8.3 Forces at a Distance

Unit Structure

Driving question: How can a magnet move another object without touching it?

Lesson Set 1: *How can a magnet and a coil of wire interact through forces at a distance?*

Lesson 1

Students look at slo-mo video of a speaker, dissect a speaker, and then build a speaker from parts in the classroom.

Lessons 2-6

Students develop a model to describe how forces and energy transfer in magnetic fields explain cause and effect relationships between parts of a speaker (magnet and coil of wire).

Lesson Set 2: *How does energy transfer through electromagnets, and across the space between magnets?*

Lessons 7-9

Students investigate energy transfer to better understand the physics of the cause-effect relationships they noticed in the speaker.

Lesson Set 3: *What factors affect the strength of magnetic fields?*

Lessons 10-12

Students plan and carry out investigations to produce data to support hypotheses about what factors cause changes in the strength of magnetic forces.

Before Teaching the Unit

Watch the unit webinar.

Read the unit storyline.

Join the Facebook Group for the unit.

Review the Assessment System Overview in the Unit Overview to complete the Grading Planning Tool for the unit.

Review the Unit Overview, Material List and Lesson Teacher Edition to check for the required materials and supplies necessary for the unit. Take note of these unit-specific items related to materials:

- Be sure to watch the teacher preparation videos for Lesson 1 for speaker dissection and homemade speaker. Try this on your own before doing it with the students.
- Lesson 4 also includes a teacher preparation video and some advanced setup. Try this demo on your own before trying with students.
- Lesson 7 involves advanced preparation for the energy transfer in fields investigation. Modifications will also need to be made if students did not complete 8.1 and 8.2, handout Making Sense of Your Investigation Results will need to be modified.

- Lesson 8 has several investigations that involve advanced preparation. Videos to support teacher preparation are provided in the Materials Preparation. Try these on your own before doing it with the students.
- Lesson 11 involves advanced preparation for the investigation. Day 2 synthesizes investigation findings. List of Cause-Effect Relationships We Figured Out handout will need to be updated to reflect the class's findings.

While Teaching the Unit

- Watch teacher set-up videos for investigations.
- Consider keeping a running record of class discoveries and investigations throughout the unit to help absent students catch up and as a reference for future years. Approaches could include a teacher version of a student notebook, or a running shared Google document.
- Organize handouts and digital materials as you go for future use.

After Teaching the Unit

- Lesson 2 speakers, coils, magnets, and batteries should be stored for next year. Keep batteries separate from coils and magnets.
- Carts and Lesson 7 field investigation can be stored for future use.
- Materials from the Lesson 8 investigation can be stored. Consider storing batteries in a cold space (freezer) for long term storage.
- Make notes of future revisions, modifications.
- Take pictures of posters, consensus models and exemplary student work.
- Survey students at end of unit for feedback and self-reflection.

Unit Fast Facts for Planning

Unit Length	12 Lessons, 30 Days
Lessons with Hands-On Investigations	1, 2, 3, 4, 6, 7, 8, 10, 11
Lessons Requiring Student Devices	5, 9
Lessons that Require In-Advance Material Preparation	1, 2, 3, 4, 7, 8
Lessons with Mid-Point or Summative Assessment Moments	6, 11, 12