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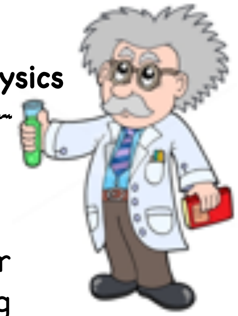


Going With the FLOW!

These are strange times so we will have to go with the flow in conducting our remaining lessons on energy. This is actually strangely appropriate for studying **electrical energy**, the "E" in our MELTS acronym for the five main forms of energy, and the subject for this lesson. Why is it appropriate? Because it is all about going with the flow…

You use electricity every single day, but what exactly IS electricity and where does if come from? The word "electricity" comes from the word electron which you are already familiar with from our study of chemistry. You learned that every atom has three main parts: protons, neutrons, and electrons. You also learned that protons have a positive charge, neutrons have no charge, and electrons have a negative charge. When there are the same number of positively-charged protons and negatively-charged electrons in an atom, the atom has NO charge since the charges cancel each other out. However, electrons are known to jump from atom to atom which changes the charge of atoms to either positive or negative. Like charges repel one another and opposite charges attract one another. It is the interaction of these charged particles that give us electrical energy. By definition, **electricity is the energy produced by the movement or FLOW of electrons.** Harnessed (or collected) electrical energy can be stored or used to do work.

There are two main types of electricity, electrostatic and current. **Electrostatic electricity** (otherwise known as static electricity) stays in one place (or is stored), which makes it a form of potential energy. The word static means "at rest." You should be shockingly familiar with this type of energy if you have ever trudged across the carpet in your socks on a dry day and then touched a door knob! OUCH! What actually occurred is that you collected electrons as you trudged across the floor and charged yourself up! When you touched the metal of the door knob, you transferred that extra energy from your body to the door knob. This is similar to a lightning strike, although on a much smaller scale (thank goodness!). Clouds become so electrically charged that they need to release the extra energy on whatever is closest, such as a tree or mountain. This is why it is dangerous to be outside when there is lightning AND why you should certainly never take cover under a tree! You don't want to be a cloud's doorknob do you?

Current electricity continuously flows and carries energy from one place to another, which makes it a form of kinetic energy. This is a very useful form of electricity. There are two forms of current electricity, alternating and direct. **Alternating current (AC)** is a current that rapidly moves back and forth. An example of an alternating current would be the electricity that is mainly used in your home with wall sockets. **Direct current (DC)** flows in only one direction. Examples of a direct current would be batteries and some generators.

In order for current electricity to flow, it must follow a circuit. A **circuit** is a closed loop or path that the electrons travel on. Circuits include several parts: a conductor, an energy source, one or more resistors, and often, a switch. Let's talk about parts of a circuit.

In the first semester, you learned about properties of matter, one of which is conductivity. A **conductor** has the ability for electric charges to pass through it because the outer electrons easily detach from their atoms. Most metals are good conductors. Copper is an excellent conductor which is why it is used in most wires. (Water is also an excellent conductor which is why it is extremely dangerous to use electricity near water.) Copper wires are always covered in plastic or rubber, which are insulators. **Insulators** do NOT conduct electricity well, so they are wrapped around the metal wires to keep the flow of electricity contained within the wire for our safety AND to make them efficient in moving the electrons.

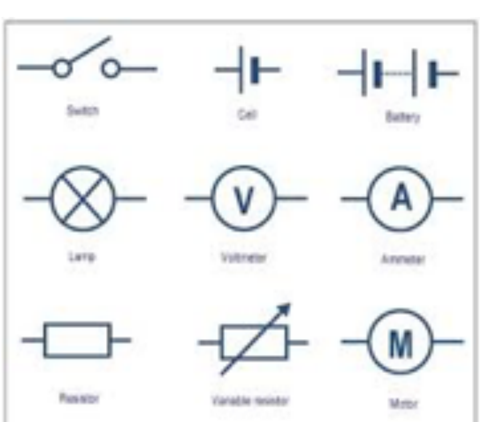
The potential amount of electricity that can flow through the circuit at one time is called **voltage**. You can think of voltage as a type of road. On a one-lane country road few cars have the potential to travel at the same time. However, on a five-lane highway, hundreds of cars can travel at the same time. The higher the voltage, the more electrons can travel through the circuit, just like a highway. The amount of voltage is measured in volts (V). The actual measure (not its potential) of the current of electricity or flow of electrons past a single point in a circuit is the Ampere or **Amp** (A).

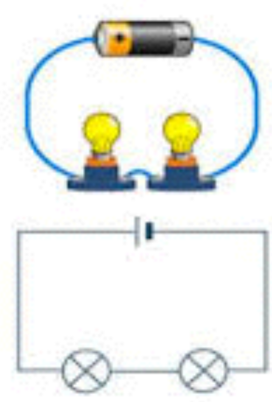
A **resistor** resists electricity flowing through it, so it slows down the flow of electrons or transfers the electrical energy into light or heat. When you transfer the electric current to turn something on such as a lamp, it is called a **load**. Loads are basically what you are trying to make work when you are plugging a cord into a socket.

A **switch** opens or closes a circuit. If a switch is open, it is breaking the path of the circuit and "turns off" the flow of electricity. If a switch is closed, it "turns on" and allows the path of electricity to flow. I came across a catchy phrase to help you remember this, "If it's open it's broken, if it's closed it flows!"

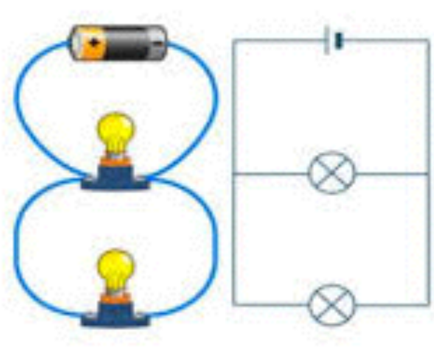
So what makes the electrons flow in a circuit? The electrons are moving along the circuit from a higher state of electrical energy to a lower state of electrical energy.

There are different ways to arrange the parts of a circuit. The two main ways are to form a series circuit or a parallel circuit. In a **series circuit**, the current flows through only one path. Any break in a series circuit will cut off the flow of electrons. A **parallel circuit** allows the current to flow through more than one path, so a break in the circuit does not prevent the flow of the current. See the diagram below, along with the symbols key.





Series Circuit



Parallel Circuit