Celebrating Chemistry

Chemistry—It's Elemental!

NATIONAL CHEMISTRY WEEK OCTOBER 18–24, 2009

AMERICAN CHEMICAL SOCIETY

WHAT'S INSIDE?

Articles

Cool Information

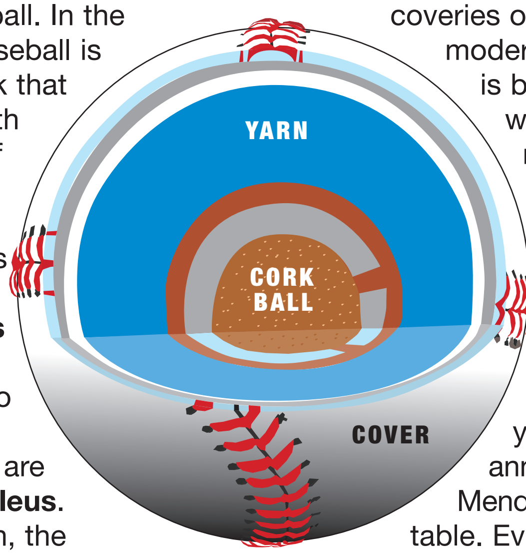
Activities

Puzzles and Games

It's All Atoms!

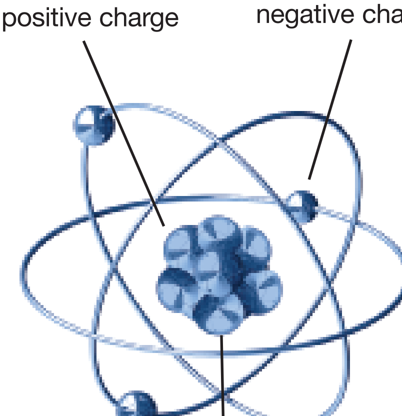
Imagine you are doing your homework and the tip of your pencil breaks off. Then, you grind the piece into a powder until it is just a bunch of tiny specks. If you divide those specks in half again and again until you have the smallest particle, that particle would be a single **atom** of carbon. Everything in nature is made of atoms. Atoms are the smallest pieces of **matter**.

What do atoms look like? Make believe an atom is like a gigantic baseball. In the center of a baseball is a piece of cork that is wrapped with many layers of yarn. At the center of an atom, two kinds of particles called **protons** and **neutrons** fit together into a tiny bunch. Together, they are called the **nucleus**. Instead of yarn, the nucleus is surrounded mostly by empty space. Tiny particles called **electrons** spin around incredibly fast in that space. Also, atoms have no thick outer layer like baseballs do. But imagine this, if the nucleus of the atom were actually as big as the cork-center of a baseball, the ball would have to be as big as a stadium!



Everything is made up of atoms, but atoms are not all the same. The lead in your pencil, the paper in your book, and the skin on your body are very different from each other. Each of these things is made of different combinations of atoms. Atoms can have different numbers of protons. When two atoms have the same number of protons, they are the same **element.** For example, carbon atoms have six protons. A handy way to keep track of all the elements is by exploring a **periodic table of elements.** Over 100 elements exist, and each one has a unique name. The periodic table is a big ingredient list of all the known elements in the world, and the **atomic number** tells you the exact number of protons in each element.

Scientists have been studying the elements for hundreds of years. As you know, we often learn things by studying the discoveries of others. The modern periodic table is based on the work of a chemist named Dmitri Mendeleev. Mendeleev got some of his ideas from the work of other chemists. This year is the 140th anniversary of Mendeleev's periodic table. Everything around you is made when people mix elements or when elements come together in nature. After reading and doing the activities in this issue of *Celebrating Chemistry*, you will realize chemistry's role in everything you do. Share your knowledge with friends, family, and teachers!



Meet the Periodic Table Top 20

You probably know more than you think about elements on the periodic table. In fact, you are probably already familiar with many of the elements, where they are found, and their uses. Each element has unique qualities. You could even say they each have their own personality. Take a look below to see what you already know about the first 20 elements.

