NATIONAL ELECTRONICS MUSEUM

Lesson Plan:

Oersted's Experiment with Electromagnetism

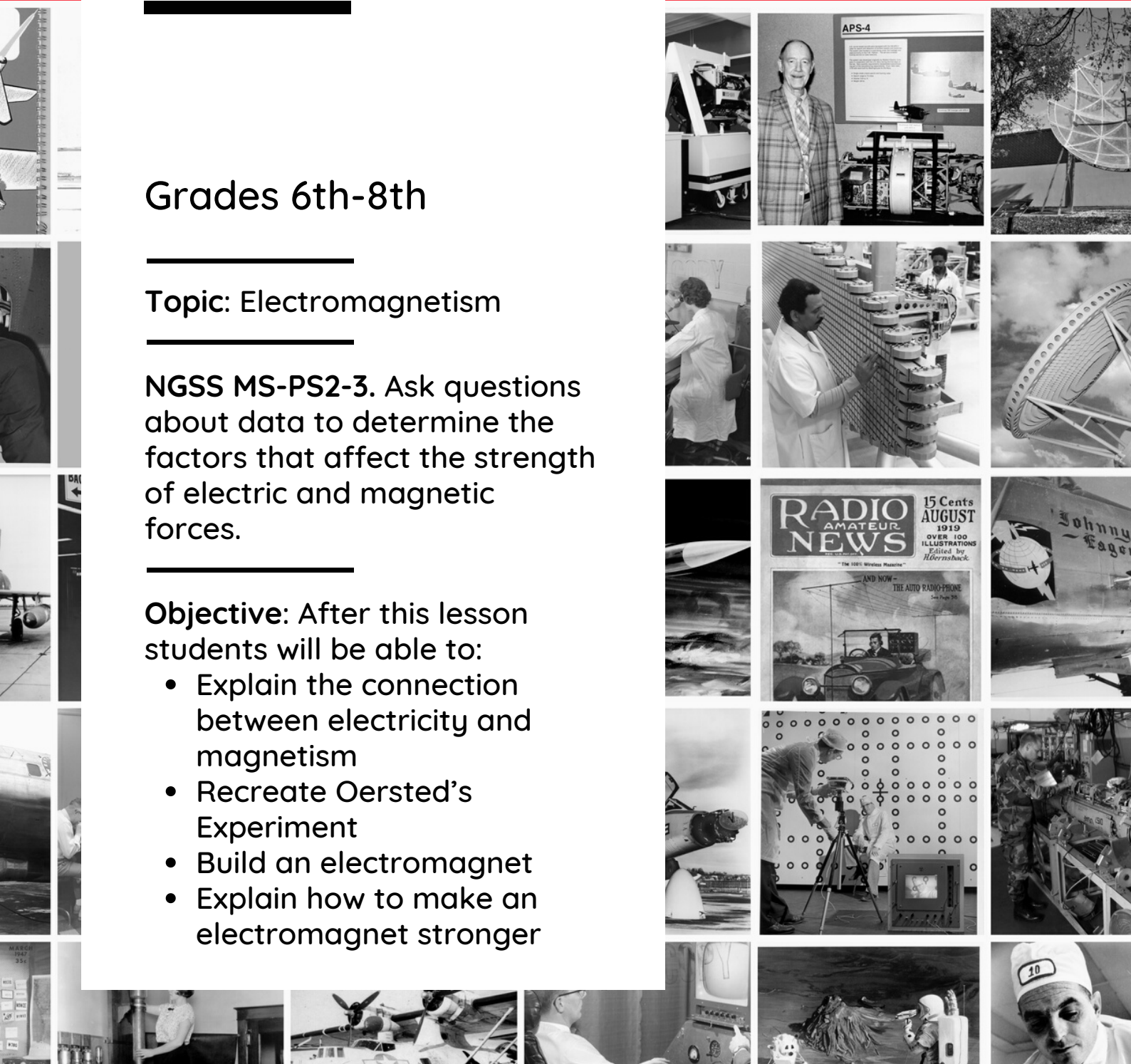
Grades 6th-8th

Topic: Electromagnetism

NGSS MS-PS2-3. Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

Objective: After this lesson students will be able to:

- Explain the connection between electricity and magnetism
- Recreate Oersted's Experiment
- Build an electromagnet
- Explain how to make an electromagnet stronger



Overview

Lesson Introduction: Oersted's Experiment (~20 minutes)

Begin by having students read the short introduction ("**Oersted's Experiment of Electromagnetism**") and click on the link to watch video **Clip #1** that demonstrates Oersted's experiment with electromagnetism.

