Topic 1 - Electric Charges

When you get a 'shock', feel a 'jolt', or, a 'spark', you are experiencing the same type of electrical effect that makes lightning. Static electricity happens when there is an imbalance of electrons (which have negative charges).

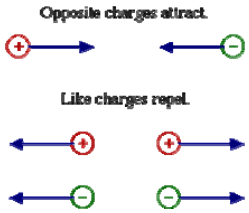
Producing Charges

Materials that attract or repel other materials are said to be charged, or carry an electric charge. Charges, which can be detected by an electroscope, are produced when materials are rubbed, touched or moved together and then separated. To refer to charges as stationary or 'static', would be inaccurate, because the charges are moving. *'Unbalanced charges'* is a more accurate way of describing this electricity. The quantity of electric charge is measured in *coulombs*.

Van de Graff (VDG) Generators These generators build up an excess of static charge using friction. A rubber belt rubs a piece of metal and transfers the charge to a sphere. When you touch the sphere the charge builds up on you. (Remember! - *like charges repel* - that is why your hair strands separate as you touch the sphere as the charge builds up on your body.)

Making Sense of Electrical Charges

Most objects have the same number of positive (proton) and negative (electron) charges. This makes them neutral (no charge).
When there is a difference in the electrical charge, certain actions are predictable, because of *the Laws of Electrical Charges.*



Benjamin Franklin was the first to describe the charges as 'positive' or 'negative'. When amber is rubbed with fur - some of the *electrons* in the fur move to the amber - the amber becomes negatively charged and the fur is positively charged. Charge separation occurs, when a charged object is brought close to a neutral object. The charged electrons repel the electrons in the neutral object and the charged object is then attracted to the protons of the neutral object (balloon on a wall)

Conductors, Insulators, and In-Between

In *insulators* electrons are bonded closely to the nuclei (allowing little movement), while in *conductors*, the electrons are free to move easily. Most metals are conductors and non-metals are insulators. A special type of conductor, called a r*esistor* allows electrons to flow, but provides some resistance (so it is sort of in-between a conductor and insulator).

Semiconductors are almost perfect conductors - they have almost no resistance to electron flow. Silicon semiconductors are used extensively to make computer microchips. The largest obstacle is to get the semiconductor to work at reasonable temperatures for practical applications. *Superconductors* are materials that offer little, if any, resistance to the flow of electrons.

Neutralizing Unbalanced Charges

Electrical Discharge is the movement of charges whenever an imbalance of charges occurs. The action results in neutralizing the objects. The over-charged electrons repel the electrons in the object and the positive protons attract the charged electrons causing a discharge or 'miniature lightning bolt'. There is now an electron balance. An ionizer can be used to neutralize charges on non-conductors.

Preventing Electrostatic Buildup

'Static cling' is a build-up of unbalanced charges on different materials. This build-up can be very costly because of the damage it can cause. Anti-static materials have to be used when handling charged objects, so that a discharge (which could cause harm or damage) does not occur. Anit-static sprays, coating or grounding strips.