Alkaline-Earth Metals
Teacher's Guide

Grade Level: 6–8 | **Curriculum Focus:** Human Body | **Lesson Duration:** Two class periods

Program Description

You know calcium is necessary for strong bones, but what else do you know about this and other alkaline-earth metals? Explore these metals, which are generally softer than most other metals. Then learn why they react quickly with water, particularly when heat is introduced.

Onscreen Questions

Part 1, "Exploring Alkaline-Earth Metals," "Calcium Building Bones," "Strontium: Fatal Fallout," and "Radium: Curie's Cure"

- What properties do the alkaline-earth metals share?
- Why does the human body treat strontium and calcium the same way?

Part 2, "Inside the Body's Bones"

- What chemicals in the human body relieve pain after an injury?
- How does the body repair broken bones?

Lesson Plan

Student Objectives

- Review the importance of the alkaline-earth metal calcium for bones.
- Research other minerals essential for human health.
- Create a healthy daily menu that includes at least five minerals.

Materials

- *Alkaline-Earth Metals* video
- Periodic table
- Print and online resources about minerals needed for human health
- Computer with Internet access

Procedures

1. After watching the video, ask students to identify the alkaline-earth metals on a periodic table. What elements are found in this group? (*Beryllium, Magnesium, Calcium, Strontium, Barium, Radium*) What do these elements have in common? (*They all have two electrons in their outer electron shell*.) Which of these elements is essential for healthy teeth and bones? (*Calcium*)
2. Remind students that our bones are a mix of calcium and other minerals. In fact, 90 percent of the calcium in our bodies is in our bones. Calcium also helps regulate our heartbeat and clot our blood. Ask students to name foods that are good sources of calcium. (*Dairy products such as milk, yogurt, cheese, and green leafy vegetables such as spinach, collard greens*.)
3. Explain that calcium is just one of many minerals that are important to human health. A mineral is a natural substance that helps the body function. Like calcium, many minerals are metals. Show students a Mineral Chart like the one below, listing several important minerals. You may want to create this on a bulletin board, as students will be adding to it later.

Mineral Chart			
Mineral Name	Importance to Health	Good Sources	Type of Element
Calcium	Helps form healthy bones and teeth, helps blood clotting, regulates heartbeat	Dairy products (milk, yogurt, cheese), green leafy vegetables (spinach, collard greens)	Alkaline-Earth Metal
Calcium			
Chlorine			
Copper			
Fluorine			
Iodine			
Iron			
Magnesium			
Phosphorous			
Potassium			
Sodium			
Zinc			

4. Divide the class into 10 groups and assign them one of the minerals above (besides calcium). Their assignment is to find out the following:

- Why the mineral is important for human health.
- What foods are good sources of that mineral.
- What type of element the mineral is (metal, metalloid, nonmetal; if metal, identify as alkali metal, alkaline-earth metal, transition metal, or other)

5. At the end of the first class period, have one member of each group to fill in the information on the Mineral Chart for their mineral.
6. The next day, have students work individually to use the chart and create a healthy daily menu that includes at least five minerals on the chart. Have students write their menu on a piece of a paper, organized into breakfast, lunch, snacks, and dinner.
7. Have students hang their menus around the Mineral Chart. End with a class discussion about some favorite and unusual foods that provide essential minerals.

Assessment

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

- 3 points: Students were active in class discussions; correctly identified the mineral's importance to human health, good sources of the mineral, and the type of element; developed a complete, varied daily diet with at least five minerals.
- 2 points: Students participated in class discussions; correctly identified the mineral's importance to human health, good sources of the mineral, and the type of element; developed a complete daily diet with four or five minerals.
- 1 point: Students did not participate in class discussions; did not identify the mineral's importance to human health, good sources of the mineral, and the type of element; developed an incomplete complete daily diet with three or fewer minerals.

Vocabulary

alkaline-earth metal

Definition: a metallic element belonging to group 2 of the periodic table, including: beryllium, magnesium, calcium, strontium, barium, and radium

Context: The alkaline-earth metals are generally softer than most other metals and they react readily with water, particularly when heated.

calcium

Definition: A soft silvery-white element that is an alkaline-earth metal; never occurs freely in nature and easily forms compounds with oxygen and water.

Context: Calcium is an important part of our diets, helping build and repair the bones in our bodies.

compound

Definition: A substance made up of atoms of two or more elements; atoms are bound together in a molecule and can only be separated by a chemical reaction.

