SECTION 1

Electric Potential

SECTION OBJECTIVES

- **Distinguish between electrical potential energy, electric potential, and potential difference.**
- **Solve problems involving electrical energy and potential difference.**
- **Describe the energy conversions that occur in a battery.**

electrical potential energy

potential energy associated with a charge due to its position in an electric field

ELECTRICAL POTENTIAL ENERGY

You have learned that when two charges interact, there is an electric force between them. As with the gravitational force associated with an object's position relative to Earth, there is a potential energy associated with this force. This kind of potential energy is called **electrical potential energy.** Unlike gravitational potential energy, electrical potential energy results from the interaction of two objects' charges, not their masses.

Electrical potential energy is a component of mechanical energy

Mechanical energy is conserved as long as friction and radiation are not present. As with gravitational and elastic potential energy, electrical potential energy can be included in the expression for mechanical energy. If a gravitational force, an elastic force, and an electric force are all acting on an object, the mechanical energy can be written as follows:

$$ME = KE + PE_{grav} + PE_{elastic} + PE_{electric}$$

To account for the forces (except friction) that may also be present in a problem, the appropriate potential-energy terms associated with each force are added to the expression for mechanical energy.

Figure 1
As the charges in these sparks move, the electrical potential energy decreases, just as gravitational potential energy decreases as an object falls.

Recall from your study of work and energy that any time a force is used to move an object, work is done on that object. This statement is also true for charges moved by an electric force. Whenever a charge moves—because of the electric field produced by another charge or group of charges—work is done on that charge.

For example, negative electric charges build up on the plate in the center of the device, called a *Tesla coil,* shown in **Figure 1.** The electrical potential energy associated with each charge decreases as the charge moves from the central plate to the walls (and through the walls to the ground).