



*The Devouring Element: Lead's Impact on Health*  
Grades 7 through 12

**Directions: Main Points/Rationale**

During this lesson, students will conduct research in groups to discuss what they know about lead, and what they want to learn about lead during their visit to the Mütter Museum's lead exhibit.

**Objectives**

1. Students will identify lead as a key element on the periodic table.
2. Students will work in groups to list what they know about lead
3. After the visit to the Museum, the students will discuss what they have learned about lead.

**PA Standards**

3.2.7 C, 3.2.10 C, 3.21.12 C Inquiry and Design

3.4.10 A, 3.4.12 A Physical Science, Chemistry and Physics

**Knowledge to be gained from visiting the exhibit:**

- Lead has found many practical applications through human history.
- Lead had been used in pipes, makeup, paint, medical instruments, medicine, and has even been found in food.
- Direct human contact with lead harms health, and this relationship has been known since ancient time. Despite this fact, doctors have used lead in various forms to try to cure a variety of ailments.
- Although people have been aware of lead's effect on human life, we continue to use lead for many purposes.
- Most direct contact with lead can be avoided. There are organizations that provide information on lead poisoning.

**Materials & Equipment**

KWL chart – Three column chart: What I **K**now, What I **W**ant to Know, What I've **L**earned

Periodic Table of Elements

Research Materials: library, internet

**Warm-Up – 3-5 minutes**

Ask the students what they know about lead. Some possible lead in questions: How does lead affect us? How do we come into contact with lead? Is handling lead healthy or unhealthy? They may not have many answers. Explain that in anticipation of their trip to the Mütter Museum, they will be exploring what they know about lead. The Mütter Museum has a new lead exhibit: The Devouring Element: Lead's Impact on Health.



### **Activity One — one class period (or as long as you need)**

Split the students into small groups and give each group a copy of the KWL chart. Have them list what they know about lead. Give them the periodic chart to help them. As they brainstorm, if they think of something they would like to learn about lead, have them list that in the second column of the KWL chart.

### **Activity Two – – 15-20 minutes**

Reconvene as a class, and have a large class KWL chart on the board. Fill in the first section with the students' responses. Then move on to the second section, what they want to know. Fill in any questions they may have come up with, as well as brainstorm as a class for any more.

The last activity is to be completed after you have taken your trip to the Mütter Museum and visited the Lead exhibit. The in-museum activity sheet should be completed by the students during their visit.

### **Activity Three – One class period**

Ask the students what they have learned about lead. (See Notes for Teachers about Lead.) Fill in the L (What I've Learned) section of the chart. They can use some of their answers from the in-museum activity sheet.

### **Closing – 5-10 minutes**

See if any of the questions from the W section (What I Want to Know) have been answered. If they have not, assign groups to research any unanswered questions and report back to the class.

### **Additional Activities**

Discuss ways they could test for lead in their home. (Water testing kits, the swab kits which can be bought from home improvement stores). Suggest the students go home and test their water and maybe some other objects for lead and report back to the class their findings.

### **Assessment of Student Performance**

1. Are the students working together in groups effectively? While they are working, walk around the classroom to assess.
2. Have they come up with any responses for what they know about lead, and what they want to know about lead?
3. For the extension activity, the students researching any unanswered questions, a grade could be assigned to that.



Web Links for more information on the dangers of lead:

- [http://www.phillyhealthinfo.org/index.php/health\\_topics/category/Childhood%20Lead%20Safety/](http://www.phillyhealthinfo.org/index.php/health_topics/category/Childhood%20Lead%20Safety/)
- <http://www.phila.gov/health/units/mcfh/clppp.html>
- [http://www.nncc.us/programs/programs\\_Lead\\_Safe\\_Babies.htm](http://www.nncc.us/programs/programs_Lead_Safe_Babies.htm)
- <http://www.dsf.health.state.pa.us/health/cwp/view.asp?Q=251744&A=190>
- [www.healthytoys.org](http://www.healthytoys.org)

### Resources for Information on Lead prevention and safety:

These organizations provide brochures and literature on the dangers of lead, and lead safety in the home.

