips: _____
5. Disconnect the wire from the battery after testing the electromagnet. Can the electromagnet pick up paperclips when the current is disconnected?
6. Can we increase the number of paperclips we are able to pick up? Start by increasing the number of coils around the nail. Record your data.

Number of Coils	Number of Paperclips
20 coils	

Extensions

- Try changing out the battery for a 9 volt or any size you have around the house
- Try changing out the nail for a shorter or longer one.
- Try changing the thickness of the wire.

