

Grade 8 Science

Unit 3: Forces at a Distance

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

18 lessons (investigations and weekly readings) and a words quiz. Use this pack with the unit's **Teacher Guide**, **Student Procedure Guide**, **Student Work Pages** and **Science Literacy Student Reader** (download them once from the course) to teach the whole unit without the internet.

What is in this pack

- A plan for each lesson: the lesson question, how many class days it takes, the Teacher Guide pages to follow, and the student pages to print.
- For each weekly reading: the Student Reader pages, words to know and the exercise page.
- The words quiz, ready to print, with its key at the back.

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Lesson schedule

Each investigation lesson takes the number of class days shown (about 45 minutes a day). Do each reading over a week alongside the lessons. Tick each one off as you go.

	Lesson	Days	Student pages
☐	Reading: Science Literacy Preface: Put Yourself in This Scene	1 week	—
☐	Lesson 1: What causes a speaker to vibrate?	4	1 to print
☐	Lesson 2: What can a magnet pull or push without touching?	2	4 to print
☐	Reading: Science Literacy Collection 1: Day-to-Day Magnets	1 week	1 to print
☐	Lesson 3: How does energy transfer between things that are not touching?	1	4 to print
☐	Lesson 4: What can we figure out about the invisible space around a magnet?	4	2 to print
☐	Reading: Science Literacy Collection 2: Beyond Magnets	1 week	1 to print
☐	Lesson 5: How does the magnetic field change when we add another magnet to the system?	1	1 to print
☐	Lesson 6: How can we use magnetic fields to explain interactions at a distance between the magnet and the coil?	3	2 to print
☐	Reading: Science Literacy Collection 3: Gravity and Earth	1 week	1 to print
☐	Lesson 7: How does changing the distance between two magnets affect the amount of energy transferred out of the field?	1	4 to print
☐	Lesson 8: How does the energy transferred from a battery to a wire coil compare to the energy transferred from a computer to a speaker?	3	4 to print
☐	Lesson 9: How do the magnet and the electromagnet work together to move the speaker?	3	7 to print

	Lesson	Days	Student pages
☐	Reading: Science Literacy Collection 4: Noncontact Energy Transfer	1 week	1 to print
☐	Lesson 10: How does distance affect the strength of force pairs in a magnetic field?	3	3 to print
☐	Lesson 11: What else determines the strength of the force pairs between two magnets in a magnetic field?	3	7 to print
☐	Reading: Science Literacy Collection 5: Magnetism and Bodies	1 week	1 to print
☐	Lesson 12: What cause-effect relationships explain how magnetic forces at a distance make things work?	2	2 to print
☐	Words quiz	—	—

Page numbers are PDF page numbers of each file, so they match what your PDF reader shows.

Reading: Science Literacy Preface: Put Yourself in This Scene

Words to know

- **science fiction** — a genre of storytelling based on imagined science and technology
- **science literacy** — the ability to read, hear, and comprehend information about scientific topics and demonstrate understanding in discussion and through writing
- **social media** — websites and applications that allow users to participate in sharing content on the internet

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 23–25: the steps, materials and timing for this lesson.

Read

Read Science Literacy Student Reader, Preface: “Put Yourself in This Scene”: PDF pages 6–7. Look at the pictures and maps together.

Check for understanding

- Use one of today's words in a sentence of your own.

Lesson 1: What causes a speaker to vibrate?

LESSON QUESTION

What causes a speaker to vibrate?

Plan about **4 class days** for this lesson.

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 26–52: the steps, materials and timing for this lesson.

Student pages to print

- Student procedures for this lesson — Student Procedure Guide, PDF pages 6–10

For the teacher

- Teacher Reference — Teacher Guide, PDF pages 281–283

Check for understanding

- Explain your answer to the lesson question, using evidence from your investigation:
What causes a speaker to vibrate?

Lesson 2: What can a magnet pull or push without touching?

LESSON QUESTION

What can a magnet pull or push without touching?

Plan about **2 class days** for this lesson.

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 53–70: the steps, materials and timing for this lesson.

Student pages to print

- Student procedures for this lesson — Student Procedure Guide, PDF pages 11–13
- Magnetic Interactions Lab — Student Work Pages, PDF pages 7–8
- Magnet and Coil Interaction Investigation — Student Work Pages, PDF pages 9–10
- Reference: Composition of Metal Objects — Student Procedure Guide, PDF page 49

Check for understanding

- Explain your answer to the lesson question, using evidence from your investigation:
What can a magnet pull or push without touching?

