What Are Charges?

1. Make copies of Student Resource Page 1.1, *Vocabulary*, and distribute to students. Discuss the definitions with students as they come up throughout the section.

2. Draw the atom shown on the board. Use the drawing to review atomic structure and the concept of charges. Ask: **What particles make up the nucleus?** *(protons and neutrons)* **What charges do these particles have?** *(Protons have a positive charge; neutrons have no charge.)* Point out the electrons. Ask: **What is an electron?** *(a negatively charged particle that surrounds the nucleus of an atom)* Explain that charge is a property of matter. Discuss that materials are neutral when they have equal numbers of positive and negative charges.

3. To get students thinking about static electricity, inflate a balloon and rub it against your hair. Then hold the balloon a few centimeters from your head and have students note how your hair stands on end. Ask: **What is static electricity?** *(a buildup of charges on a material)*

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**Vocabulary**

- **charge**: a property of matter. Matter can have a positive charge, a negative charge, or no charge.
- **neutral**: having neither a positive or negative charge. Atoms are usually neutral because they have equal numbers of protons (positively charged particles) and electrons (negatively charged particles). Objects that do not have a buildup of positive or negative charges are also neutral.
- **electron**: a negatively charged particle that surrounds the nucleus of an atom. When objects touch, one material can give up electrons to another. When an object gives up electrons it gains an overall positive charge.
- **static electricity**: the buildup of charges on an object. Static electricity occurs when electrons move from one object to another. This leaves a buildup of charges on the surface of both objects.

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**Teaching Tip**

**Step 3:** Rub balloon on dry, clean hair with no hair products such as spray or gel.

**Safety**

**Step 3:** Use caution rubbing a balloon on student hair due to the possibility of spreading parasites such as lice.
Static Electricity

When a wool cloth is rubbed on a plastic comb, the cloth loses electrons and the comb gains them. The comb now has a negative charge and the wool has a positive charge.

When a negatively charged comb is brought near a neutral piece of paper, the electrons on the surface of the paper are repelled, or pushed away. This leaves the surface of the paper with a positive charge.

Positively charged wool

Negatively charged comb

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4. Display the transparency Static Electricity. Use it to explain that when materials touch, electrons can move from one object to the other. Discuss the top drawing. Ask: What causes the comb to have a negative charge? (Electrons move to the comb, so the comb has more negative than positive charges.) Why does the cloth become positively charged? (It loses electrons and has more positive than negative charges.)

5. Tell students that charges exert forces (pushes or pulls) on other charges. Explain that unlike charges attract, or pull toward each other. Like charges repel, or push away, each other.

6. Have students look at the bottom drawing. Explain that the comb has a negative charge and the paper is neutral. Ask: How does the drawing show that like charges repel? (The electrons at the surface of the paper are pushed away from the paper's surface by the negative charges on the comb.) What effect does this have on the paper? (The surface of the paper is left with a positive charge.)

2. Students observe that neutral objects don’t interact. Have students tear the tissue into six tiny pieces and place the pieces on a desk. Tell students that the tissue and the comb are both neutral (have no electrical charge). Tell them to hold the comb near the tissue. Have them observe what happens and record their observations on the Resource Page. (Nothing happens.)

3. Students charge the comb and observe its effect on the tissue. Have students rub the comb 10 times with the wool cloth. Tell them to hold the comb near the tissue pieces and observe what happens. (The tissue pieces are attracted to the comb.) Ask: **What can you infer about the charges on the comb and the tissue? Explain.** (They are opposite, because opposite charges attract.)

4. Students charge the comb using a different material. Tell students to rub the comb 10 times with the paper towel. Have them hold the comb near the tissue pieces and observe. (The tissue pieces are attracted to the comb, but not as much as with the wool.) Ask: **Which charges the comb more—the paper towel or the wool?** (the wool)

5. Analyze the results. Discuss with students why rubbing the comb with the wool causes the tissue to be attracted to the comb. Explain that when the comb is rubbed with the wool, the wool loses electrons and the comb gains them, giving the comb a negative charge. When the negatively charged comb is brought near the neutral tissue, the electrons on the surface of the tissue are repelled, giving the tissue a positive charge. The negative charge of the comb then attracts the positive charge of the tissue.

**Assessment**

Ask: **If rubbing a comb with wool causes the comb to gain electrons, what is the overall charge on the comb? (negative)** On the wool? (positive)