



# MAGNETISM

## Teacher Notes



### FOURTH GRADE BACKGROUND

- Fourth graders studied magnetism in 3<sup>rd</sup> grade.
- They know that magnets have a north and south pole and that there are invisible magnetic fields.
- The students have dealt with simple magnets, but not electromagnets (they do know about electricity).
- They students have some experience using a compass.

### PREVIOUS LESSON REVIEW

- What did you learn about electricity? What's the difference between a closed and open circuit?
- Did you use anything with electricity at home since we last met? How about with magnets?
- In this lesson we will be exploring the magnets. Their strength can be increased using electricity.

### INTRODUCTION

All magnets have two ends, usually marked "north" (N) and "south" (S): opposites attract and likes repel. If you have two bar magnets with their ends marked "north" and "south", the north end of one magnet will attract the south end of the other. On the other hand, the north end of one magnet will repel the north end of the other (and similarly, south will repel south). Magnets attract objects made of steel or iron.

Electromagnets are the same, except that they are temporary; the magnetic field exists only when electric current is flowing. An electromagnet starts with a battery (or some other source of power) and a wire. If you look at a battery, you can see two ends: one marked plus (+) and the other marked minus (-). Electrons collect at the negative end of the battery, and, they will flow to the positive end through a wire. If you attach a wire directly between the positive and negative terminals of a battery, three things will happen:

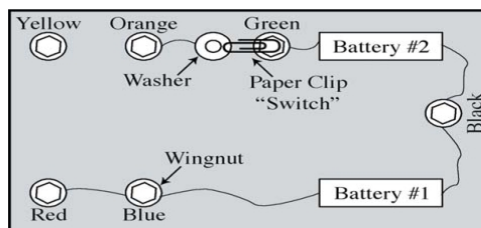
- Electrons will flow from the negative side of the battery to the positive side as fast as they can.
- The battery drains quickly, and normally, you connect some load in the middle of the wire so the electrons can do useful work. The load could be a motor, light bulb, or radio.
- A small magnetic field is generated in the wire, which is the basis of an electromagnet.

For example, if you wrap your wire around a nail 10 times, connect the wire to the battery, and bring one end of a nail near the compass, you will find that it has a much larger effect on the compass. In fact, the nail behaves just like a bar magnet; however, the magnet exists only when the current is flowing from the battery! This electromagnet is able to pick up small steel objects like paper clips, staples and thumbtacks.

Show two demonstrations. The first shows that opposite poles of a magnet repel (in a set of round magnets placed onto a wooden dowel, the top one will hover if you put similar poles together). The second is a simple motor. If you place a circular coil of wire between two round magnets in a circuit with a battery, the wire coil will spin like a motor.

### DISCUSSION THOUGHTS

Where are magnets found around you?



### VOCABULARY

- **Magnetism:** a phenomenon by which materials exert an attractive or repulsive force on other materials
- **Electromagnets:** created when electrons flow through a magnetic field
- **Magnetic Pole:** the direction of a magnetic force (north or south)
- **Permanent Magnet:** a material that stays magnetic (unlike an electromagnet)
- **Magnetic Field:** an invisible magnetic force that surrounds a magnet or electrified wire
- **Magnetic Attraction:** the attraction between oppositely charged magnetic poles
- **Magnetic Repulsion:** the repulsion between similarly charged magnetic poles