CHAPTER 9 ELECTRIC CELLS

Reflect On Your Learning

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1. [*Likely initial answer*] Chemical reactions occur that produce electricity.
   [*More complete answer*] The substance with the greatest tendency to gain electrons (i.e., with the most positive reduction potential) pulls electrons via the external circuit from another substance with the greatest tendency to lose electrons (i.e., with the most negative reduction potential). Ions transfer electric charge within the electrolyte to complete the internal circuit.
2. [*Likely initial answer*] The ability to transfer electrons is the key scientific concept.
   [*More complete answer*] The relative strengths of oxidizing and reducing agents as measured by reduction potentials is a key concept to explain why electrons are transferred. Oxidation states help to understand and describe the chemical changes that accompany the gain and loss of electrons. Other concepts such as electronegativities and ion mobility are also part of the explanation.
3. [*Likely initial answer*] Cells come in a variety of sizes; some cells are rechargeable and some are not. There are also different chemicals that are used such as nickel–cadmium (NiCad) and lead acid. Cells have a great impact because of their use in cars and portable electronic devices such as CD and DVD players.
   [*More complete answer*] Cells generally fall into three categories: primary, secondary, and fuel cells. Each has different characteristics and uses. Primary cells are not rechargeable, are relatively inexpensive, and are used in flashlights and small electronic devices. Secondary cells are rechargeable and are very useful for mobile phones, laptop computers, and small electronic devices. Fuel cells use a continuously supplied fuel and can be used for small power-generating stations and probably (in the near future) in cars. All of these cells significantly affect our lives in terms of convenience, new opportunities, and environmental effects.

Try This Activity: A Simple Electric Cell

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(a) The copper strip was momentarily connected to the positive (red) terminal of the voltmeter and the zinc strip to the negative (black) terminal. The needle of the voltmeter deflected briefly from zero to positive values (or the digital meter briefly registered a positive value). When the leads were reversed, the needle tried to go backwards below zero (or the digital meter briefly registered a negative value).
(b) Yes. (Depending on the fruit or vegetable, two may be needed, connected in series.)
(c) The orange with the two metal strips acted like a cell or battery. There must be some chemical reactions occurring that produce electricity.
(d) Yes.
(e) All fruits and vegetables contain some kind of juice as long as they are relatively fresh and not dried out.
(f) The electric cell could be improved with a more compact and convenient design. Instead of using some fruit or vegetable, use the essential chemicals inside the fruit or vegetable and put them in some kind of container.

9.1 OXIDATION AND REDUCTION

PRACTICE

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Understanding Concepts

1. (a) Reduction was used to describe a reaction producing a metal from its naturally occurring compound.
   (b) Oxidation was used to describe reactions of substances such as metals or fuels with oxygen.
   (c) An oxidizing agent is a substance that causes or promotes the oxidation of another substance.
   (d) A reducing agent is a substance that causes or promotes the reduction of another substance.
   (e) Metallurgy is the science and technology of extracting metals from their naturally occurring compounds and adapting these metals for useful purposes.
   (f) Corrosion is the adverse reaction of human-made items with chemicals in the envrionment, usually metals reacting to form oxides, carbonates, or sulfides.