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Topic: Electric Current
Code: HF60472

Conventional current is defined in terms of positive charge movement

The moving charges that make up a current can be positive, negative, or a combination of the two. In a common conductor, such as copper, current is due to the motion of negatively charged electrons, because the atomic structure of solid conductors allows the electrons to be transferred easily from one atom to the next. In contrast, the protons are relatively fixed inside the nucleus of the atom. In certain particle accelerators, a current exists when positively charged protons are set in motion. In some cases—in gases and dissolved salts, for example—current is the result of positive charges moving in one direction and negative charges moving in the opposite direction.

Positive and negative charges in motion are sometimes called *charge carriers. Conventional current* is defined in terms of the flow of positive charges. Thus, negative charge carriers, such as electrons, would have a conventional current in the direction opposite their physical motion. The three possible cases of charge flow are shown in **Table 1.** We will use conventional current in this book unless stated otherwise.

Table 1 Conventional Current

	First case	Second case	Third case
Motion of charge carriers	← −	+ →	+ → ← −
Equivalent conventional current	+ →	+ →	+ → + →

As you learned in Section 1, an electric field in a material sets charges in motion. For a material to be a good conductor, charge carriers in the material must be able to move easily through the material. Many metals are good conductors because metals usually contain a large number of free electrons. Body fluids and salt water are able to conduct electric charge because they contain charged atoms called *ions.* Because dissolved ions can move through a solution easily, they can be charge carriers. A solute that dissolves in water to give a solution that conducts electric current is called an *electrolyte.*

DRIFT VELOCITY

When you turn on a light switch, the light comes on almost immediately. For this reason, many people think that electrons flow very rapidly from the switch to the light bulb. However, this is not the case. When you turn on the switch, electron motion near the switch changes the electric field there, and the change propagates throughout the wire very quickly. Such changes travel through the wire at nearly the speed of light. The charges themselves, however, travel much more slowly.

Quick Lab

A Lemon Battery

MATERIALS LIST

- **lemon**
- **copper wire**
- **paper clip**

Straighten the paper clip, and insert it and the copper wire into the lemon to construct a chemical cell. Touch the ends of both wires with your tongue. Because a potential difference exists across the two metals and because your saliva provides an electrolytic solution that conducts electric current, you should feel a slight tingling sensation on your tongue. CAUTION: Do not share battery set-ups with other students. Dispose of your materials according to your teacher's instructions.