



# Making Magneto

## Electromagnetism



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<b>Grade Level</b>	9th – 12th Grade	<b>Time Frame</b>	1-2 class period(s)
<b>Course</b>	Physics	<b>Duration</b>	100 minutes

### Essential Question

How can unseen forces affect us?

### Summary

Electromagnets provide a great example of science in its most abstract form. In this lesson, students observe the physical phenomena of simple electromagnets and engage in an inquiry-style investigation to look into the properties of electromagnets. This lesson will be more challenging, though not impossible, if students don't know the basic properties of electricity. In this case the lesson will simply take more time.

### Snapshot

#### Engage

Students watch a video about an electromagnet.

#### Explore

Students make a magnet like the one shown in the video.

#### Explain

Students apply what they've learned to sort out fictional and factual claim statements.

#### Extend

Students test one of the unsubstantiated claim statements from the Explain activity.

#### Evaluate

Students write a Claim, Evidence, Reasoning (CER) analysis based on their results from the Extend experiment.

## Standards

*Next Generation Science Standards (Grades 9, 10, 11, 12)*

**HS-PS3-5:** Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

*Oklahoma Academic Standards (Physics)*

**PH.PS3.2.DCI.2:** That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms.

## Attachments

- [Electromagnets - Fiction in the Facts Cards - Spanish.docx](#)
- [Electromagnets - Fiction in the Facts Cards - Spanish.pdf](#)
- [Electromagnets - Fiction in the Facts Cards.docx](#)
- [Electromagnets - Fiction in the Facts Cards.pdf](#)
- [Exclaim and Question Worksheet - Spanish.docx](#)
- [Exclaim and Question Worksheet - Spanish.pdf](#)
- [Exclaim and Question Worksheet.docx](#)
- [Exclaim and Question Worksheet.pdf](#)
- [Lesson Slides—Making Magneto.pptx](#)

## Materials

- D batteries
- C batteries
- Thick gauge roll of electrical wire
- Thin gauge roll of electrical wire
- Nails
- Electrical tape
- Rubber bands
- Scissors
- Paper clips (both large and small)
- Copies of the Fiction in the Facts cards (a set for each group)
- Notebooks or paper for each student

# Engage

Pass out copies of the Exclaim and Question worksheet or have students get out a piece of paper, divide the paper in half, and label one half Exclaim and the other half Question. This is the [Exclaim and Question](#) K20 strategy.

## Teacher's Note: Spoilers

Don't tell students that they are about to see an electromagnet! It ruins the surprise. Let them have the moment.

Go to **slide 3** in the Making Magneto Teacher Slides. Play the video of [aluminum melting inside an electromagnet](#). While the video is playing, have students write down all of their observations in the Exclaim column and anything they are surprised by or don't understand on the Question column.

## Teacher's Note: Student Assistance

Documenting every observation is not something that is natural to students; it is up to you to teach them how to take down observations. Feel free to pause the video at any point and help students to articulate the observations that they noticed (but didn't realize that they noticed or didn't realize they should write down).

## Explore

Have students keep their Exclaim and Question paper for the rest of the lesson. They will actively use it during each of the phases and corresponding activities to document all observations and surprises.

Assign students to pairs or groups of three. Show **slide 4**, which illustrates the steps to make a magnet.

### **Teacher's Note: Less Is More**

There are written directions (just warnings) for a reason. We are trying to help students think about and figure out nuances from the images and translate them into reality. Try not to help too much-- learning still happens when students do something wrong.

Allow students time to make the electromagnet. Frequently remind them to jot down observations along the way and that even the most basic stuff is important to write down.

### **Teacher's Note: Motivation To Write**

If you want to build up the amount that students write, you can make it a mini-contest of who can write the most, which will force students to look for more than just the 'big' events and notice every detail.

# Explain

Show **slide 5** and pass out a set of Fiction in the Facts cards to each group of students.

## Teacher's Note: Activity Preparation

If you're short on time, have your first class of the day assist with cutting out the cards.

Students should read through the claims from the cards, and then:

1. Sort the claims into two stacks--a stack of claims that they can prove or disprove based on their observations from their Exclaim and Question sheet and a stack of claims that they can't prove or disprove yet.
2. Of the claims that they can prove or disprove, have them write each claim on their Exclaim and Question sheets where they have the evidence to support or refute that claim. If they decide that the claim is false, they should note that when they write down the claim.
3. Read through the claims that they have left to prove and make predictions of whether they think each claim will be true or false.

## Teacher's Note: If There's No Space

If the students have done a great job of taking notes on their Exclaim and Question sheets and their pages are cramped, they can use sticky notes to write down each claim and stick it to the area of the notes that contains the supporting or refuting evidence.

## Teacher's Note: Step 3!

The last step of making predictions is the bread-and-butter of hypothesis building. Students have some context from the Explore and Engage activities, they have some unknown correlation, and they must use contextual details to determine whether the correlation will happen. They might resist doing step 3 thoroughly, but it's a key step. So, push and support them to think about their predictions.

## Extend

Show **slide 6**. Based on the claims that they have left, tell the students that they are going to run experiment trials to determine if the claims are fact or fiction. Tell students where to find the supplies and remind them to take down lots of observations on their Exclaim and Question sheet.

### **Teacher's Note: Lab Sheet**

There is purposefully no lab sheet for this activity. Lab sheets are highly prescriptive (which is fine in some situations). Trust that your students have been practicing writing and using their observations enough in this lesson that they know what and how much to write down to support or refute a claim. An open notebook of just writing a lot of needed observations is exactly how real scientists work (no lab sheet there).

### **Teacher's Note: The Only Help Given**

Students might struggle with determining how 'strong' the magnet is, especially if you don't have a magnetometer. For how basic this general setup is, it's usually sufficient to test how many paper clips the nail can pick up successfully at one time. The more paper clips, the 'stronger' it is.

# Evaluate

Show **slide 7**. Tell students that they will write [Claim Evidence Reasoning \(CER\)](#) statements explaining what they think is happening in the video <https://www.youtube.com/watch?v=rP2C6M7tDhM>.

Show slide 8. Explain that CER statements should describe:

- The claim that the student is asserting (a statement explaining what the student is seeing).
- The evidence that the student is using to support the claim (which is hopefully coming from the notes students have been taking the entire lesson).
- The reasoning of why the student can rely on the evidence. Thus, why the claim should be accepted as true. (This could be a critique of the student's experimental procedures--Where does the evidence come from?)

Have students share their CER statements and write down one another's claims so that everyone has all the claims when they are done.

## Resources

- bosswaw (boss808). HQ melting aluminum w/ electromagnetic cylinder HQ (video file). <https://www.youtube.com/watch?v=qUiCh1OTLts>
- gmonkey3. Scrap metal unloaded by magnet (video file). <https://www.youtube.com/watch?v=rP2C6M7tDhM>
- K20 Center. (n.d.). Claim, Evidence, Reasoning (CER). Strategies. <https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f506fc09>
- K20 Center. (n.d.). Exclaim and Question. Strategies. <https://learn.k20center.ou.edu/strategy/a89b55a468ff764491d10ec5b201cc3d>
- K20 Center. (n.d.). Fiction in the Facts. Strategies. <https://learn.k20center.ou.edu/strategy/6f19b778b73e4c339d1a7d9653000991>