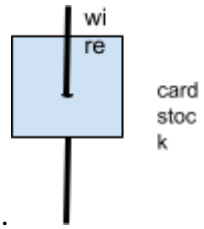
Student activity page: Why does an electric motor have magnets and coils of wire?

Follow the instructions to carry out the three investigations that follow. When you have finished Investigations 1 and 2, answer the questions at that follow, then continue on to Investigation 3.

Investigation 1: What does the field around a single wire look like?

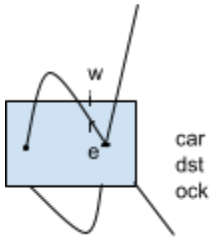
1. Place a single wire through the center of a piece of card stock



2. Connect the wire to the power supply and note the negative and positive connections.
3. Place a compass on the cardstock adjacent to the wire. Observe the position of the needle. Remove the compass and draw an arrow on the paper at the compass location matching the position of the needle.
4. Move the compass to a new location and repeat step 2.
5. Repeat step 3 until enough arrows surround the wire to show the shape of the field.
6. Reverse the direction of the current by switching the connection to the positive and negative terminal of the power supply. Repeat steps 3-5 with a different color marker.

Investigation 2: What does the field around a coil of wire look like?

1. Students will place a coil of wire through on a piece of cardstock. The wire will be perpendicular to the cardstock with the loop resting vertically halfway above/below the cardstock. (Punch two holes in the cardstock to make the loop.)



2. Repeat procedure in Part 1 to map field around the coil.
3. Move the magnets farther apart. Redraw the fields.

Data analysis

1. Describe similarities and differences in the fields in Part 1 and 2.

2. What happens to the field when you reverse the current?

3. How might differences in the fields seen when reversing the current in Investigation 2 be related to how the motor works (Why does the coil spin)?

Investigation 3: How does the number of coils change the magnetic field?

1. Make a coil of wire ____cm in diameter. Circle the number of loops in your coil assigned to your group by your teacher- 5, 15, 25, 35, or 45 loops.
2. Place a coil firmly against a piece of wood at the end of the track so that it does not move. This represents the starting line. Place the cart up against the coil and connect the coil to the power supply such that the electromagnet and the magnet on the cart will repel.
3. Release the cart and record the distance it travels.
4. Record your data.
5. Switch coils with another group. Be sure you have a different coil diameter. Repeat steps 2 and 3 for each of the coils with 5, 10, 15, 20, 25, and 30 loops.
6. Make a graph of number of loops vs. distance travelled.

When you have finished with Investigation 3, answer the questions below. Be prepared to discuss and defend your answers in a full class discussion.

1. What happens to the magnetic field when the current is reversed?

2. What does making loops in the wire do to the magnetic field?

3. Does the coil have a North and South Pole?

4. How is the number of coils related to the strength of the electromagnetic field?

5. How is the number of coils related to the potential energy of the electromagnetic field?

Name _____ Class _____

Record data from your investigation, then exchange coils with another group and repeat. When you finish, graph both data sets on the same axis below.

Coils	Not connected to the battery	5	10	15	20	25	30	Coil Diameter
Distance Traveled								
Distance Traveled