Context: Calcium carbonate is a carbon compound used to make white paint, cleansing powder, toothpaste, and stomach antacids.

element

Definition: A substance that is composed of one type of atom; an element cannot be chemically separated.

Context: Calcium is an essential element for countless living organisms.

mineral

Definition: A pure, solid substance that occurs in nature; every mineral has distinct characteristics and a unique chemical makeup.

Context: Our bones are a hard mix of calcium and other minerals on the outside, but they are spongy on the inside.

valence electrons

Definition: The electrons in an atoms outermost electron shell that dictate how elements interact.

Context: Each alkaline-earth metal has two valence electrons in its outermost electron shell.

Academic Standards

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
- Health—Understands essential concepts about nutrition and diet

National Academy of Sciences

The National Academy of Sciences provides guidelines for teaching science in grades K–12 to promote scientific literacy. To view the standards, visit this Web site:
http://books.nap.edu/html/nses/html/overview.html#content.

This lesson plan addresses the following science standards:

- Physical Science
- Life Science

- Science as Inquiry
- Science and Technology

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

DVD Content

This program is available in an interactive DVD format. The following information and activities are specific to the DVD version.

How To Use the DVD

The DVD starting screen has the following options:

***Play Video*—**This plays the video from start to finish. There are no programmed stops, except by using a remote control. With a computer, depending on the particular software player, a pause button is included with the other video controls.

***Video Index*—**Here the video is divided into sections, indicated by video thumbnail icons. Watching all parts in sequence is similar to watching the video from start to finish. Brief descriptions and total running times are noted for each part. To play a particular segment, press Enter on the remote for TV playback; on a computer, click once to highlight a thumbnail and read the accompanying text description and click again to start the video.

***Curriculum Units*—**These are specially edited video segments pulled from different sections of the video (see below). These nonlinear segments align with key ideas in the unit of instruction. They include onscreen pre- and post-viewing questions, reproduced below in this Teacher's Guide. Total running times for these segments are noted. To play a particular segment, press Enter on the TV remote or click once on the Curriculum Unit title on a computer.

***Standards Link*—**Selecting this option displays a single screen that lists the national academic standards the video addresses.

***Teacher Resources*—**This screen gives the technical support number and Web site address.

Video Index

I. Exploring Alkaline-Earth Metals (5 min.)
Almost as unstable as alkali metals, alkaline-earth elements are soft silvery metals that react easily with water. Learn about the common properties and unique characteristics of these metallic elements.

II. Calcium: Building Bones (5 min.)
Learn more about calcium and the many uses for its compounds while examining the relationship between this reactive element and the human skeletal system.

III. Strontium: Fatal Fallout (5 min.)
Like the other alkaline-earth elements, strontium can be extremely volatile. Learn about the properties and uses of strontium, as well as the dangers of the radioactive isotope strontium 90.

IV. Radium: Curie's Cure (7 min.)
An extremely radioactive element, radium has few everyday uses, but its value as a cancer-fighting tool is immeasurable. Explore the properties of radium and its role in changing nuclear medicine.

V. Inside the Body's Bones (24 min.)
The human body is capable of doing amazing things, including repairing itself after an injury. Examine the skeletal system as one little girl's body repairs and replaces her broken radius.

Curriculum Units

Segment 1. Alkaline-Earth Metals and Their Properties
Pre-viewing question
Q: Which of the alkaline-earth metals do you think is the most useful and why?
A: Answers will vary.
Post-viewing question
Q: Why are the alkaline-earth metals considered unstable?
A: The alkaline-earth metals are in Group 2 on the periodic table because they have only two electrons in their outermost shell. Because atoms need eight electrons in their outermost (or valence) shells to be stable, the two valence electrons in alkaline-earth metals make them unstable. As you move from beryllium to radium, the atoms' hold on their valence electrons becomes more tenuous, making each alkaline-earth metal more reactive than the one before it.

2. Calcium and Its Uses
Pre-viewing question
Q: What kinds of objects contain calcium?
A: Answers will vary.
Post-viewing question
Q: What are some uses of calcium compounds?
A: Calcium compounds have many uses: Calcium carbonate is in white paint, cleansing powder, toothpaste, and antacids; other compounds make drywall, plaster, and fertilizers.

