ELECTRICITY

Electricity and Magnetism

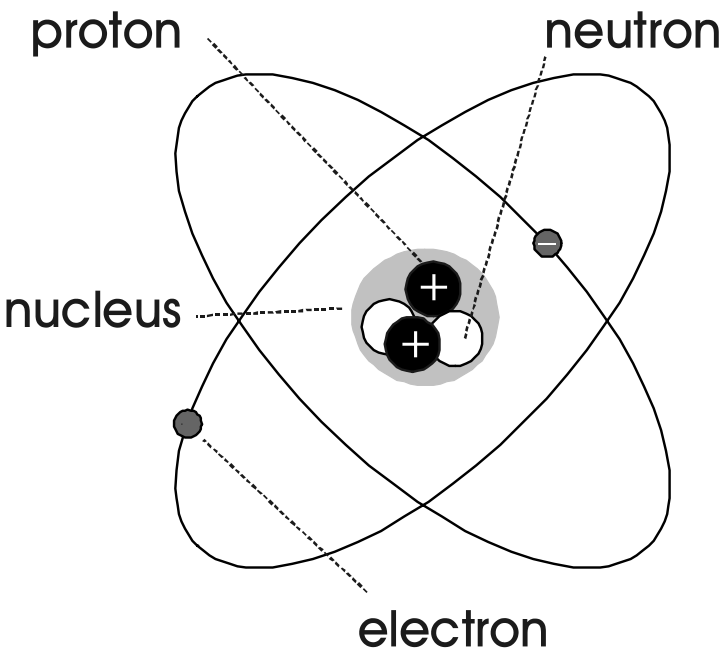
What is Electricity?

Electricity is a mysterious force. We can't see it like we see the sun. We can't hold it like we hold coal. We know when it is working, but it is hard to know exactly what it is. Before we can understand electricity, we need to learn about atoms.

WHAT ARE ATOMS?

Everything is made of atoms—every star, every tree, every animal. Even you and I are made of atoms. The air and water are, too.

Atoms are the building blocks of the universe. They are very, very tiny particles. Millions of atoms would fit on the head of a pin.



ATOMS ARE MADE OF EVEN SMALLER PARTICLES

An atom looks like the sun with the planets spinning around it. The center is called the **nucleus**. It is made of tiny **protons** and **neutrons**. **Electrons** move around the nucleus in clouds, or **shells,** far from the nucleus.

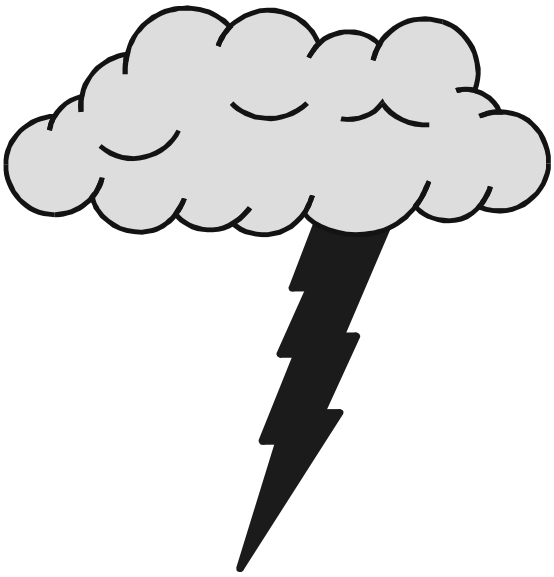
When an atom is in balance, it has the same number of protons and electrons. It can have a different number of neutrons.

PROTONS AND ELECTRONS ATTRACT EACH OTHER

Electrons stay in their shells because a special force holds them there. Protons and electrons are attracted to each other. We say protons have a **positive charge (+)** and the electrons have a **negative charge (-)**. Opposite charges attract each other.

ELECTRICITY IS MOVING ELECTRONS

The electrons near the nucleus are held tight to the atom. Sometimes, the ones farthest away are not. We can push some of these electrons out of their shells. We can move them. Moving electrons are called **electricity**.



STATIC ELECTRICITY

Electricity has been around forever. Lightning is electricity. It is electrons moving from one cloud to another or jumping to the ground.

