

# Electromagnetism

Can you imagine a doorbell that never stopped ringing? Or a toaster that only makes burnt toast? Magnets are used in many tools we see every day, but sometimes it would be more helpful if they weren't working all the time. That's where electromagnets come in! Powered with electricity, they are only magnetic when you need them to be.



## Engineering

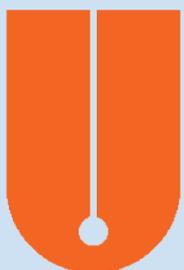
Unlike permanent magnets, whose electrons are always aligned for magnetism, electromagnets only have the electrons aligned in the presence of an *electric current*. Knowing that electrons have a negative charge, and protons have a positive one, helps to understand why magnets have poles (a positive end, and a negative one) and how they can be used.

## Nature

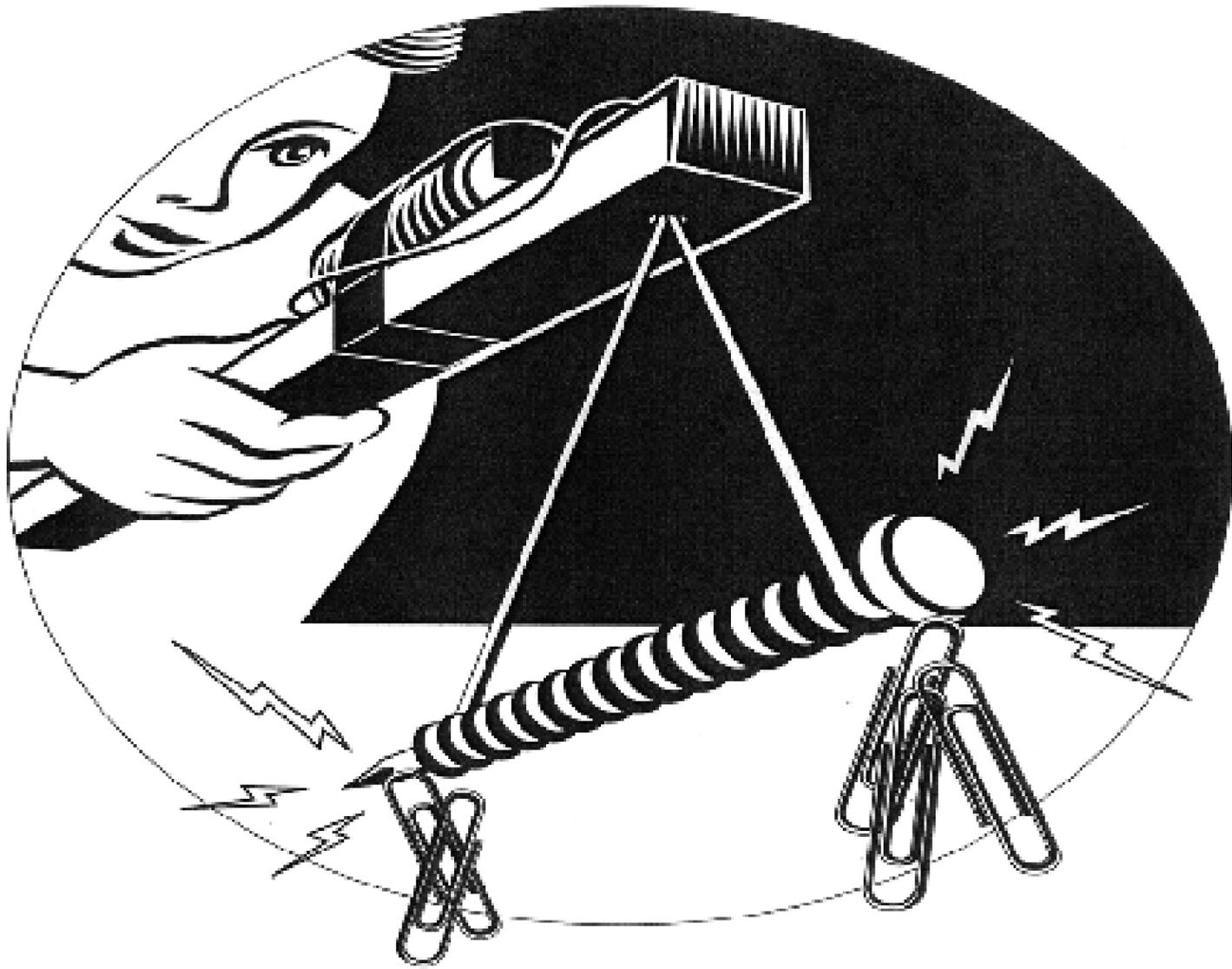
The *Ampullae of Lorenzini* in sharks and rays allows these creatures to sense electromagnetic fields. This organ is not found on bony fish. Magnets and electromagnets are idea for use in fisheries and as bycatch reduction devices where you would not want the presence of sharks!