Reading: Science Literacy Collection 1: Day-to-Day Magnets

Words to know

- **attract** — to draw toward; the opposite of repel
- **electric current** — electrical charges in motion through a conductive material
- **electromagnet** — a device consisting of a core through which electric current is passed to produce a magnetic field
- **hypothetical** — referring to something that might or could happen but has not occurred as a confirmed event
- **magnet** — an object that generates a magnetic field
- **magnetic field** — the region around a magnetic material where magnetism is able to exert force
- **obstruction** — a blockage in a passageway that may allow some material to get through or may stop all material from passing through
- **social media** — websites and applications that allow users to participate in sharing content on the internet

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 71–76: the steps, materials and timing for this lesson.

Read

Read Science Literacy Student Reader, Collection 1: “Day-to-Day Magnets”: PDF pages 8–15. Look at the pictures and maps together.

Student pages to print

- Exercise Page 1 — Student Work Pages, PDF pages 53–54

Check for understanding

- Use one of today's words in a sentence of your own.

Lesson 3: How does energy transfer between things that are not touching?

LESSON QUESTION

How does energy transfer between things that are not touching?

Plan about **1 class days** for this lesson.

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 77–88: the steps, materials and timing for this lesson.

Student pages to print

- Student procedures for this lesson — Student Procedure Guide, PDF pages 14–15
- Blocking Air Investigation — Student Work Pages, PDF pages 11–12
- Framing Hypotheses — Student Work Pages, PDF pages 13–14
- Writing an Explanation — Student Work Pages, PDF pages 15–16

Check for understanding

- Explain your answer to the lesson question, using evidence from your investigation:
How does energy transfer between things that are not touching?

Lesson 4: What can we figure out about the invisible space around a magnet?

LESSON QUESTION

What can we figure out about the invisible space around a magnet?

Plan about **4 class days** for this lesson.

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 89–117: the steps, materials and timing for this lesson.

Student pages to print

- Student procedures for this lesson — Student Procedure Guide, PDF pages 16–22
- Reading: Finding the Way — Student Procedure Guide, PDF pages 53–54

For the teacher

- Teacher Reference 1 — Teacher Guide, PDF page 284
- Teacher Reference 2 — Teacher Guide, PDF pages 285–289

Check for understanding

- Explain your answer to the lesson question, using evidence from your investigation:
What can we figure out about the invisible space around a magnet?

Reading: Science Literacy Collection 2: Beyond Magnets

Words to know

- **attract** — to draw toward; the opposite of repel
- **electric current** — electrical charges in motion through a conductive material
- **electrostatic force** — a noncontact push or pull that results from the electrical charges of particles in a material
- **force** — a push or pull that can change the motion of an object
- **gravity** — the universal, noncontact force that attracts all masses of matter to all other masses; experienced on Earth as the downward pull of weight
- **hypothesis** — a starting point for further investigation
- **magnet** — an object that generates a magnetic field
- **magnetic field** — the region around a magnetic material where magnetism is able to exert force
- **magnetism** — the force applied by magnetic materials that attract or repel one another based on the alignment of charges in the particles of which they are made
- **noncontact force** — a force that acts on an object without touching it
- **repel** — to push away; the opposite of attract

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 118–124: the steps, materials and timing for this lesson.

Read

Read Science Literacy Student Reader, Collection 2: “Beyond Magnets”: PDF pages 16–23. Look at the pictures and maps together.

Student pages to print

- Exercise Page 2 — Student Work Pages, PDF pages 55–56

Check for understanding

- Use one of today's words in a sentence of your own.

Lesson 5: How does the magnetic field change when we add another magnet to the system?

LESSON QUESTION

How does the magnetic field change when we add another magnet to the system?

Plan about **1 class days** for this lesson.

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 125–132: the steps, materials and timing for this lesson.

Student pages to print

- Student procedures for this lesson — Student Procedure Guide, PDF pages 23–24

Check for understanding

- Explain your answer to the lesson question, using evidence from your investigation:
How does the magnetic field change when we add another magnet to the system?

Lesson 6: How can we use magnetic fields to explain interactions at a distance between the magnet and the coil?

LESSON QUESTION

How can we use magnetic fields to explain interactions at a distance between the magnet and the coil?

Plan about **3 class days** for this lesson.

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 133–148: the steps, materials and timing for this lesson.

Student pages to print

- Student procedures for this lesson — Student Procedure Guide, PDF pages 25–27
- Cause-Effect Table — Student Work Pages, PDF pages 17–18

For the teacher

- Answer Key — Teacher Guide, PDF pages 290–293

Check for understanding

- Explain your answer to the lesson question, using evidence from your investigation:
How can we use magnetic fields to explain interactions at a distance between the magnet and the coil?

Reading: Science Literacy Collection 3: Gravity and Earth

Words to know

- **collision** — an event in which bodies come into sudden contact
- **force** — a push or pull that can change the motion of an object
- **gravity** — the universal, noncontact force that attracts all masses of matter to all other masses; experienced on Earth as the downward pull of weight
- **interaction** — the way in which matter and fields affect one another
- **magnetic field** — the region around a magnetic material where magnetism is able to exert force
- **orbit** — to revolve in a curved path around a central object

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 149–154: the steps, materials and timing for this lesson.

