

Updated Resources for Assembling an Element Collection

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Assembling a collection of elements for a classroom display can be expensive and time consuming; nevertheless, as any collector knows, part of the satisfaction is in the collecting itself. For a chemistry teacher, such a collection provides students with the opportunity to see samples of actual elements that are normally just names in the periodic table (1–4). While teachers can tackle element collecting alone, encouraging students to find interesting element samples and contribute them to the class collection provides an enjoyable collaborative class project. Samples of common elements such as copper, tin, lead, sulfur, iron, and silver can be readily located around the house or in local hardware stores. Historically for rarer elements, however, the only sources have been chemical companies. In a 1991 article by Solomon and Bates on element collecting (1), chemical companies (Aldrich, Flinn, Aesar, Alfa, and Ward's) were the only commercial sources of elements cited. Similar sources were listed for collecting lanthanide samples (2).

Today, the situation is quite different. With the advent of the Internet, numerous collectors and businesses sell samples of almost every element through online auction sites and online stores. eBay (5) is a useful online source for an incredible variety of elements that range in size from just a few grams to large, kilogram-sized display pieces. In addition, there are hundreds of U.S. companies in the metal manufacturing business, many of which will sell (and in some cases donate) element samples for academic purposes. This article looks at some of the sources for assembling an element collection.

Purchasing Element Samples from Individuals

David Hamric developed an interest in element collecting as a child (6). Hamric, based near Boston, MA, sells more than 80 different elements from his online store, Metallium (7).



Figure 1. Photograph of some of Theodore Gray's element collection on his wooden periodic "table". Photograph by the author.

Prices are reasonable for small samples, and he often offers elements through the eBay Element Sales store. Hamric also sells a series of 50 coins cast in various pure elements.

Justin Bauer, based in Austria, has a very large inventory—more than 1000 samples of more than 85 different elements are available through his online store, Smart Elements (8). For safety, he also sells a line of element samples encased in acrylic resin.

More than anyone else on the planet, Theodore Gray deserves the title of "Element Man": his personal collection of elements—more than 2300 pieces—is second to none (9). Gray is especially interested in collecting samples of elements in which they have an unusual application; for example, his collection includes a tantalum skull plate, as well as a protective lead "hand" that fits over the arm of an X-ray technician. Although Gray sells some element samples through eBay, it is worth going to his Web site because it is an excellent resource for information about element properties and their sources (9). For constructing a wooden table in the shape of the periodic table of elements (see Figure 1) (10), Gray won a 2002 Ig Nobel Prize; these Prizes "honor achievements that first make people laugh, and then make them think" (11). He has also created a stunning periodic table Web site (12) that shows high-resolution photographs of his extensive collection, which can be an excellent resource for teachers who do not have an element collection of their own.

Kevin and Molly Spencer have sold elements through their online store, Emovendo Magnets and Elements, since 2003. They stock about 45 elements in the form of cylinders, pellets, shot, and flakes in quantities from a few grams to several kilograms (13).

The Mists of Avalon is an eBay store with dozens of element samples (14). Many small, odd, and interestingly shaped samples are available starting at just a few U.S. dollars each. Items are shipped from the U.K.

Commercial Purveyors of Element Samples

Walmart has the advantage of being accessible to just about everyone in the U.S. Surprisingly, perhaps, it can be a source of many element samples. Examples include small helium tanks for balloons, oxygen cylinders for brazing torches, blocks of magnesium (~97% pure) for fire starters, niobium jewelry used for body piecing (because the metal is largely inert), lead fishing weights (now often made of bismuth, a much less hazardous metal than lead), and many others. Theodore Gray has compiled a comprehensive list of elements available from Walmart (15). Dozens more elements can be found in hardware stores and builder's supply centers, such as True Value, Ace, Menard's, Lowe's, and Builders Square.

United Nuclear, in New Mexico, sells samples of about 25 elements; most are reasonably priced. They sometimes have small pieces of uranium for sale for ~\$40 (16).

American Elements is a company in California that provides technical information and manufactured products

for more than 3000 elemental metal, metallic compound, ceramic, and crystalline items (17). Metal purity has a range of 99–99.9999%; samples come in rod, foil, shot, granules, lump, flake, and odd pieces.

Element Displays is a division of The Red Green and Blue Co., a science production company based in London (18). They sell interesting lumps, blobs, and ingots of just about every metal and most elements.

Leico Industries, Inc. offers an extensive line of elements (>70) whose purity ranges from 99 to 99.9999% (19).

A. D. Mackay, Inc. has sold metals and alloys for more than 80 years. The company, based in New York, has >70 elements available (20).

Traditional chemical companies are obvious element sources. Prices tend to be high and samples, often in the form of powder, wire, or foil, are not especially interesting to display. Sigma-Aldrich (21) and Alfa Aesar (22) are the best known.

Thomas Publishing Co. does not sell elements—rather, this company maintains a large registry of manufacturers and distributors of metals and elements (23). The Web site allows searches by element, with results listing metal manufacturers around the U.S. While most companies sell mainly in bulk to other industries, some will sell small samples to academic institutions—some will even donate samples. For example, I obtained free samples of Si, W, Cr, Mo, B, Ti, and others this way. Look for manufacturers in your local area or state, as they are more likely to donate to schools in their region.

Acquiring Element Sets

For those who do not enjoy the thrill of collecting, or who want to acquire an element collection quickly, complete sets are available from several sources, including Metallium (7) and Element Displays (18). Depending on the number and size of samples in a set, the cost in U.S. dollars runs from about a few hundred to several thousand dollars.

Hazards To Address in Collecting Elements

Some elements are perfectly safe to handle, while others are toxic, combustible, volatile, radioactive, reactive, or a combination. Use appropriate precautions when handling and displaying samples. The searchable online Chemical Database at the University of Akron (24) has hazard information for many common chemical compounds and all the elements, including recommendations for storage and handling, flammability, exposure limits, and first-aid treatment. Consult the database or other safety information before acquiring element samples if they will be displayed or handled.

The only elements that students should be permitted to handle are bulk samples (e.g., blocks or cylinders) of nontoxic metals such as Al, Fe, Cu, Ni, Cr, Ti, Bi, or W, or samples of nonmetallic elements such as Si, C, or S. Most other elements in solid form should be stored in clear plastic bottles so that students can examine them closely and safely. Students should not handle toxic or reactive elements (e.g., Os, Be, Hg, U, Br, alkali metals, lanthanides). This *Journal* has published Chemistry Laboratory Information Profiles (CLIPs) for many elements and compounds (25). Each CLIP offers an overview of a given element's or compound's hazards, as well as suggestions

of precautions users should take and strategies for storing and handling specific chemicals.

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