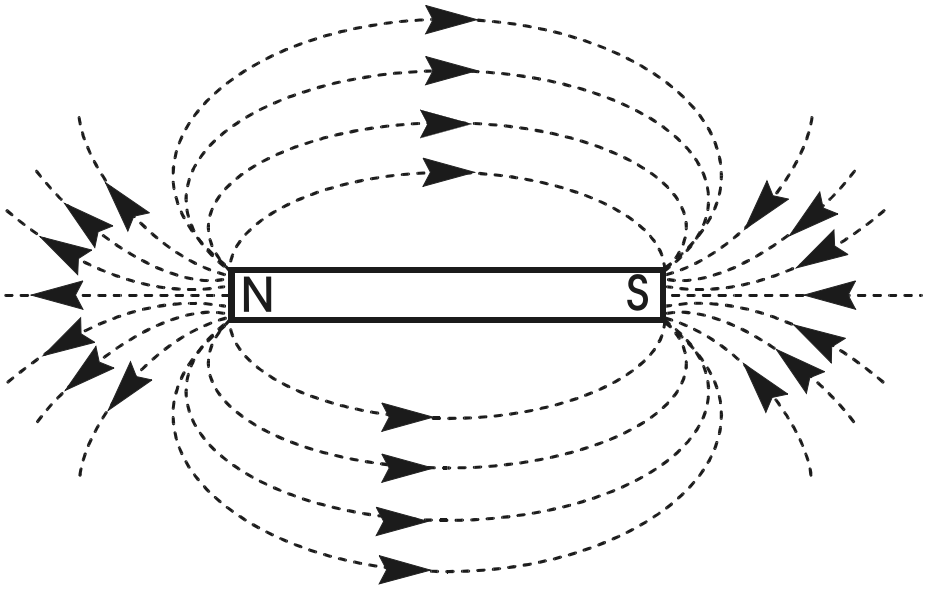
Have you ever felt a shock after walking across the carpet? A bunch of electrons jumped to you from another object.

This kind of electricity is called **static electricity**. Electrons aren't moving through a wire, they are jumping from one object to another.

ELECTRONS REPEL EACH OTHER

Have you ever rubbed a balloon over your head. Did your hair stand straight up on your head?

If so, you rubbed electrons off the balloon. The electrons moved into your hair from the balloon. They tried to get far away from each other. They moved to the ends of your hair. They pushed against each other and made your hair move—they **repelled** each other.

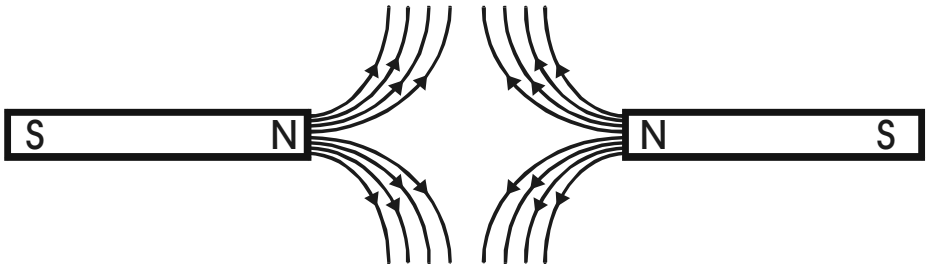


BAR MAGNET

MAGNETS ARE SPECIAL

In most objects, all the atoms are in balance. Half of the electrons spin in one direction; half spin in the other direction. Magnets are different. In magnets, the atoms at one end have electrons spinning in one direction. The electrons at the other end spin in the opposite direction.

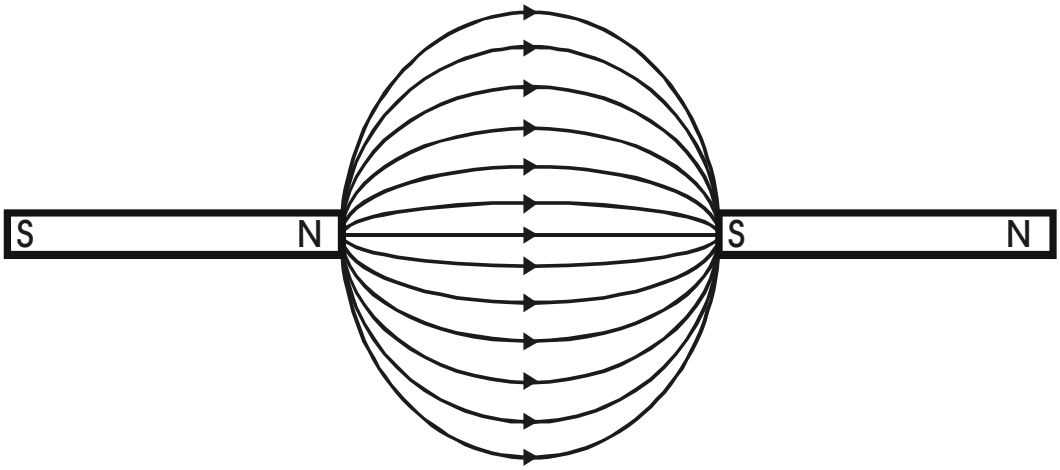
The electrons don't move from one end to the other to find a balance. They stay where they are, even though they're out of balance. We call one end of the magnet the **North (N) pole** and the other end the **South (S) pole**. The force of the magnetic field flows from the North pole to the South pole.



