SN EDUCATOR GUIDE

January 21, 2017

Charging the Future

About this Issue

The article "Charging the future" describes the current scientific and technological pursuit for better batteries. Researchers are trying to develop long-lasting batteries that would have advantages over existing types of batteries, such as lithium-ion batteries that are currently used in most rechargeable electronic devices. After an introduction about the growing need for a longer-lasting, highly energy-efficient battery, a development that could lead to less dependence on fossil fuels, the article explains the general chemistry behind how batteries work. The article then discusses several different types of new batteries under development, how they function and the components researchers are striving to improve. Students can focus on the science of batteries, follow connections to earlier articles about battery research, explore the cross-curricular connections of battery technology and conduct their own experiments making batteries and measuring their performance. For additional information about batteries written at slightly lower Lexile levels, see the following *Science News for Students* articles: "Building a better battery," "This battery stretches without losing oomph," "Nanowires could lead to super-long-lived battery" and "Powered by poop and pee?" Also, *Science News for Students* offers an "Explainer" about Batteries and Capacitors.

Connections to Curricula

- Quantitative observations
- Reduction-oxidation (redox) reactions
- Electrochemistry
- Electric circuits
- Cellular respiration
- Photosynthesis
- Batteries
- Alternative energy sources

What's in this Guide?

- Article-Based Observation: These questions focus on reading and content comprehension by drawing on information found in the article "Charging the future." Questions focus on battery design, the mechanism and performance of lithium-ion batteries in comparison to new types of batteries and the nature of experimental design and modification.
- Quest Through the Archives: With Internet access and your school's digital access to *Science News*, your students can use this section to explore the history of battery research as reported by *Science News*.
- Cross-Curricular Discussion: These questions and extension prompts encourage students to think about ways that different elements create varied results in battery design and related redox reactions. The section is divided by subdiscipline for educators who would like to focus on a particular topic area. The extension prompts are either more topic-specific or more conceptually advanced. **Biological Sciences** questions involve biologically relevant reduction-oxidation (redox) reactions in respiration and photosynthesis and the energy production associated with these processes. **Chemistry and Physical Sciences** questions concern redox reactions, electrochemistry and electric voltage and current. **Engineering and Experimental Design** questions focus on designs, characteristics and applications of batteries.

- Activities: This section includes one teacher-led demonstration and two activities that students can perform. **Reduction-Oxidation Reaction Demonstration** is a straightforward introduction to reduction-oxidation reactions. **What Makes Different Type of Batteries Unique?** asks students to research specific battery types from "Charging the future" or other resources and report what they have found. **Building the Best Battery** allows students to build, test and optimize their own batteries using various metal electrodes and liquid electrolytes.

Standards Alignment

Next Generation Science	Common Core
Matter and Its Interactions: HS-PS1-1, HS-PS1-2, HS-PS1-3, HS-PS1-4	ELA Standards: Reading Informational Text (RI): 1, 2, 4, 7
Energy: HS-PS3-1, HS-PS3-3	ELA Standards: Writing (W): 1, 2, 4, 6, 7, 8, 9, 10
From Molecules to Organisms: Structures and Processes: HS-LS1-5, HS-LS1-7	ELA Standards: Speaking and Listening (SL): 1, 2, 3, 4, 5, 6
Engineering Design: HS-ETS1-3	ELA Standards: Reading for Literacy in Science and Technical Subjects (RST): 1, 2, 3, 4, 7, 9
	ELA Standards: Writing Literacy in History/Social Studies and Science and Technical Subjects (WHST): 1, 2, 4, 6, 7, 8, 9