## Challenge!

You can build your own electromagnet using a few basic materials. Check out the following pages to build your own electromagnetic fishing rod.



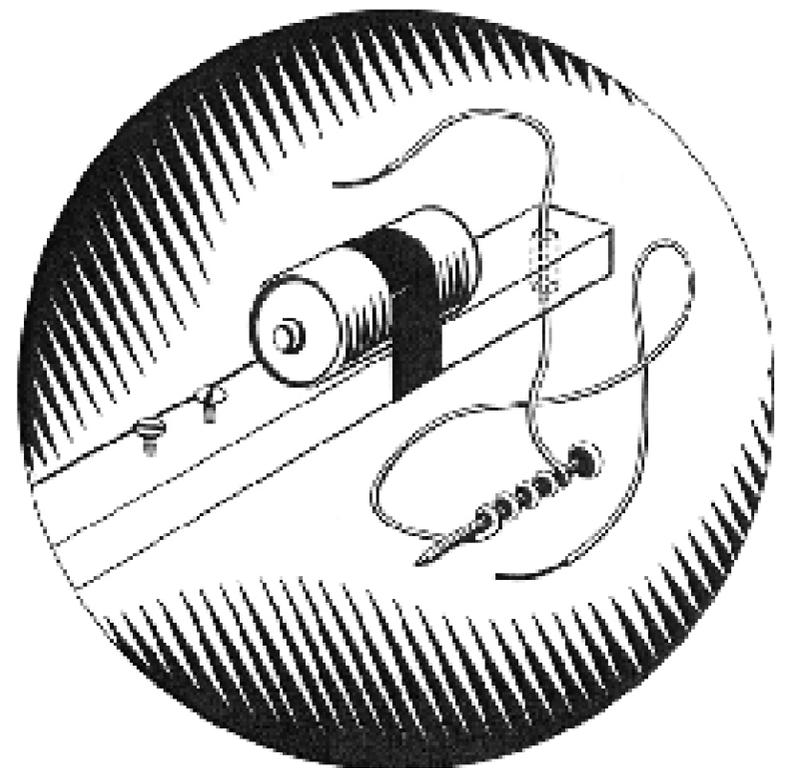
## Go Fish

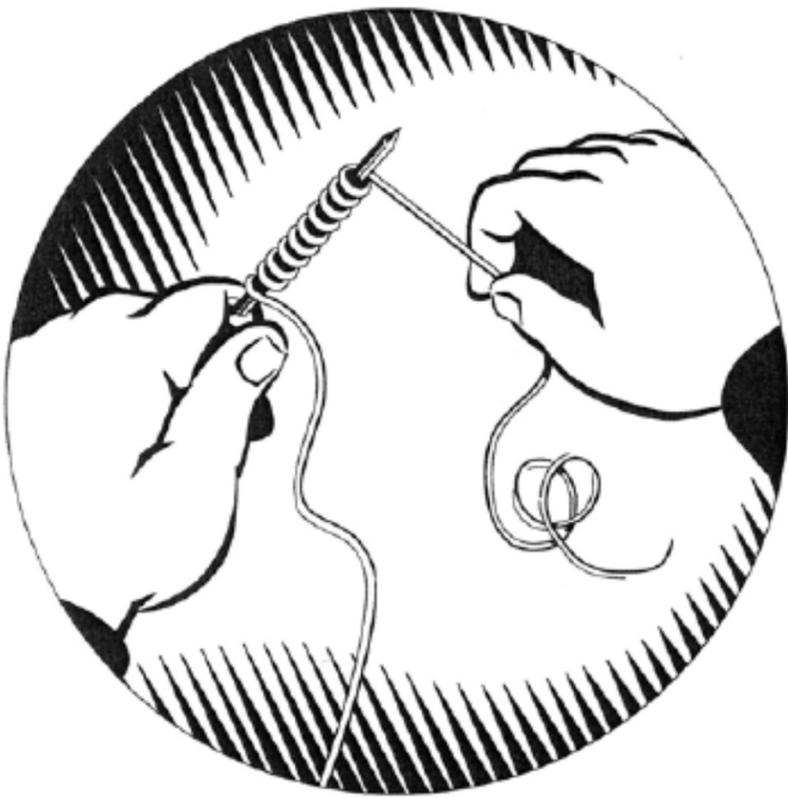


You can build an electromagnetic fishing pole and catch some fish with magnetic personalities!