Read

Read Science Literacy Student Reader, Collection 3: “Gravity and Earth”: PDF pages 24–31. Look at the pictures and maps together.

Student pages to print

- Exercise Page 3 — Student Work Pages, PDF pages 57–58

Check for understanding

- Use one of today's words in a sentence of your own.

Lesson 7: How does changing the distance between two magnets affect the amount of energy transferred out of the field?

LESSON QUESTION

How does changing the distance between two magnets affect the amount of energy transferred out of the field?

Plan about **1 class days** for this lesson.

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 155–166: the steps, materials and timing for this lesson.

Student pages to print

- Student procedures for this lesson — Student Procedure Guide, PDF pages 28–29
- Hypotheses and Variables — Student Work Pages, PDF pages 19–20
- Data Table and Procedure — Student Work Pages, PDF pages 21–22
- Making Sense of Your Investigation Results — Student Work Pages, PDF pages 23–24

Check for understanding

- Explain your answer to the lesson question, using evidence from your investigation:
How does changing the distance between two magnets affect the amount of energy transferred out of the field?

Lesson 8: How does the energy transferred from a battery to a wire coil compare to the energy transferred from a computer to a speaker?

LESSON QUESTION

How does the energy transferred from a battery to a wire coil compare to the energy transferred from a computer to a speaker?

Plan about **3 class days** for this lesson.

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 167–197: the steps, materials and timing for this lesson.

Student pages to print

- Student procedures for this lesson — Student Procedure Guide, PDF pages 30–35
- Reading: What is electric current? — Student Work Pages, PDF pages 25–26
- Reading: Music to My Ears — Student Procedure Guide, PDF pages 55–59
- Reading: What is electric current? — Student Procedure Guide, PDF page 60

For the teacher

- Teacher Reference — Teacher Guide, PDF pages 294–295

Check for understanding

- Explain your answer to the lesson question, using evidence from your investigation:
How does the energy transferred from a battery to a wire coil compare to the energy transferred from a computer to a speaker?

Lesson 9: How do the magnet and the electromagnet work together to move the speaker?

LESSON QUESTION

How do the magnet and the electromagnet work together to move the speaker?

Plan about **3 class days** for this lesson.

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 198-214: the steps, materials and timing for this lesson.

Student pages to print

- Student procedures for this lesson — Student Procedure Guide, PDF pages 36-38
- Cause-Effect Table — Student Work Pages, PDF pages 27-28
- Optional Electricity Extension — Student Work Pages, PDF pages 29-30
- Reference: Guidance for Student Facilitators — Student Procedure Guide, PDF page 50
- Reading: Magnetic Levitation Trains — Student Procedure Guide, PDF pages 61-62
- Reading: Junkyard Magnets — Student Procedure Guide, PDF pages 63-64
- Reading: Electric Motors — Student Procedure Guide, PDF pages 65-66

Check for understanding

- Explain your answer to the lesson question, using evidence from your investigation:
How do the magnet and the electromagnet work together to move the speaker?

Reading: Science Literacy Collection 4: Noncontact Energy Transfer

Words to know

- **attract** — to draw toward; the opposite of repel
- **electromagnet** — a device consisting of a core through which electric current is passed to produce a magnetic field
- **force** — a push or pull that can change the motion of an object
- **gravity** — the universal, noncontact force that attracts all masses of matter to all other masses; experienced on Earth as the downward pull of weight
- **magnet** — an object that generates a magnetic field
- **magnetic field** — the region around a magnetic material where magnetism is able to exert force
- **magnetism** — the force applied by magnetic materials that attract or repel one another based on the alignment of charges in the particles of which they are made
- **science fiction** — a genre of storytelling based on imagined science and technology

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 215–220: the steps, materials and timing for this lesson.

Read

Read Science Literacy Student Reader, Collection 4: “Noncontact Energy Transfer”: PDF pages 32–39. Look at the pictures and maps together.

Student pages to print

- Exercise Page 4 — Student Work Pages, PDF pages 59–60

Check for understanding

- Use one of today's words in a sentence of your own.

Lesson 10: How does distance affect the strength of force pairs in a magnetic field?

LESSON QUESTION

How does distance affect the strength of force pairs in a magnetic field?

Plan about **3 class days** for this lesson.

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 221–234: the steps, materials and timing for this lesson.

Student pages to print

- Student procedures for this lesson — Student Procedure Guide, PDF pages 39–42
- Investigating the Effects of Distance on Magnetic Force — Student Work Pages, PDF pages 31–36
- Reference: The Identify and Interpret (I2) Strategy - Student Guide — Student Procedure Guide, PDF pages 51–52

For the teacher

- Teacher Reference — Teacher Guide, PDF pages 296–299

Check for understanding

- Explain your answer to the lesson question, using evidence from your investigation: How does distance affect the strength of force pairs in a magnetic field?