Recreate Oersted's Experiment (~15-20 minutes)

With just a few materials, students will recreate Oersted's experiment (on **Worksheet 1**) to have a better understanding of the connection between electricity and magnetism. Click on the link to view **Clip #2**, which is the instruction video.

On **Worksheet 1**, have students answer the Oersted's Experiment Questions They can use both video clips (**Clips #1 & 2**) and their own version of Oersted's experiment for help.

Lesson Activity: (~15 minutes)

Students will follow the instruction sheet to make their own electromagnet.

Post Activity Questions: (~15-20 minutes)

After students build their electromagnet, have students answer the questions and fill out the data collection chart (on **Worksheet 3**) and indicate the number of coils on their nail and how many paper clips they were able to pick up.

After filling out the chart, students will look back on their data, and answer the Review Your Data questions (on **Worksheet 3**), to analyze the data collected.

Student Learning Goal:

By the end of the lesson students will be able to build, experiment, and test the strength of their own electromagnet and be able to explain electromagnetism.

Oersted's Experiment of Electromagnetism

In 1820, Danish Scientist Hans Christian Oersted wanted to know if there was a connection between **electricity** and **magnetism**. At that time, scientists did not think that there was a connection between the two. In this lesson, you will discover that based on Oersted's experiments, a new field called **electromagnetism** emerged.

Oersted conducting his experiment-1820

Watch the video below to find out how Oersted was able to prove that an electric current produces a magnetic field.

Click on the link Clip #1 to see Oersted's Experiment in action!

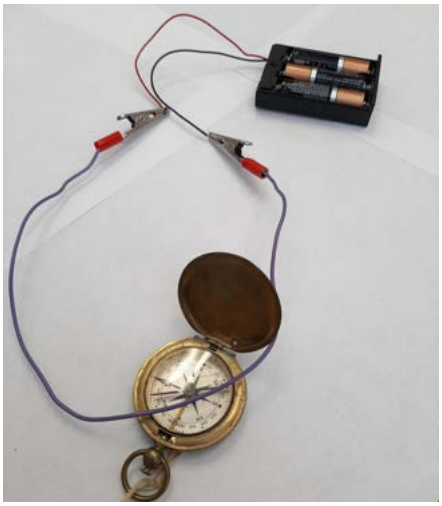
Worksheet 1

Recreate Oersted's Experiment: Linking Electricity and Magnetism

Oersted's experiment was truly groundbreaking and it showcases **electromagnetism**, which is magnetism produced by electricity.

With just a few materials, you can create Oersted's experiment at home!

Click on the link Clip #2 to see how you can create Oersted's experiment at home!



Materials:

- Battery holder
- Compass
- 3 AA Batteries
- Insulated wire with Alligator clips at each end

Oersted's Experiment Questions

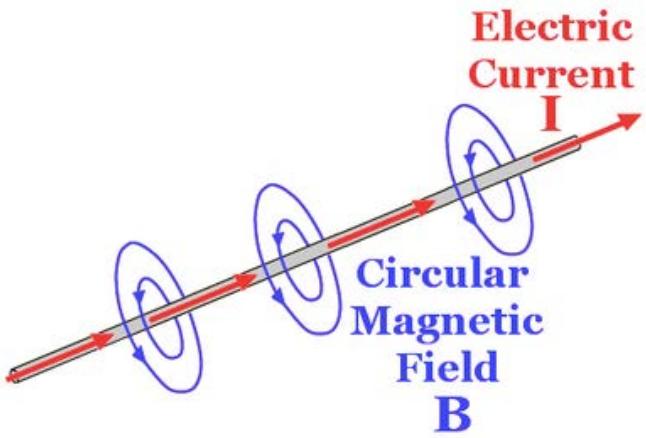
Directions: Using the video clips and what you have learned about Oersted's experiment and electromagnetism, answer the following questions.

