For thousands of years, it has been known that an electric charge can build up on some objects. You are familiar with this kind of electricity in everyday life. Sometimes you get a shock when you touch a doorknob after shuffling your feet across a rug. Your clothes may cling together after they have been run through a dryer. A closer look at the structure of an atom will help to explain what is happening in each of these cases.

22:1 Micro-structure of Matter

Models of the atom place the protons and neutrons in its center or nucleus. The protons have a positive electric charge. The charge is exactly the same on each proton. Neutrons are neutral and have no electric charge. Located outside the nucleus of the atom is a “cloud” of electrons. Each electron has a negative charge equal in magnitude but opposite in sign to the charge of a proton. The magnitude of the charge is the same on all electrons and protons. The charge on an electron or proton is the elementary unit of charge. Usually, an atom contains the same number of electrons as protons. Then, the atom is electrically neutral. Electric charges appear when this balance is disturbed.

The proton is firmly “locked” in the nucleus of the atom. It can be dislodged only by methods used in nuclear physics. The electron is the mobile particle of the atom. Thus, all electric phenomena are due to the movements of electrons.
22:2 Charging Bodies Electrically

Because an electron can be moved easily, negative and positive charges can be produced on objects. A neutral body contains the same number of electrons as protons. By moving electrons about, it is possible to add electrons to a neutral body. Electrons are then in excess, and the body has a net negative charge. If electrons are taken away from a neutral body, the body has a net positive charge. The body then contains an excess of protons. In both cases, the protons remain in the nucleus and the electrons move. When a body is charged by adding or removing electrons, the charge stays on the body, at least for a short time. The body has a static charge. Static means “at rest.”

To illustrate, rub a glass rod with a piece of silk. Electrons leave the glass and move onto the silk. The glass rod then has a net positive charge while the silk has a negative charge.

If two glass rods are rubbed with a silk cloth, both have a positive charge. Then one of the rods may be suspended and the second rod brought close to it. The suspended rod will be repelled. Thus, two positively charged bodies repel one another. In the same way, two rubber rods can be charged negatively by rubbing them with fur or wool. If one of the rubber rods is suspended, it is repelled by the second rubber rod. Thus, two negatively charged bodies repel one another. However, if the negatively charged rubber rod is brought close to the suspended, positively charged rod, attraction occurs. There are three important facts about static electric charges.

1. Electric charges are of two distinct kinds, positive and negative.
2. Like charges repel. Unlike charges attract.
3. Charges exert forces through a distance.

FIGURE 22-1. Objects become charged through a gain or loss of electrons. (a) The neutral object has equal numbers of electrons and protons. (b) The negative object has excess electrons. (c) The positive object is deficient in electrons.

When a neutral body gains electrons, it gains a net negative charge.

When a neutral body loses electrons, it has a net positive charge.

An electrically-charged body has a static charge.

Read this!!
1. Give 2 examples of Static Electricity “build up” from everyday life.

2. What is the center of the atom called?

3. In our model of the atom:
   A. Name 2 particles that are located in the center of the atom.
   B. State the electric charge each one has.

4. What is the name of the particle located outside of the center of the atom?

5. What is the charge of the particle located outside of the center of the atom?

6. What is the charge on an atom usually?

7. In question #6 why is this so?

8. Which particle of the atom can be made to move easily?

9. What are all electrical phenomena caused by?

10. How does a neutral body gain a:
    A. Net negative charge?
    B. Net positive charge?

11. When a body loses or gains electrons, what is the name given to the charge produced?

12. State 3 important facts about static charges.