Atomic number: the number of protons the element has

Symbol: the code for the element

Atomic mass: the mass of one atom of the element

1 H
Hydrogen
1.008
Hydrogen is a gas and is the lightest element. It is also the most plentiful element in the universe.
Discovered: 1776
Some of its uses: water, rocket fuel, ammonia

2 He
Helium
4.003
Helium is a gas and is the second most abundant element in the universe.
Discovered: 1895
Some of its uses: balloons, blimps

3 Li
Lithium
6.941
Lithium is the lightest metal. It can withstand very high heat (like an oven mitt), which makes it very useful.
Discovered: 1817
Some of its uses: batteries

4 Be
Beryllium
9.012
Beryllium is a strong, lightweight metal. It is also found in emerald gemstones.
Discovered: 1798
Some of its uses: watch springs, X-ray tube windows

5 B
Boron
10.811
Boron is a metalloid (has a personality that is in between a metal and a non-metal). It is also an important nutrient for plants.
Discovered: 1808
Some of its uses: heat-resistant glass, eye disinfectant, detergents

6 C
Carbon
12.011
Carbon is a non-metal and among the top-10 most plentiful elements in the universe. It is present in all known life forms.
Discovered: known to the ancients
Some of its uses: diamond, pencils, coal, plastics

7 N
Nitrogen
14.007
Nitrogen is a colorless, odorless gas that makes up most of the Earth's atmosphere. It is found in all living organisms.
Discovered: 1772
Some of its uses: coolant (liquid nitrogen), ammonia production, fertilizer component

8 O
Oxygen
15.999
Oxygen is a colorless, odorless gas that plays a vital role for all living organisms. By mass it makes up most of the air, sea, and land.
Discovered: 1774
Some of its uses: combustion, life support, steel production

9 F
Fluorine
18.998
Fluorine is a pale yellow gas that reacts with most elements.
Discovered: 1886
Some of its uses: toothpaste additives, refrigerator coolants

10 Ne
Neon
20.18
Neon is a colorless gas that glows reddish-orange when placed in a vacuum tube.
Discovered: 1898
Some of its uses: neon lights, fog lights, TV tubes, lasers

11 Na
Sodium
22.99
Sodium is a soft, silvery-white metal. In nature it is found in many minerals that are essential to animal nutrition.
Discovered: 1807
Some of its uses: street lights, kitchen salt, soda, glass, batteries

12 Mg
Magnesium
24.305
Magnesium is a tough, lightweight, grayish-white metal. It is an important element for plant and animal life.
Discovered: 1808
Some of its uses: sparklers, airplanes, pigments, chlorophyll

13 Al
Aluminum
26.982
Aluminum is a lightweight, silvery, and flexible metal. It is also the most abundant metal in the Earth's crust.
Discovered: 1825
Some of its uses: foil, window frames, fireworks, flash bulbs, cars, rockets, planes

14 Si
Silicon
28.086
Like boron, silicon is a metalloid. It makes up much of the Earth's crust and is a good conductor of electricity.
Discovered: 1823
Some of its uses: solar cells, microchips, tools, quartz, sand, glass, silicone rubbers, oils

15 P
Phosphorous
30.974
Phosphorus is a nonmetal and is found in many different minerals. It is also essential to living organisms.
Discovered: 1669
Some of its uses: fireworks, matches, fertilizers, detergents, toothpaste, pesticides

16 S
Sulfur
32.066
Sulfur is a pale yellow, brittle nonmetal. It is also essential to living organisms.
Discovered: known to the ancients
Some of its uses: matches, fireworks, batteries, odorant for natural gas

17 Cl
Chlorine
35.453
Chlorine is a greenish yellow gas that likes to bond with many other elements. It is needed for most living organisms.
Discovered: 1774
Some of its uses: water purification, kitchen salt, bleach, hydrochloric acid, stain removers

18 Ar
Argon
39.948
Argon is a colorless and odorless gas that is heavier than air. It likes to stay by itself, and often resists bonding to other elements.
Discovered: 1894
Some of its uses: light bulbs, lasers, Geiger counters

19 K
Potassium
39.098
Potassium is a soft silvery-white metal. Like sodium, it is needed to help living cells to function.
Discovered: 1807
Some of its uses: fertilizers, glass lenses, gun powder; found in bananas

20 Ca
Calcium
40.078
Calcium is a soft gray metal. It is essential for most living organisms and is also the fifth most common element in the Earth's crust.
Discovered: 1808
Some of its uses: plaster of Paris, concrete, fertilizer, vitamin supplements; found in bones

