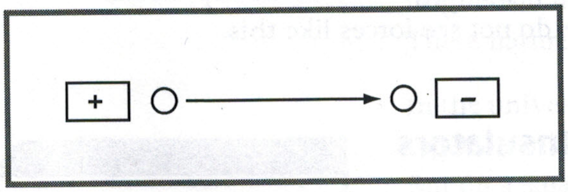
Even atoms can be induced to become positively charged on one side and negatively charged on the other. When this happens, the atom is **electrically polarized.** In this way, electrons can be induced to flow along conductors, such as copper wires, which makes electricity useful for lighting our homes and starting our cars.

Electrical and magnetic forces, like gravity, act between things that are not in direct contact as well as those that are. A force field exists in each of these cases, which influences charges and masses. Just as the space around a planet or any other mass is filled with a gravitational field, the space around every electric charge is filled with an electric field. An electric field has both magnitude, or strength, and direction. The magnitude of the field at any point is the force per unit of charge ($E = F/q$).



However, unlike a gravitational field, an electric field is filled with vectors that can lead in more than one direction. Generally, these vectors move from positively charged objects to negatively charged ones, as the negative charges attract the positive.

Another difference between electric fields and gravitational fields is that electric fields can be shielded with certain materials, while gravitational fields cannot be shielded with anything. Oil, metal, and even air can diminish an electric field.

When we looked at potential energy earlier in this book, we learned that an object may have gravitational potential energy because of its position in a gravitational field—at the top of the stairs, for example, or about to fall from a tree. A charged object in an electric field can have potential energy because of its position as well. If you take two positively charged balloons, for example, and push them together as closely as you can, the two will try to repel each other and accelerate away from each other. Their position, relative to another charged object, causes them to have electric potential energy.

The unit for electric potential is the **volt.** One volt is equal to 1 joule over 1 coulomb. Thus, a 1.5-volt battery gives 1.5 joules of energy to every 1 coulomb of charge passing through the battery. Another word for electric potential is *voltage.* Voltage can exist, and have a definite value, whether there is a charge present or not.