1. When an electric current flows through a wire, a _____ _____ is produced.

2. In video Clip #1, what happens to the compass needles when I reverse the polarity, or flip the switch in the opposite direction?

3. In video Clip #2, what happens to the direction of the compass needle when it is placed near a wire with an electrical current running through it?

4. Before Oersted's experiment, scientists believed that electricity and magnetism were unrelated. Oersted's experiment proved that magnetism is produced by an electric current, and from that a new field called _____ emerged.



Answers:

1. Magnetic Field
2. The compass needles travel in the opposite direction because the direction of the current in the wire changed.
3. The magnetic field around the wire causes the compass needle to move, and the compass needle points in the direction of the magnetic field produced by the current
4. Electromagnetism

Worksheet 2

In the next section, you will build your own electromagnet!

Activity: Make Your Own Electromagnet!

Now that you know about electromagnets, you can make one at home with some easy to find materials! Follow the instructions below to make your own electromagnet!

Step 1: Materials!

Materials:

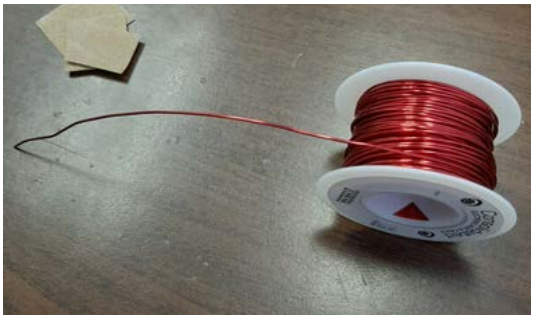
- Battery (C or D battery)
- Cork
- Nail
- Tape
- Magnet Wire
- Sandpaper
- Aluminum Foil
- Metal paperclips, bottle caps and/or staples
- Wire Cutters
- Glue & googly eyes (optional)

Step 2

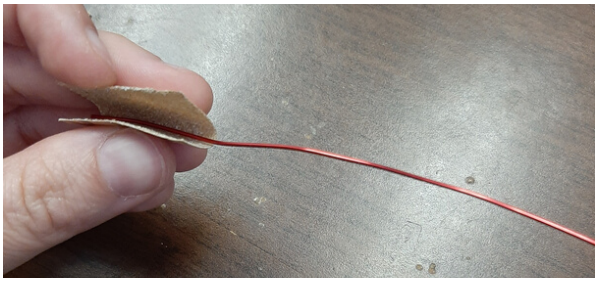
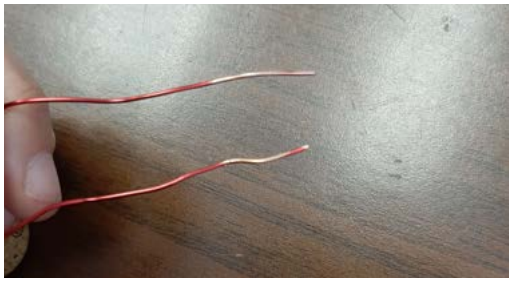
Now that you have your materials, tape your cork to your battery, and then stick the nail in the cork.


Step 3: Prepare your wire

Roll out about three feet of magnet wire and then use the wire cutters to cut through.

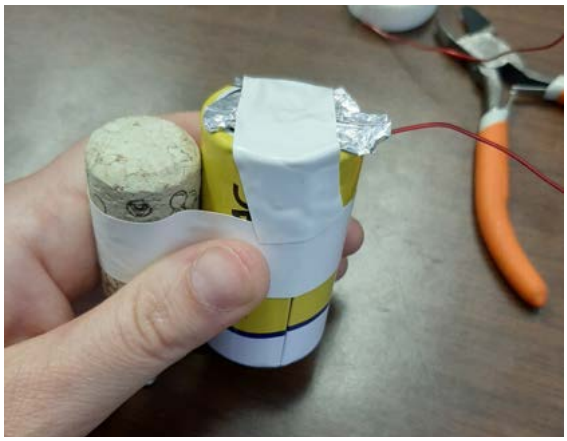



Next, use your piece of sandpaper to sand the wire about an inch on each end, until the outer coating rubs off. You will notice the color change.