Lesson 11: What else determines the strength of the force pairs between two magnets in a magnetic field?

LESSON QUESTION

What else determines the strength of the force pairs between two magnets in a magnetic field?

Plan about **3 class days** for this lesson.

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 235–249: the steps, materials and timing for this lesson.

Student pages to print

- Student procedures for this lesson — Student Procedure Guide, PDF pages 43–46
- Investigation Plan — Student Work Pages, PDF pages 37–40
- Interactive Predictions and Results — Student Work Pages, PDF pages 41–42
- Cause-Effect Chain — Student Work Pages, PDF pages 43–44
- List of Cause-Effect Relationships We Figured Out — Student Work Pages, PDF pages 45–48
- Peer Feedback Rubric for Planning Investigations — Student Work Pages, PDF pages 49–50
- Reading: Strong or Weak? — Student Procedure Guide, PDF pages 67–72

Check for understanding

- Explain your answer to the lesson question, using evidence from your investigation: What else determines the strength of the force pairs between two magnets in a magnetic field?

Reading: Science Literacy Collection 5: Magnetism and Bodies

Words to know

- **magnet** — an object that generates a magnetic field
- **magnetic field** — the region around a magnetic material where magnetism is able to exert force
- **magnetism** — the force applied by magnetic materials that attract or repel one another based on the alignment of charges in the particles of which they are made

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 250–255: the steps, materials and timing for this lesson.

Read

Read Science Literacy Student Reader, Collection 5: “Magnetism and Bodies”: PDF pages 40–48. Look at the pictures and maps together.

Student pages to print

- Exercise Page 5 — Student Work Pages, PDF pages 61–65

Check for understanding

- Use one of today's words in a sentence of your own.

Lesson 12: What cause-effect relationships explain how magnetic forces at a distance make things work?

LESSON QUESTION

What cause-effect relationships explain how magnetic forces at a distance make things work?

Plan about **2 class days** for this lesson.

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 256–263: the steps, materials and timing for this lesson.

Student pages to print

- Student procedures for this lesson — Student Procedure Guide, PDF pages 47–48
- Electricity Extension: Modeling Microphones — Student Work Pages, PDF pages 51–52

For the teacher

- Answer Key — Teacher Guide, PDF pages 300–307

Check for understanding

- Explain your answer to the lesson question, using evidence from your investigation: What cause-effect relationships explain how magnetic forces at a distance make things work?

WORDS QUIZ

Forces at a Distance

Name: _____ Date: _____

Circle the letter of the best answer.

1. Which word means “a device consisting of a core through which electric current is passed to produce a magnetic field”?

- a) electromagnet
- b) magnetic field
- c) social media
- d) interaction

2. Which word means “the act of moving regularly and repeatedly from one position to another and back”?

- a) oscillation
- b) dynamic
- c) science literacy
- d) science fiction

3. Which word means “movement of an object or material back and forth past its starting position”?

- a) hypothesis
- b) noncontact force
- c) repel
- d) vibration

4. Which word means “pushes and pulls between objects that are touching”?

- a) electrostatic force
- b) science fiction
- c) contact force
- d) interaction

5. Which word means “websites and applications that allow users to participate in sharing content on the internet”?

- a) tesla
- b) social media
- c) contact force
- d) orientation

6. Which word means “to push away; the opposite of attract”?

- a) magnetism
- b) hypothetical
- c) repel
- d) hypothesis

- 7.** Which word means “subject to ongoing change”?
- a) dynamic
 - b) interaction
 - c) electric current
 - d) attract
- 8.** Which word means “an object that generates a magnetic field”?
- a) hypothetical
 - b) magnet
 - c) electrostatic force
 - d) gravity
- 9.** Which word means “to draw toward; the opposite of repel”?
- a) magnetism
 - b) attract
 - c) tesla
 - d) social media
- 10.** Which word means “to revolve in a curved path around a central object”?
- a) interaction
 - b) gravity
 - c) orbit
 - d) orientation
- 11.** Which word means “the force applied by magnetic materials that attract or repel one another based on the alignment of charges in the particles of which they are made”?
- a) magnetism
 - b) collision
 - c) dynamic
 - d) force
- 12.** Which word means “a blockage in a passageway that may allow some material to get through or may stop all material from passing through”?
- a) hypothetical
 - b) magnetic field
 - c) magnetism
 - d) obstruction

FOR THE TEACHER

Answers

Unit quiz key

1. a 2. a 3. d 4. c 5. b 6. c 7. a 8. b 9. b 10. c 11. a 12. d