

## *Frequently Asked Questions*

- **How Fast is Electricity?**

From a basic science course, one learns that all matter is made up of atoms, then that atoms are made of protons, neutrons, and electrons. One also learns that electrons move at the speed of light. If electricity is the flow of electrons, then the question arises, “Does electricity travel at the speed of light?” The answer is surprisingly “no.” The reason is that electrons move at the speed of light in open space, but in a wire, atoms are packed tightly together and the only available free space is the space between atoms. In colliding from atom to atom, the electrons move at the speed of light but from point “a” to point “b” along a wire they move very slowly, less than a foot per second! How then does the light turn on immediately when you flip the switch? Before the switch is turned on, electrons are already present at the light bulb. When the switch is turned on, those electrons are merely pushed through the light bulb by the electrons behind them and so on all the way back to the switch. Because these electrons bump into each other at the speed of light, the light bulb turns on immediately.

An excellent way to illustrate this concept is to line up some desks or tables so they make a small corridor to represent the wire. Have several children stand haphazardly in this corridor to represent the atoms of the wire. Choose some of the smaller children to represent electrons and have them move through the corridor and LIGHTLY bump into the “atoms” while trying to get through the corridor. They will soon see that even though they can run very fast, it still takes a while to run through the “wire”.

- **How do Batteries Move Electrons?**

Voltage sources create what is called an electric field that goes through a wire. This field is similar to the gravitational field of the earth because it is invisible and creates a force which can move things. In the case of an electric field, the things are electrons instead of physically observable objects. The direction of the field is from the positive terminal of the battery, or higher potential point, to the negative terminal, or lower potential point. When the electrons are caught in this field they are pulled along and thus produce a current. Current flows opposite to the flow of electrons.

- **Why do I get shocked in the winter when I turn on a light switch or open a car door?**

In the winter, the weather is dry and the air does not conduct electricity well. When you walk across a carpet, you collect charge on your body that, in dry weather, does not dissipate into the air. When you touch metal, the charge on your body is attracted to the UNLIKE charge on the metal you are touching and electricity flows temporarily to make you electrically neutral once again. When the weather is more humid, any charge you collect is dissipated into the air before you can hurt yourself.

- **How can electricity hurt you?**

Electricity can hurt you in one of two ways: mechanically or electrically. Mechanically, if you get too much electricity in your body by touching a high voltage source or wall outlet, the current literally burns your skin and other parts of your body. If lightning hits you, it burns your body in this way. Electrically, if you touch something that causes just the WRONG amount of current to flow through your body (this is a relatively small amount... about what your smoke alarm has in it), it can upset the electrical rhythm of your heart and your heart can lose its regular beat, causing a heart attack and possibly death.

- **What causes lightning?**

Lightning is caused when two electrically charged clouds rub against each other. In doing this, they create a large voltage (up to millions of volts) that immediately tries to discharge by finding the closest (highest object) thing it can find. When lightning strikes a tree or building, the charge created by clouds rubbing together dissipates into the ground, tree, or building.