

3.2 Grade 9

CONCEPT 1

Electrons carry a negative charge, and protons carry a positive charge.

Activity

Recalling Atoms and Charge

Sketch an atom. Add labels to show protons and electrons. Write a caption to describe their properties.



negative charges the charges of electrons

positive charges the charges of protons

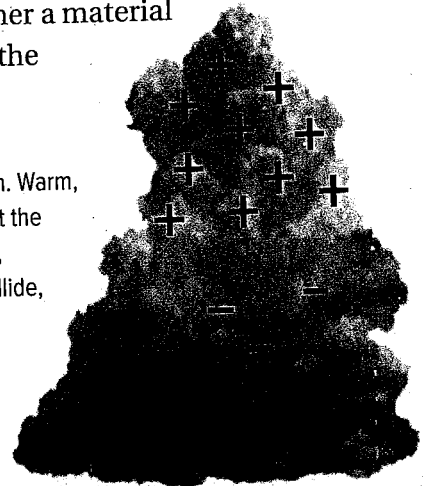
Rub two different materials together. Depending on the materials you use, something may come off one and transfer to the other, and the two materials will attract each other. About 250 years ago, American scientist Benjamin Franklin used the term **negative charges** to describe the “somethings” rubbed off a material. He said that an excess of **positive charges** were left behind.

Today we know the negative charges are the charges of electrons, and the positive charges are the charges of protons. Protons are part of the nucleus of atoms and are held firmly in place, so they cannot be rubbed off materials. Electrons can be rubbed off, because they surround the nucleus and some are not tightly bound to it.

When electrons are rubbed off a material, it becomes positively charged. The material that gains electrons becomes negatively charged. Charging a material by rubbing is called *charging by friction*. **Figure 3.9** shows an example. Whether a material gains or loses electrons depends on the combination of materials.

Figure 3.9 Clouds may be charged by friction in a thunderstorm. **How do you think lightning forms?**

Clouds in storms can become charged by friction. Warm, moist air causes strong updrafts in the clouds. At the same time, hail and ice crystals fall from the top, causing downdrafts. As droplets and crystals collide, electrons are stripped from upward-moving particles and are carried downward. As a result, clouds are negatively charged at the bottom and positively charged at the top.



Extending the Connections

Lightning Rock of the Sumas First Nation

Find out the story of the “transformer rock” that challenged Thunderbird and how a culturally important site stopped a developer’s plans.



Electrically Neutral and Electrically Charged Materials

The following is true of uncharged and charged materials or objects:

- **Uncharged Materials:** Before two materials are rubbed together, they have equal numbers of positively charged protons and negatively charged electrons. Because the equal numbers of positive and negative charges cancel each other out, the materials are *electrically neutral*.
- **Charged Materials:** If electrons are rubbed off one material, the protons stay behind and the material becomes *electrically charged*. So does the material that gains the electrons. A material or object that is electrically charged has an unequal number of positive and negative charges.

Figure 3.10 shows two materials before and after they were rubbed together. Observe the number of charges in each material.

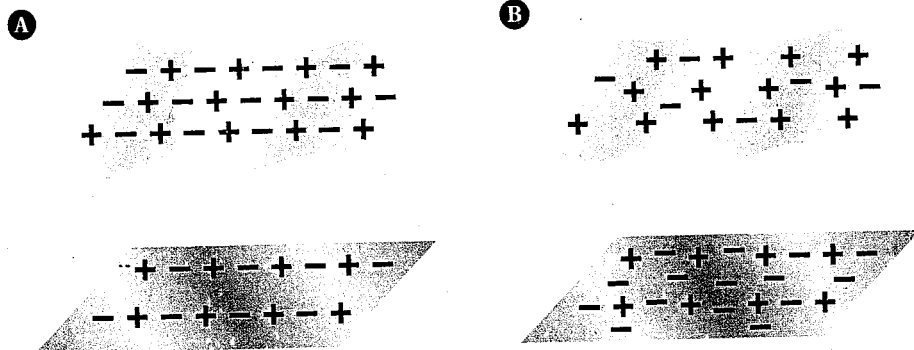


Figure 3.10 Two materials before and after being rubbed together

This diagram shows a paper towel (top) and an acetate strip (bottom) before they are rubbed together. Therefore, each one has an equal number of positive and negative charges. These cancel each other out so each material is electrically neutral.

This diagram shows the two materials after they are rubbed together. Electrons are rubbed off the paper towel and transferred to the acetate strip. The paper towel now has fewer negative charges, and the acetate strip has more negative charges. The paper towel is positively charged, and the acetate strip is negatively charged.

Before you leave this page . . .

1. Explain the relationship among negative charges, positive charges, electrons, and protons.
2. Describe what sometimes happens in terms of charges when you rub two different types of materials together.