Reactions in a Battery

Summary

With this inquiry experiment students will design their own batteries and learn about why batteries work.

Time Frame

1 class periods of 90 minutes each

Group Size

Small Groups

Materials

- student sheet
  (attached)
  1 cm wide strips of copper, zinc, iron, magnesium, or others
  steel wool
  salt
  an assortment of other chemicals, some good electrolytes, some not
  a wet cell chamber (a beaker will work)
  graduated cylinder
  jumper leads
  voltmeter
  paper towel

Background for Teachers

Time Needed:
10-15 min. introduction, 50 minutes for experiment, 20 minutes for follow-up discussion and for students to do questions.
Background:
"Oxidation" and "reduction" reactions make a battery work. Oxidation/reduction reactions are electron-transfer reactions. For a battery to work, both an oxidation and a reduction must happen. One generates electrons at one electrode, and the other uses them up at the other electrode. Each of these is called a "half reaction". If the electrodes are connected outside the cell by a circuit, electrons flow and the full reaction is completed.
Oxidation is when electrons are transferred from a substance to oxygen or some other compound. Oxidation doesn't have to involve oxygen, and can be thought of as "de-electronation." Since electrons are negatively charged particles they are related to electricity. Electrons moving along a conductor is electric current. The electrode where oxidation (loss of electrons) takes place is called the anode. On a commercial battery it is marked as the "-" side.
For information on the reasons some combinations of metals and electrolytes are better than others in real batteries see: http://antoine.frostburg.edu/chem/senese/101/redox/faq/choosing-battery-reactions.shtml

Instructional Procedures

Discuss the introduction with students and show them where materials are located.
Read procedures (on student sheet attached) with students. When you get to #4 where they design their own experiment, you may need to guide them. The variables in this experiment that

they could change include: adding less salt water, adding pure water, adding a variety of other chemicals to the water, adding more metal strips, putting metal strips closer or farther apart, adding an entirely different liquid (weak HCl, vinegar, weak base) See if students can come up with their own ideas before helping them. Insist that groups do not all do the same thing.
Allow students time to collect their data.
Have each group report on the results of their experiments. Summarize which metal strips produced that most and least electricity.

Bibliography

Lesson Design by Jordan School District Teachers and Staff.

Authors

Utah LessonPlans