Physical Science: Elements
Teacher’s Guide

Program Description
There are 91 naturally occurring elements, and another 25 that are created artificially. The atoms of an element are specific to that element, having a particular number of protons, neutrons, and electrons. Most elements combine with others to form compounds, such as water (hydrogen and oxygen). It’s the many combinations of elements that make for the variety of substances in the world. Keeping track of all the elements would be difficult were it not for the handy periodic table, which organizes the elements by atomic structure. Hydrogen, the simplest of elements, always exists as a compound. Hydrogen fuels both stars and the rockets that reach for them. The light bulb is a study in practical elements. Because tungsten has the highest melting point of any metal, it makes the perfect material for the filaments that—once electrified—glow with white-hot light. Inside the bulb’s glass is not oxygen but argon, used because it won’t react with the tungsten filament. Carbon is the stuff of diamonds and the stuff of life. The process by which diamonds are created and extracted is slow and arduous. It’s no wonder the flashy gems are so valued. In a fireworks display, the elements are showcased. From the propellants to the colors to the patterns, a fireworks show is a chemical extravaganza.

Discussion Questions
• What is an element? How many elements exist naturally and artificially?
• What is a compound? Name some examples of compounds.
• What is the periodic table, and how is it organized?
• What element only exists as a compound on Earth and is the fuel of stars?
• Explain how a light bulb works and what elements make it possible.
• What is an allotrope, and what are some allotropes of carbon?
• Describe the process by which diamonds are created and extracted.
• How are elements used in the making and displaying of fireworks?

Lesson Plan
Student Objectives

• Be able to define an element and a compound.
• Understand how elements are organized in the periodic table.
• Create a new periodic table after looking at some that feature unique twists on table design.

Materials

• Computer with Internet access
• Print resources about elements

Procedures

1. Interactive online periodic tables make understanding elemental organization easier than ever. Let students explore element and table basics at these sites:
   • Wikipedia’s Chemical Element
     http://en.wikipedia.org/wiki/Chemical_element
   • Periodic Table
     http://en.wikipedia.org/wiki/Periodic_table
   • How To Read the Periodic Table
     http://web.buddyproject.org/web017/web017/pertab.html
   • WebElements Periodic Table, Scholar Edition offers a wealth of information and fun facts available by clicking on any of the element blocks

2. After they’ve had a chance to explore the table online, have students answer these questions:
   • Who devised the periodic table? (Dmitri Mendeleev)
   • What is a “group” in the periodic table? (one of 18 vertical columns)
   • What is a period? (one of seven horizontal rows)
   • What does the atomic number represent? Give an example. (The atomic number is the number of protons found in the nucleus of the elements’ atoms. The atomic number for Potassium is 19.)
   • What information is found in the table’s boxes? Give an example. (Each box represents one element and has that element’s atomic number, symbol, name, and atomic mass. For example, silver has an atomic number of 47, the symbol is Ag, and the atomic mass is 107.8682.)
   • What is unique about elements 117 (ununseptium) and 118 (ununoctium)? (They are as yet “undiscovered,” but scientists expect to create them in a lab someday.)
For additional activities to give students more in-depth table knowledge go to the Science Spot’s Chemistry Lesson Plans at http://www.sciencespot.net/Pages/classchem.html#Anchor-ptable. There you can find several lessons germane to the elements, along with printable worksheets and online links.

3. After all their hard work in deciphering the periodic table, students deserve to have some fun. In the process they’ll reinforce the general concepts already covered. Explain that they will work as a class to develop a “new” periodic table, organized any way they like. For examples of fun and funky tables, they can check out:

- The Periodic Table of Comic Books
  http://www.uky.edu/Projects/Chemcomics/
- The Periodic Table of Haiku
- The Periodic Table of Rejected Elements
  http://www.schneertz.com/elements.html
- The Visual Elements Periodic Table (requires the Flash plugin)
  http://www.chemsoc.org/viselements/pages/pertable_fla.htm

Some ideas for tables include a periodic table of literature in which element boxes feature a quotation from literature mentioning the element. The periodic table of movies and television could highlight elements referenced in shows or movies. The periodic table of bling bling would feature useful or desirable qualities of elements. If you wish, you could also have students write their own elemental poems, as in the haiku table. Or they can have fun coming up with their own rejected elements. The possibilities are bound only by your students’ imaginations. The class doesn’t have to come up with 116 boxes for their new tables; one for each student will work well.

**Assessment**

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

- **3 points:** Students were highly engaged in class discussions; conducted thorough research and answered all questions correctly; created an imaginative “new” periodic table.
- **2 points:** Students participated in class discussions; conducted research and answered most questions correctly; created a good “new” periodic table.
- **1 point:** Students participated minimally in class discussions; conducted minimal research and answered few questions correctly; did not contribute much to the “new” periodic table.

**Vocabulary**
allotrope

Definition: One form of an element that can exist in several forms
Context: Carbon allotropes include graphite and diamonds.

chemical compound

Definition: A substance created by the bonding of two or more elements.
Context: Once a chemical compound—such as water—is formed, it is difficult to separate the compound back into its original components.

element

Definition: A substance that consists of atoms that all share the same number of protons
Context: There are 91 naturally occurring elements and 25 artificial ones.

kimberlite

Definition: A type of rock formation where diamonds are found
Context: Kimberlite takes its name from Kimberley, a city in South Africa where diamond mines were discovered.

noble gas

Definition: Also called inert gas, meaning it does not react chemically with other elements
Context: The noble gases are found in Group O of the periodic table and include helium, neon, and radon.

periodic table

Definition: A chart originally devised by Dmitri Mendeleev that organizes chemical elements by atomic structure
Context: The periodic table groups elements so that those with similar properties are in the same column or group.

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: Properties and changes of properties in matter

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; Reading — Uses reading skills and strategies to understand and interpret a variety of informational texts

Support Materials

Develop custom worksheets, educational puzzles, online quizzes, and more with the free teaching tools offered on the DiscoverySchool.com Web site. Create and print support materials, or save them to a Custom Classroom account for future use. To learn more, visit

http://school.discovery.com/teachingtools/teachingtools.html

Also find more Discovery lesson plans devoted to elements at:

- Elements
  http://school.discovery.com/lessonplans/programs/elements/
- Elements and Compounds
  http://school.discovery.com/lessonplans/programs/elementsandcompounds/