- Philadelphia Department of Public Health: 215-685-2788
  - Childhood Lead Poisoning Prevention Program: 215-685-2797
    - Pamphlet: “Lead and Your Child’s Diet”
    - Pamphlet: “Lead – Is Your Child at Risk?”
    - Pamphlet: “Reducing Lead in your Home”
  - Division of Maternal, Child and Family Health: 215-685-5225
    - Pamphlet: “Prevent Lead Poisoning with Good Food”
  - Philadelphia Citizens for Children and Youth: 215-563-5848
- National Nursing Centers Consortium:
  - DVD: Protecting our Children’s Health: Lead Poisoning
    - [www.greentreks.org/health](http://www.greentreks.org/health)
  - 215-731-7140
- U.S. Department of Housing and Urban Development
  - “Lead Paint Can Poison: Learn the Facts”
  - “Lead Paint Can Poison: Is Your Family At Risk”
  - [www.hud.gov](http://www.hud.gov)
- United States Environmental Protection Agency
  - “Renovate Right: Important Lead Hazard Information for Families, Child Care Providers and Schools” EPA-740-F-08-002
  - “Fight Lead Poisoning with a Healthy Diet – Lead Poisoning Prevention Tips for Families” EPA-747-F01-004
  - “Lead Poisoning and Your Children” EPA-747-K-00-003
  - “Is There Lead In the Drinking Water?” EPA-903-F-01-002
  - “Protect Your Family From Lead In Your Home” EPA-747-K-99-001
  - 1-800-424-LEAD (5323)
  - [www.epa.gov/lead](http://www.epa.gov/lead)
- The Orange County Register
  - “Toxic Treats”
  - [www.ocregister.com/investigations/lead](http://www.ocregister.com/investigations/lead)



## Facts for Teachers about Lead:

Lead serves no biological purpose in the human body, but since antiquity people have been fascinated by, and have constructed materials made of lead. Further, people have ingested, applied, and attempted to cure themselves of illnesses and disorders with lead. *The Devouring Element: Lead's Impact on Health* explores the consequences of people's involvement with lead: its deleterious effect on health. *The Devouring Element: Lead's Impact on Health* examines changing notions of the utility and danger of lead to human health from classical times until the present. Featuring unique specimens, both biological (wet specimens, bones), artificial (plaster casts, medical instruments), as well as images, rare books and manuscripts from the Library of The College of Physicians of Philadelphia *The Devouring Element: Lead's Impact on Health* shows that, for most of human history, lead's involvement in human biological development was viewed as natural, despite known dangers. Only with the development of genetics, chemistry, and molecular biology has lead's poisonous effects on health been understood.

Historically known as *plumbism*, lead poisoning may be one of the oldest occupational diseases. The Romans referred to lead as *plumbum nigrum*, using lead for pipes that supplied water to their cities. Alchemists connected lead with the planet Saturn, referring to lead poisoning as *saturnism*. Although the use of lead today is controlled or even banned because of its poisonous effects, lead still finds its way into the body. Plants that we eat contain minute amounts of lead absorbed from the soil in which they grow. Lead enters the body through liquids consumed from glasses or pitchers containing lead, or water passing through lead pipes. In addition, lead is still used in some of today's most technically advanced products such as cell phones and orbiting satellites.

Famous people have suffered from lead poisoning. England's Queen Elizabeth I used lead-based make-up that degraded her health and may have hastened her death. Long after his death, composer Ludwig van Beethoven's hair was found to have lead present in a concentration 100 times that of a normal person. United States President Andrew Jackson suffered from a form of lead poisoning also called plumbism. Renaissance artist Michelangelo and Spanish artist Francisco Goya suffered from lead poisoning because they mixed their own lead based paints. Lead is unavoidable. When civilization began to grow because of agriculture, the clearance of plant life and the disturbance of soil released lead into the atmosphere. When lead mining began on a large scale during ancient times, lead in the atmosphere increased.