Like poles of magnets (N-N or S-S) repel each other.

Have you ever held two magnets close to each other? They don't act like most objects. If you try to push the two North poles (N) together, they repel each other. If you try to push the two South poles (S) together, they repel each other.

Turn one magnet around and the North (N) and the South (S) poles attract. The magnets stick to each other with a strong force. Just like protons and electrons, opposites attract.

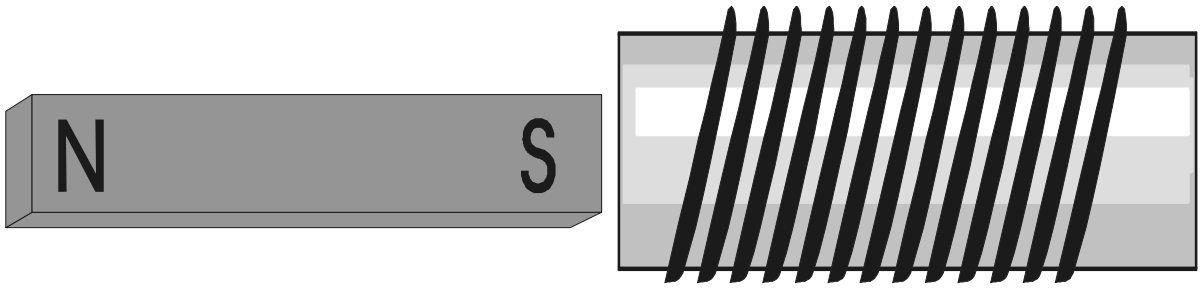


Opposite poles of magnets (N-S) attract each other.

MAGNETS CAN MAKE ELECTRICITY

We can use magnets to make electricity. A magnetic field can pull and push electrons to make them move. Some metals, like copper, have electrons that are loosely held. They are easily pushed from their shells.

If we move a magnet quickly through a coil of copper wire, electricity is made. The magnetic field has force. The moving force pushes the electrons in the copper wire. The electrons move through the wire. Moving electrons are called electricity.



COIL OF COPPER WIRE

POWER PLANTS USE MAGNETS

Power plants use huge magnets to make electricity. A big coil of copper wire spins inside the magnets. As it spins, the magnetic fields push and pull electrons in the wire.

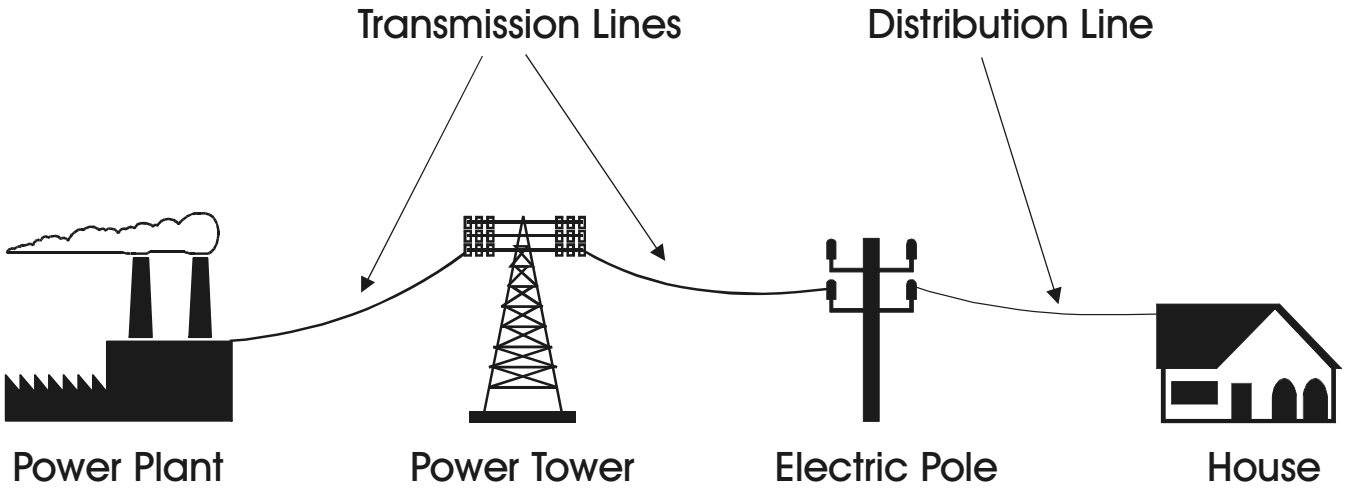
The electrons in the copper wire flow into power lines. These moving electrons are the electricity that flows to our houses.