Element Scavenger Hunt

Think about the rooms in your home, like the bedroom, bathroom, and kitchen. How much chemistry can be found in them? It's everywhere! In fact, your home is built out of materials made possible by chemistry. Chemical elements are essential to the contents and structure of your home. Have you ever heard of an Element Scavenger Hunt? Well, here's how it works. Get a bunch of your friends together and divide into teams. Set a time to find the answers to the clues below. Draw lines from the clues on the left to the correct elements on the right and write the name of the element underneath the atomic symbol. The team with the most correct answers to the clues at the end of that time wins. No friends around? That's okay! Challenge yourself to see how many answers you can find. **Hint:** During your hunt you may want to review the "Words to Know" on page 11 as well as the Periodic Table of Elements insert that came with this magazine!

1. You put this element on your teeth two times each day, once in the morning and once at night. It helps prevent cavities!
2. This gas is found in balloons you see at parties. (**Hint:** They're the types of balloons that float!)
3. This is an important ingredient in DNA and many other living processes. It is also used in fertilizers and soaps!
4. This is one-half of common table salt. It is also important in the treatment of drinking water, cleaning products, and the water in swimming pools!
5. This metal is in wires, cables, pipes, and orangish coins with Abraham Lincoln's face on them.
6. This common element makes up over a quarter of the Earth's crust, is used in making glass, is in solar cells, and makes up part of what is under your feet if you run on the beach!
7. This element is an important mineral for strong bones. Lots of kids drink milk to try and get lots of this!
8. At the grocery store, you'll often find cans of food and beverages made of this metal. (**Hint:** It has a shiny silver color and you can wrap up leftover food with it!)
9. This is used in gates and stoves and when it's combined with other metals and carbon, it makes steel.

15 **P**
Atomic mass 30.9738

Phosphorus
____

20 **Ca**
Atomic mass 40.078

____

9 **F**
Atomic mass 18.9984

____

13 **Al**
Atomic mass 26.9815

____

26 **Fe**
Atomic mass 55.845

____

29 **Cu**
Atomic mass 63.546

____

2 **He**
Atomic mass 4.00260

____

14 **Si**
Atomic mass 28.0855

____

11 **Na**
Atomic mass 22.9898

____

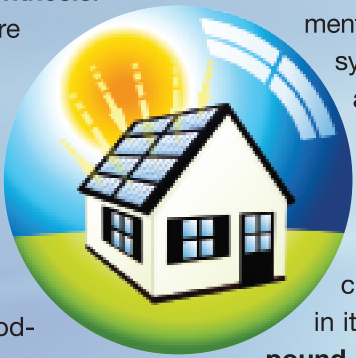
TRY THIS:

Want an extra challenge? Try to find examples of items in your home that contain these elements. Is the element not on the label? Use the Internet to look it up!

Answers for the Element Scavenger Hunt can be found on page 12.

Sunshine Science: Green Chemistry and Solar Energy

The sun is the "greenest" and largest source of energy available to the earth. This energy is called **solar energy**. Leaves and plants change sunlight into the kind of energy they need through **photosynthesis**. With solar panels (which are made up of lots of **solar cells**), humans are trying to copy what plants do by using different elements from the periodic table. A leaf converts sunlight into energy so it can live, sort of like how our bodies change food into energy so we can live. Solar panels sit on roofs of all types of buildings and change sunlight into electrons, which are then used as electricity inside the buildings.



The first solar cells were made from silicon (Si). It has to be very hot (over 1000 degrees) in order to make the silicon solar cells. This takes a lot of energy, and one of the goals of **sustainability** is to find ways to use less energy.

Chemists have tried using other elements to make solar cells. The symbols for these elements are Cd, Te, Cu, In, Se, Ga, and As. Can you find these elements on the periodic table?

Another type of solar cell has a sun-sensitive dye in it. It is made from a **compound** called titanium dioxide (chemists use the chemical formula TiO_2) and contains a dye that absorbs light. TiO_2 is a white pigment that is also used in white paint and in sunscreen lotion. In this type of solar cell, the dye begins the sun-to-electricity process by taking in sunlight, just like the green pigment in leaves begins photosynthesis. Some of the **green chemistry** and sustainability rewards for this type of solar cell are that TiO_2 is not toxic, not expensive, and easy to make in the laboratory or find in nature. One popular green chemistry lab experiment for high school students involves making a solar cell with TiO_2, the dye from a crushed blackberry, and glass slides (see **www.acs.org/ncw** for full experiment). As solar panels become less expensive, better at converting sunlight into electricity, and made by more earth-friendly processes, they will be used more often as a source of green and sustainable energy.