Step 4

Fold a piece of aluminum foil around one end of the wire, and then tape it to the bottom of the battery.



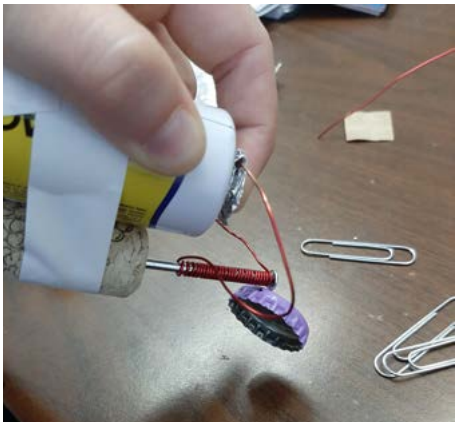
Next, wrap the wire around the nail (shown above), leaving a few inches free, which will act as a switch. Make sure that you are wrapping your wire along the nail close together, as this will make your electromagnet stronger!

Step 5

Put some more aluminum foil at the other end of the wire, and this is your switch. Leave it unattached so you can turn your electromagnet on and off.

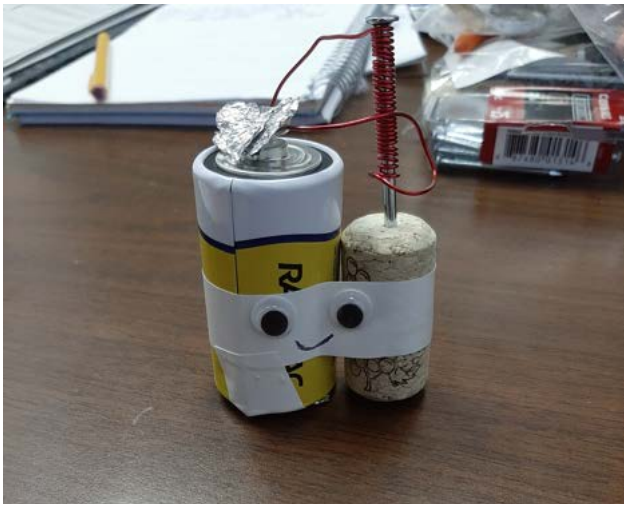
Step 6

See what your electromagnet can do! Hold the foil on the top of your battery, and try picking up staples, paper clips, and bottle caps. Test out which materials your electromagnet can pick up! Make sure to add more coils of wire around and record how many paperclips you can pick up in the table below!



You have made a small **solenoid**, a type of electromagnet which generates a magnetic field when you pass electricity through the coil of wire.

Oersted's Experiment of Electromagnetism



Glue on some googly eyes to make your electromagnet even MORE fun!!

Click the links below to see the electromagnet go to work!

Electromagnet Picking Up Paper Clips
Electromagnet Picking Up Bottle Cap

Worksheet 3

Post Activity Questions

Directions: Answer the following questions after making your own electromagnet.

Increasing the number of coils of wire around the nail will _____ the strength of the electromagnet.

Do you think the electromagnet with a less powerful battery or a more powerful battery will pick up more paper clips? Explain!

Collect Data

Directions: Use your electromagnet to see how many paperclips you can pick up and record below. After making your electromagnet, wrap more coils around the nail and try again to see how many paperclips you can pick up. Record in the table below.

Number of Coils	Number of Paper Clips Picked Up
0	
10	
20	
30	

Worksheet 3, continued

Review your data: After making your electromagnet, answer the following questions.

1. Did increasing the number of coils make your electromagnet stronger? Why or why not?

2. How many coils of wire around the nail did it take to pick up the most paper clips?

3. Which type of battery was available for you to use? Was it strong enough?

4. How could you modify your electromagnet to make it even stronger next time?

Glossary

Conductor: a material that allows electricity to flow through it easily.

Current: The movement of electrons along a conductor.

Electrical Circuit: a path or line through which an electrical current flows.

Electromagnet: a temporary magnet produced when a current passes through a coiled wire surrounding an iron core.

Electromagnetism: magnetism produced by an electric current

Magnetic Field: the area around a magnet in which there is a magnetic force. Moving electric charges can make magnetic fields.

Polarity: the direction of current flow in an electrical circuit.