

SECTION 4

Electric Power

SECTION OBJECTIVES

- Differentiate between direct current and alternating current.
- Relate electric power to the rate at which electrical energy is converted to other forms of energy.
- Calculate electric power and the cost of running electrical appliances.

SOURCES AND TYPES OF CURRENT

When you drop a ball, it falls to the ground, moving from a place of higher gravitational potential energy to one of lower gravitational potential energy. As discussed in Section 1, charges behave in similar ways. For example, free electrons in a conductor move randomly when all points in the conductor are at the same potential. But when a potential difference is applied across the conductor, they will move from a position of higher electric potential to a position of lower electric potential. Thus, a potential difference maintains current in a circuit.



Figure 13

Batteries maintain electric current by converting chemical energy into electrical energy.

Batteries and generators supply energy to charge carriers

Batteries maintain a potential difference across their terminals by converting *chemical* energy to electrical potential energy. **Figure 13** shows students measuring the potential difference of a battery created using a lemon, copper, and tin.

As charge carriers move from higher to lower electrical potential energy, this energy is converted into kinetic energy. This motion allows collisions to occur between the moving charges and the remaining material in the circuit elements. These collisions transfer energy

(in the form of heat) back to the circuit.

A battery stores energy in the form of chemical energy, and its energy is released through a chemical reaction that occurs inside the battery. The battery continues to supply electrical energy to the charge carriers until its chemical energy is depleted. At this point, the battery must be replaced or recharged.

Because batteries must often be replaced or recharged, generators are sometimes preferable. Generators convert *mechanical* energy into electrical energy. For example, a hydroelectric power plant converts the kinetic energy of falling water into electrical potential energy. Generators are the source of the current to a wall outlet in your home and supply the electrical energy to operate your appliances. When you plug an appliance into an outlet, an effective potential difference of 120 V is applied to the device.

extension

Integrating Chemistry

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