# Fields at Work

Trace how magnetic fields affect materials.

**PS.9.d** "magnetic fields cause the magnetic effects of certain materials;"

NAME _____ DATE _____

## 1 READ AND MARK

Read it twice

**YOUR JOB** Underline each sentence that tells what a magnetic field does to a material or object. Circle the name of each material that responds strongly to a magnetic field.

### Invisible Pulls

1. At a recycling center, an electromagnet lifts steel cans from a moving belt. Electric current in a coil creates a magnetic field around the coil. The field reaches into nearby space, even though people cannot see it. Steel contains iron, a material that can respond strongly to a magnetic field. Inside the steel, tiny magnetic regions can line up more nearly in one direction. This makes the can temporarily magnetized, so the field pulls it toward the electromagnet. When workers switch off the current, the electromagnet's field mostly disappears.

2. Not every metal is pulled strongly by a magnet. Aluminum cans, copper wire, and many other materials do not form the same lasting alignment of magnetic regions. A magnetic field can still produce very weak effects in some of these materials, but those effects are usually too small to notice in an ordinary test. Iron, nickel, cobalt, and many steels are called ferromagnetic because they can become strongly magnetized. Their response helps explain why a magnet attracts a paper clip made of steel but not a similar-size piece of aluminum.

3. Magnetic effects also reveal the presence and direction of a field. If a small compass is placed near a bar magnet, the compass needle turns because the needle is itself a tiny magnet. The needle aligns with the magnet's field at its location. Field strength is generally greater closer to a magnet, so a nearby steel pin may be pulled more strongly than one farther away. Magnetic fields can act without direct contact, but distance and material matter. A wooden block between a magnet and a steel pin does not stop the field.

## 2 ANSWER WITH EVIDENCE

Use the passage

1. What creates the magnetic field around an electromagnet's coil?

2. What happens inside a steel can when it is placed in an electromagnet's magnetic field?

3. Why does a magnet attract a steel paper clip but not a similar-size piece of aluminum?

4. How can a compass needle show the direction of a nearby magnet's magnetic field?

## 3 YOUR TURN

Your own words

Draw two labeled panels showing an iron nail wrapped with wire beside paper clips. In Panel 1, show no current in the wire. In Panel 2, show current in the wire and a magnetic field that causes the nail to attract the clips. Write one sentence below each panel explaining what changes.

ANSWER KEY

# Fields at Work

GRADES 7-8 · PS.9.d

## PART 1 · READ AND MARK

Underline each sentence that tells what a magnetic field does to a material or object. Circle the name of each material that responds strongly to a magnetic field. Accept any marking that follows this job and points at the right text.

## PART 2 · ANSWERS

| # | QUESTION | ANSWER |
|---|---|---|
| 1 | What creates the magnetic field around an electromagnet's coil? | **Electric current in the coil creates the magnetic field.** |
| 2 | What happens inside a steel can when it is placed in an electromagnet's magnetic field? | **Tiny magnetic regions in the steel line up more nearly in one direction. The can becomes temporarily magnetized.** |
| 3 | Why does a magnet attract a steel paper clip but not a similar-size piece of aluminum? | **Steel contains iron and can become strongly magnetized. Aluminum does not form the same lasting alignment of magnetic regions and is not pulled strongly.** |
| 4 | How can a compass needle show the direction of a nearby magnet's magnetic field? | **The compass needle is a tiny magnet. It turns and aligns with the magnetic field at its location.** |

## PART 3 · YOUR TURN (SAMPLE ANSWER)

Panel 1: With no current, the coil produces no strong electromagnet field, and the nail does not attract the paper clips. Panel 2: With current, the coil's magnetic field magnetizes the iron nail, so it attracts the paper clips.

Accept explanations that connect electric current to a magnetic field and the field to temporary magnetization of the iron nail. Student sketches should show the nail attracting clips only when current is present.