Quick ‘n’ Easy DC Motor

Overview One of the big mysteries of the universe is why we can’t separate the north from the south end of a magnet. No matter how small you break that magnet down, you’ll still get one side that’s attracted to the north and the other that’s repelled. There’s just no way around this! Or is there?

What to Learn Today, you get to find out how magnetic fields interact with each other and cause things to rotate. In this case, we’re using an electromagnet and a permanent magnet so we can turn our motor on and off.

Materials

- AA battery
- 5 different sizes of metal screws
- 6” insulated wire
- Very strong metal magnet

Lab Time

Watch your fingers on this experiment – if you’re not careful and leave your wire contacting the magnet too long, you’ll roast your battery (and that’s really bad).

1. Place your magnet on the head of the screw.
2. Put the point of the screw on the plus end of the battery. Everything should hold together if you’ve got a nice, strong magnet.
3. Fan the ends of one end of the wire out to make it look like a little paintbrush.
4. Hold the battery in your hand with the negative side up.
5. Take the other end of the wire and press it on the negative end of the battery with your finger. Hold the battery with the rest of your fingers so that the magnet dangles an inch or two above the table.
6. Take the little wire paintbrush end and barely touch the top of the magnet. The magnet and screw should start to spin!
7. **Note: Do not leave the paintbrush wire attached to the magnet or you will roast your battery (which may explode).**
8. You may need to re-center your screw, especially once you really get it going.
9. Complete the table for all the screws, trying each one on either the positive or negative terminal.

Quick DC Motor Data Table

Screw Size/Description *(Example: 2" brass screw)*	**Which Terminal is the Screw Attached to?** *(positive or negative)*	**Spin Rate** *Rate on scale: (very slow/slow/medium/fast/very fast)*

Reading

If you COULD separate the north from the south pole, you could point a magnet's south pole toward your now-separated north pole, and it would always be repelled, no matter what orientation it rotated to. Normally, as soon as the magnet is repelled, it twists around and lines up the opposite pole and SNAP! (*there go your fingers*.) But if it were always repelled, you could chase it around the room or stick a pin through it so it would constantly move and rotate.

Well, what if we sneakily use electromagnetism? Note that you can use a metal screw, ball bearing, or other metal object that easily rotates. If your metal ball bearing is also magnetic, you can combine both the screw and the magnet together.

Famous scientist Michael Faraday built the first one of these while studying magnetism and electricity, and how they both fit together. Here's what he figured out:

The current from the battery is flowing through the wire, creating a magnetic field around the wire, which interacts with the magnetic field in the gold disk magnet. Since the wire creates a magnetic field that is perpendicular to the field in the gold magnet, the magnet feels a push, which causes it to rotate.

Exercises

1. How does this experiment work?
2. What happens if you reverse the polarity and attach the screw to the negative side of the battery?
3. How do you get your motor to spin the fastest?

Answers to Exercises: Quick 'n' Easy DC Motor

1. How does this work? (When you touch the paintbrush wire to the magnet, electricity starts to flow, which creates a magnetic field. That magnetic field interacts with the magnetic field in the metal magnet, and the result is that it starts to rotate. Two magnetic fields are interacting and causing stuff to rotate.)
2. What happens if you reverse the polarity and attach the screw to the negative side of the battery? (The magnet spins in the opposite direction.)
3. How do you get your motor to spin the fastest? (Make sure the screw is centered on both the battery and the magnet, and that the wire barely touches the magnet.)