Milli's Safety Tips Safety First!

ALWAYS:

- Work with an adult.
- Read and follow all directions for the activity.
- Read all warning labels on all materials being used.
- Wear eye protection, specifically goggles.
- Follow safety warnings or precautions, such as wearing gloves or tying back long hair.
- Use all materials carefully, following the directions given.
- Be sure to clean up and dispose of materials properly when you are finished with an activity.
- Wash your hands well after every activity.

Never eat or drink while conducting an experiment, and be careful to keep all of the materials away from your mouth, nose, and eyes!

New Sense about Cents

Pennies today are made of zinc (Zn) with a thin, bright coating of copper (Cu) metal. Pennies are very shiny, but they don't stay bright forever. Over time copper reacts slowly with oxygen in the air to create a coating of copper oxides. Copper oxides are dull and dark. In this experiment, you will explore some of the properties of copper using a few common household ingredients. **SAFETY FIRST!** Be sure to follow Milli's Safety Tips and do this activity with an adult! Do not get the vinegar/salt mixture or the ketchup in any wounds or cuts and do not eat or drink any of the materials used in this activity. Wash your hands and throw everything away when you're done.

SAFETY! Chemical protective goggles MUST be worn when performing this activity.

Materials

- **masking tape**
- **marking pen**
- **6 dull pennies**
- **4 small plastic cups (4 oz)**
- **1/4 cup milk**
- **1/4 cup ketchup (also known as catsup)**
- **1/4 cup white vinegar**
- **1 teaspoon salt (NaCl)**
- **1 plastic spoon**
- **water**
- **measuring spoon**
- **paper towels**

Procedure

1. Use the masking tape and pen to label the cups: "salt and vinegar", "ketchup", "milk", and "water."
2. Place one penny in each of the cups, and describe each in the "What Did You Observe?" table.
3. Pour the salt and vinegar into the labeled cup.
4. Stir until the salt dissolves.
5. Pour the other materials into their labeled cups.
6. Wait three to five minutes. Can you see anything happening? Write it down under "Other observations" in your table.
7. Use the plastic spoon to remove the penny from the "salt and vinegar" cup. Write your observation in the "What Did You Observe?" table.
8. Rub the penny with a paper towel and record your observations. Look at the paper towel. What color is the material you rubbed off?
9. Rinse the penny well under running water, dry it with a paper towel, and place it on the work surface in front of the cup from which it was removed.
10. Repeat steps 7–9 with each of the pennies in the other cups ("ketchup" cup tip: make sure there is plenty of ketchup on the penny before you rub it!).

Where's the Chemistry?

Not all liquids are the same. The liquids you used that contained acid were better cleaners than the ones that were not. An **acid** is a **molecule** that usually contains a hydrogen (H) atom. Strong acids, like the acid in car batteries, are very dangerous. Ketchup and vinegar contain acetic acid, which is weak enough to be safe to eat (BUT NOT DURING THE EXPERIMENT!). The water is not acidic at all and milk is a very weak acid. The acids in the ketchup and vinegar react with the copper underneath the oxides on the outside of the penny to form new materials. These newly formed materials dissolve in the liquid and are washed away. So, what is left behind is a very thin coating of copper oxides that you can easily rub away.

What Did You Observe?

Penny	Salt and Vinegar	Milk	Ketchup	Water
When placed into the cup				
When removed from the cup				
After rubbing with paper towel				
Other observations				

Iodine Investigators!