Power plants use giant wheels, called **turbines**, to spin the coils of wire. It takes a lot of energy to spin turbines. Power plants use many fuels to get that energy.

ELECTRICITY TRAVELS THROUGH WIRES

The spinning turbines make electricity. It flows into power lines. The electrons flow through the power lines to our houses. They flow through the wires in our houses and back to the power plant. Then they start their journey again.

Electricity moves through the wires very fast. In just one second, electricity can travel around the world seven times.



HOW WE GET OUR ELECTRICITY

The **power plant** makes electricity. The electricity flows through **transmission lines** held up by **power towers**. The **transmission lines** carry large amounts of electricity to **electric poles** in cities and towns.

Distribution lines carry small amounts of electricity from the **electric poles** to houses and businesses.

ELECTRICITY TRAVELS IN LOOPS

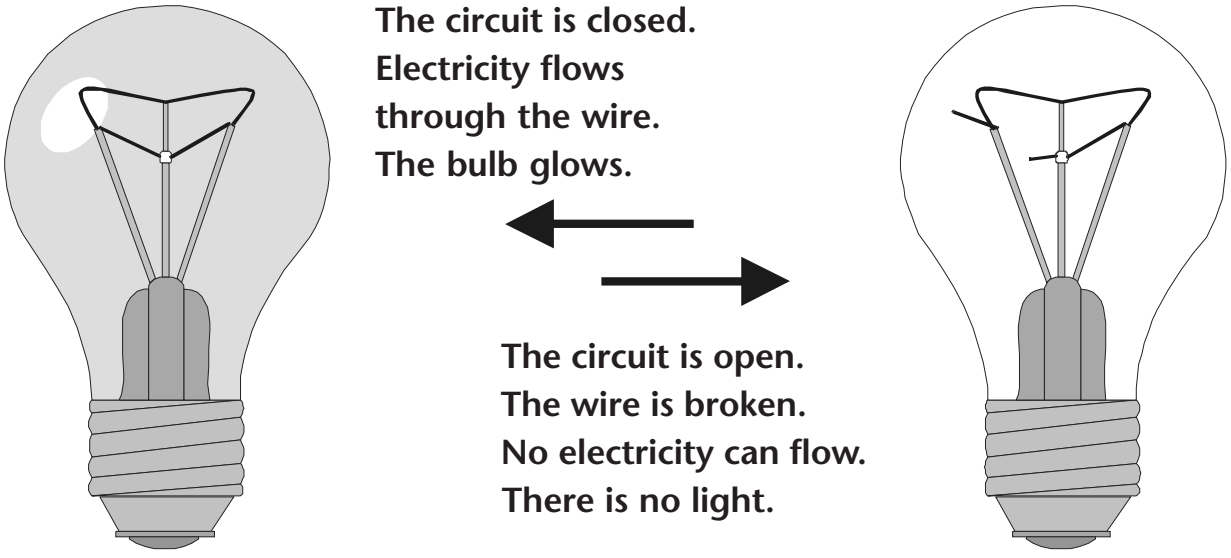
Electricity travels in closed loops, or **circuits** (from the word circle). It must have a complete path from the power plant through the wires and back.

If a circuit is open, the electricity can't flow. When we flip on a light switch, we close a circuit. The electricity flows through the light and back into the wire. When we flip the switch off, we open the circuit. No electricity flows to the light. It flows straight through the switch.

ELECTRICITY DOES WORK

When we turn a light switch on, electricity flows through a tiny wire in the bulb. The wire gets very hot. It makes the gas in the bulb glow. When the bulb burns out, the tiny wire has broken. The path through the bulb is gone.

When we turn on the TV, electricity flows through wires inside the set, making pictures and sound. Sometimes electricity runs motors—in washers or mixers.



WE USE ELECTRICITY EVERY DAY

Electricity does a lot of work for us. We use it many times each day. It lights our homes—and warms and cools and helps us clean them. It runs our TVs, VCRs, video games, computers and fax machines. It cooks our food and washes the dishes. It mows our lawns and blows the leaves away. It can even run our cars. We use more electricity every year.