Lead is mined and mostly comes from the ore galena. Australia heads the world's lead production, followed by the United States and then China, although other countries produce lead also. People have mined lead for almost 5000 years. Although galena is the main ore that yields lead, other varieties exist. A reddish version, litharge, has been used in paints and varnishes. A related yellow mineral, massicot, has found similar application. Minium or red lead and white lead or ceruse have been used as pigments in paints and cosmetics. Lead's versatility—it can be bent, molded, pressed, and even rolled in sheets—has ensured its enduring value. Although early forms of lead were used for decorative purposes because of their colors, for over two thousand years lead has been a



key ingredient in some varieties of glass. Modern flint glass (originally a Chinese invention) has a lead component, as does crystal.

Lead can enter the body in many ways, such as ingestion, absorption through the skin, or inhalation. When it does enter the body, it is absorbed into the blood stream. Lead inhibits the production of hemoglobin, which is found in red blood cells and is the compound responsible for carrying oxygen to all the cells of the body.

### *Medical Conditions Due to Lead Poisoning*

- anemia
- gout
- porphyria
- hypertension (high blood pressure)
- kidney disease
- brain disorders
- seizure
- weariness
- cramps and pain
- muscular degeneration
- insanity
- death

For centuries, physicians have recognized symptoms of lead poisoning. Around 250 B.C., the Greek physician Nicander of Colophon described symptoms including anemia and colic (severe abdominal pain). Other symptoms include miscarriage in women, severe paralysis, and an atrophy of the muscles known as wrist drop and ankle drop. Over a century ago, physicians described a tell-tale sign of the accumulation of lead sulfide, a bluish tint to the gums known as “the Burton Line.”

Although he wrote about the toxicity of lead, Roman physician Celsus (1<sup>st</sup> century B.C.) also suggested lead’s importance and utility in a range of ointments to stop bleeding from wounds and reduce inflammation of the extremities. Memecrates, the physician to the Roman emperor Tiberius, prescribed a combination of lead oxide and olive oil to create a paste for various skin disorders. Some doctors even recommended covering burns with white lead paint to aid in recovery. Lead poisoning became a public health issue in 18<sup>th</sup>-century Boston because of lead-tainted rum. Rum was distilled in containers including a “worm” made of lead. In fact, for centuries lead was an ingredient to many popular drinks.

Since the invention of firearms, bullets and musket balls have been made of lead. Even before firearms, soldiers fashioned edged and pointed weapons with lead alloys. By the 19<sup>th</sup> century, lead was not only used for making ammunition, but also appeared in the



manufacture of guns and cannons. The manner of producing lead shot—melting lead and pouring it into molds—was itself a toxic process. Gunshot wounds might have been treated on the battlefield, leaving in the wound fragments of lead, particularly lead shrapnel from explosive devices. Over time, lead leached into the bloodstream causing poisoning and eventually death.

Although people have known for centuries that lead was poisonous, they have continued to handle and ingest lead for many reasons. Since there was no immediate bodily response to lead in most cases, many people did not believe that it was so dangerous. With lead so cheaply available and easily applied to industry, people in manufacturing and trade have been reluctant to search for alternative materials. Even recent history shows our love-hate relationship with lead. During the early 20<sup>th</sup> century when the ill effects of lead in paint had become clear, state and federal governments wrestled with how to manage the problem: what in fact was the definition of paint? Shouldn't the buyer assume the risk? Should products be labeled about lead content? Who should bear the cost of the search for an alternative to lead? Even today in some parts of the world, people continue to ingest food and beverages tainted with lead, or handle lead raw materials or products. Many people still think that their contact with lead is too casual to require special precautions. Further, lead continues to be a versatile, useful, and cheap material, hence its continued use in many applications. Lead can also be re-captured during recycling and re-used. For all of these reasons, even despite everyone agreeing that lead is dangerous to health, it will continue to be present in our lives.

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