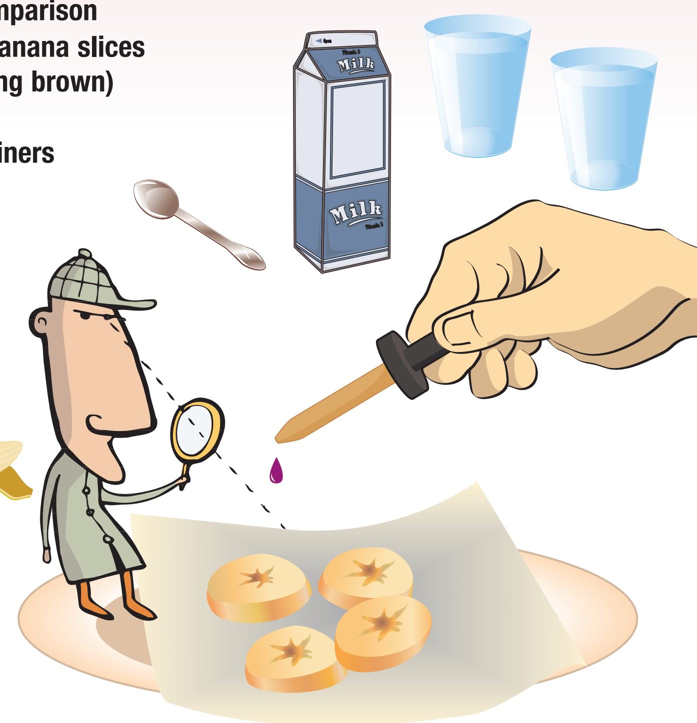
Have you ever wondered about what happens in your mouth and stomach to help break down a piece of food? Did you know that your stomach has special ways to break down the different kinds of food you eat? Many of the foods you eat contain **starch**, and in this experiment, you will be using an element called iodine (element number 53) to identify foods with starch in them. Good luck Iodine Investigator!

Where's the chemistry?

Many foods have very big molecules in them called starches. Your body needs to break these starches down so it can get the nutrients it needs. There is a special molecule in your saliva called an enzyme that starts digestion by changing the big starch molecules in your mouth into small little sugar molecules! When bananas and other fruit are left in the open air, nature does its own version of digestion with a reaction we commonly call ripening. During ripening, the starches start to break down into smaller sugar molecules. For fun, you can test for starch in a variety of foods such as potatoes, apples, cucumbers, crackers, and any others you would like to try.

You will need:

- **dropper**
- **iodine that you can purchase from a pharmacy or grocery store. You can use Betadine (a povidone–iodine mixture) or Lugol's solution. All have a very strong color, so dilute the mixture with about 10 parts water to see the reaction clearly.**
- **1 tablespoon of flour mixed with 1/3 cup of water**
- **1/3 cup of milk, for comparison**
- **starchy foods to test: banana slices that are overripe (turning brown) and unripe (green)**
- **2 plastic cups or containers**
- **measuring spoons**
- **2 paper plates**
- **paper towels**



Procedure

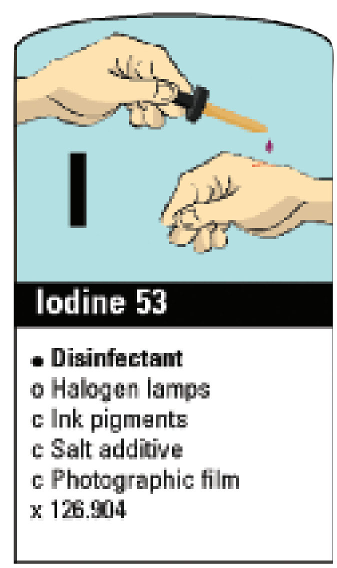
1. Cover your work surface with newspaper.
2. Place the two paper plates on the newspaper.
3. Mix flour and water in a paper cup.
4. Add milk to the second cup.
5. Add a drop of iodine to each cup.
6. Place a paper towel on top of a paper plate. Then place one slice of unripe banana on top of the paper towel.
7. Add a drop of the iodine solution to each banana slice.
8. Repeat steps 3 and 4 with one slice of overripe banana.
9. Write down any color changes on the "What Did You Observe?" chart.
10. When you're done, wash your hands and throw everything away.

What Did You Observe?

A change of color from brown to a blue-black or purple color shows that starch is present. If there is no change in color, this hints that no starch is detectable.

