A surface charge can be induced on insulators by polarization

A process very similar to charging by induction in conductors takes place in insulators. In most neutral atoms or molecules, the center of positive charge coincides with the center of negative charge. In the presence of a charged object, these centers may shift slightly, resulting in more positive charge on one side of a molecule than on the other. This is known as *polarization.*

This realignment of charge within individual molecules produces an induced charge on the surface of the insulator, as shown in **Figure 5(a).** When an object becomes polarized, it has no net charge but is still able to attract or repel objects due to this realignment of charge. This explains why a plastic comb can attract small pieces of paper that have no net charge, as shown in **Figure 5(b).** As with induction, in polarization one object induces a charge on the surface of another object with no physical contact.

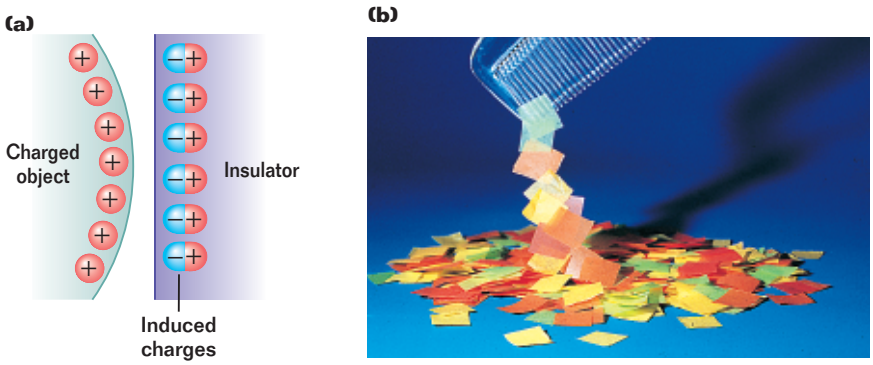

Figure 5
(a) The charged object on the left induces charges on the surface of an insulator, which is said to be *polarized.* **(b)** This charged comb induces a charge on the surface of small pieces of paper that have no net charge.

SECTION REVIEW

1. When a rubber rod is rubbed with wool, the rod becomes negatively charged. What can you conclude about the magnitude of the wool's charge after the rubbing process? Why?
2. What did Millikan's oil-drop experiment reveal about the nature of electric charge?
3. A typical lightning bolt has about 10.0 C of charge. How many excess electrons are in a typical lightning bolt?
4. If you stick a piece of transparent tape on your desk and then quickly pull it off, you will find that the tape is attracted to other areas of your desk that are not charged. Why does this happen?
5. **Critical Thinking** Metals, such as copper and silver, can become charged by induction, while plastic materials cannot. Explain why.
6. **Critical Thinking** Why is an electrostatic spray gun more efficient than an ordinary spray gun?