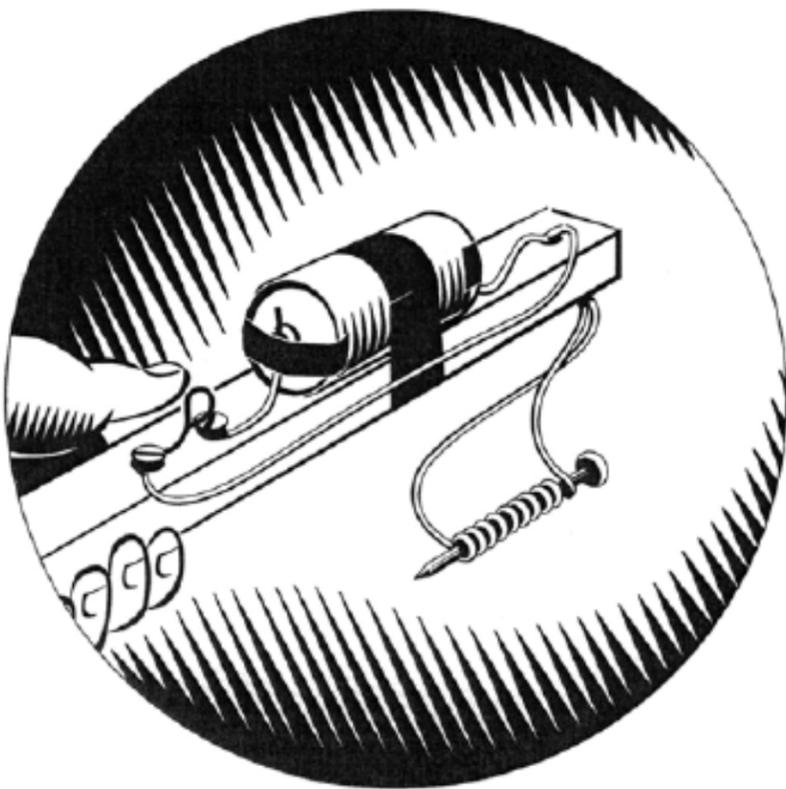
### Materials

- Piece of wood 12" long, 1/2" x 3/4"
- Two wires (41" and 2") with the ends stripped: one end stripped to 1" and the other to 1/2"
- One 2 1/2" nail
- D-size battery
- Electrical tape
- Two 1/2"-screws
- Paper clips





Engineers use magnets in motors, audio speakers and medical equipment, just to name a few uses. Magnets are useful because they generate a force called a magnetic field. You've seen the effect of a magnetic field when watching a magnet attract, or pull, an object. Magnets have a north and a south pole. The same kind of poles push each other apart and different poles attract or pull each other together.



Metals are made up of groups of atoms. If these groups are lined up in the right way, a magnetic field is produced. Electricity flowing through a wire has the ability to line up the groups of atoms in metals, creating a magnetic field, and turning the metal into an electromagnet. In this activity, you will make an electromagnet with wood and wires. The more times the wire is wrapped around the nail, the stronger the magnetic field becomes. An electromagnet acts just like a permanent magnet except an electromagnet is turned on and off by starting or stopping the flow of electricity through the wire.

### Build an Electromagnet!

1. Put two screws into the wood, one 3" and one 4" from one end. Leave about 1/4" of each screw exposed. Drill a hole 1/2" from the opposite end. The hole should allow two wires to pass through.
2. Place the battery on the wood, near the screws. Fasten the battery to the wood using the electrical tape.
3. Leave 7" of wire from the short stripped end of the wire. Start wrapping the wire tightly around the nail, starting from the head of the nail. Stop wrapping the wire around the nail when about 13" of wire are left to the long stripped end of the wire.
4. Pull the 7" long piece of wire through the hole. Tape the bare wire to the battery.
5. Pull the 13" end of the wire through the hole. Wrap the bare end of the wire, starting at the yellow insulation, around the bottom-most screw twice. Make a loop at the end of the bare piece of wire. Wrap the small wire around the top screw twice then tape the other end to the battery. Touching and holding the loop to the top-most screw will cause electricity to flow through the wire. Make sure the connections to the battery are good.
6. Scatter the paper clips, grab your fishing pole and go fish!

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