

Dig Deeper: Homopolar Motor



Materials:

- Neodymium Magnets (these have a strong force, so be careful!)
- Battery(AA or AAA, preferably)
- Copper Wire
- Pliers
- Utility knife or Scissors (to remove insulated coating of the copper wire)

Safety:

Since the circuit will be short while the copper wire is spinning, both the copper wire and battery will get hot. Do not run your motor unsupervised or for more than 3 minutes at a time.

Steps for Homopolar Motor Fan (<https://www.youtube.com/watch?v=RGFtpOZxThc>):

1. Stand the battery upright.
2. Put the neodymium magnet on one end of the battery (it should magnetically attach on to the end).
3. Take your copper wire, and create a spiral opening/wrap around at the other end of the wire. Make sure that it is slightly bigger than the end of the battery.
4. Make sure to bend the other end of the copper wire, so that it points downwards.
5. You will need to put the copper opening on top and through the battery, so that it can cover the magnet on the negative end. In addition, the bent end of the copper wire should touch the side of the battery that does NOT have the magnet attached to it.
6. Observe what happens and record your observations!

Questions:

1. What happens when you put the magnet on the negative side of the battery? What about the positive side? Why do you think that is?

Well, this depends on the direction of the magnetic field. Let's say that the direction of the magnetic field is the same for both of the negative or positive terminals of the battery, then the direction of the Lorentz force will change because of the right hand rule.

2. Is the Law of Conservation of Energy being applied here? If so, what energy source(s) are involved in this motor?

Chemical energy, electrical potential energy, work done by friction, kinetic energy, and thermal energy.

3. Can ANY metal work for our wire? Why or why not?

Yes. As long as the metal wire is a highly conductive type of metal. However, a non-metal such as graphene is also a good conductor.

4. Going back to the previous experiment, could we make a Homopolar Motor with a potato battery? Why or why not?

Yes. We just need to redesign our potato batteries setup into a big cylinder as a rotational axle for the copper wire to rotate.

Another Analogy:

Using the information about voltage, current, and resistance we've given you so far, try and find a way to relate these three components using a different analogy that you like or that makes the most sense for you and share it with us on the Facebook Page or via email (tHSTEM@uh.edu)!

Reminder: Do not use any of the analogies that were already used in the lesson and make sure it is school appropriate.

Lastly, be creative! We look forward to reading what analogies resonated with y'all!

Sushi Conveyor Belt Example:

Voltage is the sushi chef

Current is how fast the chef can make the sushi to push out to the customer

Resistance is the customer

- Small resistance
- Big resistance

Electron is sushi plate

Electrical energy is the sushi or sashimi