Compounds and Reactions

Student Objectives

- Identify common substances and predict the elements they are made of.
- Discover some common substances and their chemical composition.
- Identify elements in common substances and describe how they form compounds.
- Write a description of the substance and how it is used.

Materials

- *Elements of Chemistry: Compounds and Reactions* video
- Computer with Internet access
- Paper and pencils
- Newsprint and markers

Procedures

1. Begin the lesson by asking students to write down some common substances they use every day, such as shampoo, toothpaste, sunscreen, and cleaning fluids. Then ask them to write down the elements they think these substances are made of. Have students put away the papers until the end of the lesson.
2. Tell students that they will work in small groups to learn about the chemical composition of common substances. Then take a few moments to assign students to their groups.
   Note: For this lesson, each group will need access to a computer. Make sure that students can have some computer time so that they can complete the lesson.
3. Tell students to visit the American Chemical Society Web site below, which lists a collection of 52 common substances.
   http://www.chemistry.org/portal/a/c/s/1/acsdisplay.html?DOC=vc2%5C1rp%5Crp1.html.
4. Each group of students should do the following:
   - Choose at least 15 substances to focus on. Possible choices include the following sunscreen, toothpaste, licorice, chocolate, or lipstick.
   - Predict the elements each substance is made of.
   - Click on the substance and read the description. Identify the elements and read how they form the compounds that make up the substance.
   - Write a brief paragraph describing why the substance is useful and at least two additional facts about it.
5. Before students begin work on the activity, have them watch the video Elements of Chemistry: Compounds and Reactions. The first three segments ("A Matter of Change"; "Bonds: Keeping It Together"; "Reacting to Chemical Changes") give background information that will help students complete the lesson.
6. Give students time in class to work on this activity. Remind students to complete all three parts of the assignment.
7. During the next class period, allow students to finish the assignment if necessary. Then bring the groups together to share results.
8. Keep a class list of products the students investigated. Include the name of the substance and a brief description. A sample entry for sunscreen is shown below.
   Sunscreen
   Sunscreen protects our skin from the dangers of the sun's ultraviolet rays. Sunscreens are organic or inorganic. Organic sunscreens use organic compounds such as octyl methoycinnamate.

Inorganic sunscreens mix the element titantium with dioxide and zinc with oxide. To create the most powerful combinations, inorganic and organic sunscreens may be combined.

9. Conclude the lesson by asking students to revisit the lists from the beginning of the lesson. What have they learned about how common substances are produced? How would they modify their original ideas?

Assessment

Use the following three-point rubric to evaluate students' work during this lesson.

- **3 points:** Students made thoughtful predictions about what each substance was made of; researched each substance thoughtfully and carefully; and wrote clear, accurate descriptions of each substance.
- **2 points:** Students made satisfactory predictions about what each substance was made of; researched each substance adequately; and developed satisfactory descriptions of each substance.
- **1 point:** Students had difficulty making predictions about what each substance was made of; did not complete research of the substances; and did not write descriptions of each substance.

Vocabulary

atom
Definition: The smallest unit of an element
Context: Democritus, a Greek philosopher who lived around 440 B.C, was one of the first people who believed that matter was composed of tiny particles, which he called atomos, Greek for "uncuttable."

chemical change
Definition: A change in the chemical composition of two elements as a result of the formation of bonds between atoms
Context: During a chemical change, the elements rearrange and may look different, but the original number of atoms remains unchanged.

compound
Definition: A substance made of two or more elements chemically combined in a specific way
Context: The elements in a compound combine to form a new substance.

element
Definition: A substance that cannot be broken down into any other substances through physical or chemical reactions
Context: The known elements are organized in a periodic table.

compound
Definition: A substance composed of atoms of two or more elements in chemical combination
Context: Many materials are compounds, which are comprised of several atoms held together by invisible forces.

Academic Standards

National Academy of Sciences
The National Science Education Standards provide guidelines for teaching science as well as a coherent vision of what it means to be scientifically literate for students in grades K–12. To view the standards, visit this Web site: http://books.nap.edu/html/nses/html/overview.html#content.
This lesson plan addresses the following national standards:

- Physical Science: Structure and properties of matter; Chemical reactions

Mid-continent Research for Education and Learning (McREL)
McREL's Content Knowledge: A Compendium of Standards and Benchmarks for K–12 Education addresses 14 content areas. To view the standards and benchmarks, visit http://www.mcrel.org/compendium/browse.asp.
This lesson plan addresses the following national standards:

- Science: Physical Sciences – Understands the structure and properties of matter
- Language Arts: Viewing – Uses viewing skills and strategies to understand and interpret visual media; Writing: Uses the general skills and strategies of the writing process, Gathers and uses information for research purposes; Reading: Uses reading skills and strategies to understand and interpret a variety of informational texts