

One Wire Motor

AT A GLANCE:

Kids can build a working motor with household materials.

STUDENTS WILL BE ABLE TO:

Demonstrate the process of science inquiry by posing questions and investigating phenomena through language, methods and instruments of science.

BACKGROUND INFORMATION:

This motor relies on electromagnetism to turn the copper wire.

PRINCIPALS:

The magnet's magnetic field and the electrical current of the battery, when combined, create a force that propels the copper wire in a direction perpendicular to the combination of the two forces.

MATERIALS:

- Neodymium magnet
- 1.5V, AA battery
- Small flat head bolt
- Metal washer
- Copper wire, uncoated (about 8 in.)
- Pliers
- A dull nail or screw



PROCEDURE:

1. Using a dull nail or screw, **very carefully** tap a small dent into the top of your battery at the positive end. You can use your pliers to tap it.
2. Attach your neodymium magnet to the washer so that it can sit flat on the table. This acts as a stand for your motor.
3. Place your bolt, upside down, on top of the magnet.
4. Place your battery, positive terminal up, onto the bolt. The magnetic force will cause the bolt to stick to the battery.
5. Bend your copper wire so that the midpoint of the wire can rest in the dent on the top of the battery. The bottom of the copper wire needs to rest lightly on the magnet. Do not make the two ends too close around the magnet! The friction may stop your motor.
6. Experiment with different shapes until you find one that allows your wire to easily propel itself around the magnet.
7. Now impress your friends with your new found physics abilities!

WHAT'S HAPPENING?:

The neodymium magnet, or rare earth magnet, has a very strong magnetic field. This magnetic field wraps around the magnet in two distinct directions, giving the magnet what we call it's North and South poles. The electricity from the battery flows in a specific direction as well, from the negative terminal to the positive terminal. As the electrical current flows through the circuit we've created with our copper wire and conductive bolt, it combines with the magnetic fields flowing from the magnet. When combined, another force emerges that pushes the copper wire away from the other two forces in a direction perpendicular to the other two. Without the small dent in our battery, the wire would likely be propelled right off the battery!

TRY THIS:

- Try using different materials to build your motor. Are there other conductors that work as well as the copper?
- Try different sizes of batteries and wires.
- Try making different shapes with your wire. A heart works well, too.
- Note the direction of rotation of your wire. Can you think of a way to change it's direction?

What do you notice or observe?

What conclusions can you make?

What can you do differently next time?

