Making Magneto

Electromagnetism

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Grade Level	9th – 12th Grade	**Time Frame**	2–3 class period(s)
Course	Physics	**Duration**	90–120 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

ACT College and Career Readiness Standards - Science (6-12)

IOD304: Determine how the values of variables change as the value of another variable changes in a simple data presentation
SIN301: Understand the methods used in a simple experiment
EMI502: Determine whether presented information, or new information, supports or contradicts a simple hypothesis or conclusion, and why

Oklahoma Academic Standards for Science (Grades 9, 10, 11, 12)

PH.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.

Attachments

- Exclaim and Question Worksheet—Making Magneto.docx
- Exclaim and Question Worksheet—Making Magneto.pdf
- Fiction in the Facts Cards—Making Magneto.docx
- Fiction in the Facts Cards—Making Magneto.pdf
- Lesson Slides—Making Magneto.pptx

Materials

- Lesson Slides (attached)
- Fiction in the Facts cards (attached; one per group)
- Exclaim and Question worksheet (attached; one per student)
- Batteries (C & D)
- Electrical Wire (thick & thin; bare copper (solid) is preferred)
- Nails
- Electrical tape
- Rubber bands
- Scissors
- Paper clips (small & large)

Preparation

Print and cut the attached **Fiction in the Facts Cards**. Group each set of cards with a paper clip or a Ziploc bag. Consider printing the cards on cardstock to reuse the cards multiple times.

15 minutes

Engage

Use the attached **Lesson Slides** to facilitate this lesson. Use **slide 2** to introduce the lesson title to the students. Move to **slide 3** and introduce students to the Exclaim and Question strategy. Pass out copies of the **Exclaim and Question** worksheet.

Transition to **slide 4** and 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. Pause the video at any point and help students to articulate the observations that they noticed but didn't write down. Display **slides 5–6** to go over the essential question and lesson objectives.

25 minutes

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 7**, which illustrates the steps to make a magnet. Allow students time to make the electromagnet. Frequently remind them to jot down observations along the way.

25 minutes

Explain

Show **slide 8** and pass out a set of **Fiction in the Facts Cards** to each group of students.

Students should read through the claims from the cards. Ask them to sort the claims into two stacks—a stack of claims that they have evidence for and a stack of claims that they don't.

Display **slide 9.** 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. 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.

30 minutes

Extend

Show **slide 10**. 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: Measuring Magnet Strength

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.

15 minutes

Evaluate

Transition to **slide 11** and introduce students to the Claim Evidence Reasoning instructional strategy. Tell students that they will write Claim Evidence Reasoning (CER) statements explaining what they think is happening in the video.

Show **slide 12**. 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 behind 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 (boss8O8). 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/156
- K20 Center. (n.d.). Exclaim and Question. Strategies. https://learn.k20center.ou.edu/strategy/94
- K20 Center. (n.d.). Fiction in the Facts. Strategies. https://learn.k20center.ou.edu/strategy/60