Segment 3. Calcium and the Human Skeleton
Pre-viewing question
Q: What do you know about the human skeleton?
A: Answers will vary.
Post-viewing question
Q: What is the connection between calcium and the human skeleton?
A: Every one of the 206 human bones depends on the element calcium. About 90 percent of the body's calcium is in the bones, a hard mix of calcium and other minerals on the outside. Bones are made up of living cells imbedded in a calcium carbonate matrix that makes up the hard parts. When a bone breaks, cells called osteoblasts call in more calcium to repair and rebuild.

Segment 4. Strontium and Nuclear Fallout
Pre-viewing question
Q: What do you know about the Chernobyl nuclear disaster?
A: Answers will vary.
Post-viewing question
Q: What is nuclear fallout and why is it dangerous?
A: Nuclear fallout is made up of radioactive particles that are scattered through the Earth's atmosphere by air currents. Nuclear fallout is dangerous because it contains radioactive isotopes of the elements strontium, cesium, carbon, and iodine, which can cause severe health problems and sometimes death. Strontium 90, remains radioactive for decades. When humans consume contaminated foods and liquids, the strontium 90 accumulates in their systems, creating disease and genetic damage.

Segment 5. Radioactive Radium and Its Uses
Pre-viewing question
Q: What are some medical treatments for cancer?
A: Answers will vary.
Post-viewing question
Q: What are some common uses of radium?
A: Radium is highly radioactive, so its use is limited. It is primarily used in the treatment of cancer. Radium is also used to produce radon gas, which is also used to combat some cancers. In the past, small amounts of radium were used to make glow-in-the-dark paint for watches, aircraft dials, and other instrument displays.

Segment 6. Marie Curie and Nuclear Medicine
Pre-viewing question
Q: What are some of the greatest discoveries in medicine?
A: Answers will vary.
Post-viewing question
Q: Were Marie Curie's medical discoveries worth the price she paid?
A: Answers will vary.

Segment 7. Composite Elements and Our Bones
Pre-viewing question
Q: What daily activities create stress on your body?
A: Answers will vary.
Post-viewing question
Q: Describe the inside of a human bone.
A: Deep inside, bone is made of interconnecting arches. This honeycomb-like structure houses nerves and blood vessels and is built of a composite material consisting of the alkaline-earth metal calcium, the nonmetal phosphorous, and a flexible protein called collagen. Bones resist compression forces twice as well as granite, yet they are just one-fifth the weight of steel.

Segment 8. A Youthful Skeletal System
Pre-viewing question
Q: What do people do to keep their bodies youthful?
A: Answers will vary.
Post-viewing question
Q: How do osteoclasts and osteoblasts work together to keep the skeletal system healthy?
A: The human body has a complex maintenance network that works to keep our bones healthy. Specific types of cells have different jobs within this network and use such elements as calcium, carbon, and hydrogen to repair and maintain our skeletal system. First, cells called osteoclasts squirt a hydrolic acid, which is strong enough to burn through sheet metal and is used to break down bone for repairs. Next, crews of bone-building cells called osteoblasts come in and lay down new collagen and coat it with calcium salts. Osteoclasts and osteoblasts work together so that bones do not crack or crumble.

Segment 9. Broken Bones and Endorphins
Pre-viewing question
Q: Have you ever broken a bone in your body?
A: Answers will vary.
Post-viewing question
Q: Why does the brain release endorphins when a person is in pain?
A: The brain releases endorphins to keep pain at bay for a few vital minutes in case a person must escape danger.

Segment 10. First Stages of Healing
Pre-viewing question
Q: What has caused your body to feel pain?
A: Answers will vary.
Post-viewing question
Q: Why is pain a necessary sensation?
A: Pain is the body's way of alerting it to internal damage; otherwise we might not seek help for an injury or illness. Pain can also be a protective force, making sure that we are cautious and do not do anything to further aggravate an injury.

Segment 11. Hematomas, Stem Cells, and Bone Repair
Pre-viewing question
Q: Have you ever had a bad bruise?
A: Answers will vary.
Post-viewing question
Q: What is the job of stem cells?
A: Stem cells are specialist cells that are responsible for replacing dead and damaged tissue. They are factories making new cells, usually dividing to create a new cell once every two days. When a bone breaks, they can divide to make new cells once every few minutes.

Segment 12. Movement, Mending, and Scarring
Pre-viewing question
Q: Why do children's bones heal faster than adults' bones?
A: As the body ages, the bones' regenerative powers decline. So a child who breaks an arm will heal faster than an adult with the same injury.
Post-viewing question
Q: Describe the recovery process of an injury, yours or someone else's.
A: Answers will vary.