Food	Color change	Is starch present?
Ripe banana		
Overripe banana		
Milk		
Flour and water		

CAUTION: ***Be sure to follow Milli's Safety Tips! Goggles MUST Be worn when performing this activity. Be careful when you handle iodine. It can stain clothing and skin. DO NOT put iodine in your mouth and DO NOT eat any tested foods— iodine can be poisonous! Wash your hands and throw everything away when you're done.***



Collecting Elements for Fun

Theodore Gray works at his company, Wolfram Research, Inc., makers of the scientific software Mathematica®. He is a software architect, a writer, and an artist. For fun, he writes a monthly column for *Popular Science* magazine called "Gray Matters". His new book *Mad Science* is all about wild chemistry experiments you could do at home, but probably shouldn't. He wants to tell you all about his other hobby: collecting elements.

Theodore Gray

You probably know someone who collects rocks and minerals, but have you heard of anyone who collects elements? I do!

People find pretty rocks in gravel beds, caves, mountain sides, or just about anywhere outdoors. But only a few elements can be found in pure form out in nature. In some parts of Michigan you can find pure copper (Cu) in the ground, and if you sift through the sand at the bottom of certain rivers in California or Colorado, you can find specks of pure gold (Au). Where I live in central Illinois, about the best I can do in the wild is air, which is about 78% nitrogen (N).

There aren't many pure elements out in nature, but if you know where to look, you can find them in all sorts of places. For example, if you're in the kitchen there are probably aluminum (Al) pots and pans; those are usually about 99% pure aluminum. If you're sitting at a steel desk in your classroom, that's about 98% pure iron (Fe).

You can find some elements easily in very pure form. For example, find the solar cell in a solar-powered pocket calculator or a solar power panel, and you're looking at 99.9999% pure silicon (Si). Other elements can be found in the most unexpected places. In the seven years that I've been looking for and photographing elements, I've been surprised by how many pure ones I could find at local supercenters or hardware stores. Here are some examples:

Element	What is it found in?	Where can you find it?
Helium	Balloons and helium tanks	Wal-Mart
Lithium	Camera batteries	Radio Shack
Magnesium	Camp fire starters	Wal-Mart
Argon	Light bulbs	Grocery and hardware stores
Krypton	Flashlight bulbs	Hardware store
Americium	Smoke detectors	Hardware store

If you really get serious about finding elements, the place you want to search is on eBay. From water pitchers made of uranium (U) glass, to slabs of pure beryllium (Be), to titanium (Ti) turbine blades, there's no element you can't find on eBay. I encourage you to read more at **www.periodictable.com**. I've created this website to provide a complete periodic table reference containing not just beautiful pictures of pure elements, but also all the information a student would need to know about each of the chemical elements.

Chemistry—It's Elemental!

WORD SEARCH

E	R	E	P	P	O	C	R	O	B
N	A	N	L	S	I	L	V	E	R
E	D	I	A	M	B	R	M	N	O
G	X	T	T	U	R	E	O	P	M
Y	O	R	I	I	A	T	I	N	I
X	R	O	N	C	A	R	B	O	N
O	T	G	U	L	B	L	G	I	E
Y	M	E	M	A	E	N	O	O	S
Z	I	N	C	C	T	A	L	S	N
L	T	L	A	B	O	C	D	A	R

BROMINE	ZINC	NITROGEN
SILVER	COBALT	TIN
IRON	GOLD	LEAD
COPPER	CALCIUM	ARGON
OXYGEN	PLATINUM	CARBON

Answers available at **www.acs.org/ncw**

Titanium on the Cranium!

Titanium is the 22nd element on the Periodic Table of Elements, and was discovered in 1791 (over 200 years ago!). The word "titanium" comes from the name that was given to some of the most powerful gods of Greek legend, the Titans. So "titanium" stands for strength. Titanium is as strong as steel, but it weighs about half as much, so it is used in jet engines and rockets. That's why some people call it the "space age metal"! It also does not rust or cause allergic reactions, which is why doctors use it for man-made hip joints, screws, and even metal head plates!

From missiles to rings to razors, titanium is a popular superstar. But where do we find it in nature? Like many metals, titanium is always found stuck to other elements. In fact, pure titanium metal is expensive because it's very hard to get it unstuck from other elements. In nature it is often found in a **compound** called "titanite", where it is joined with silicon, calcium, and oxygen. Titanite is found all over the world, and could even be buried deep below your back yard or your school!

So where else do you see this stuff? Another common compound of titanium is called titanium dioxide, which has one atom of titanium bonded to two atoms of oxygen. It is used in paper, toothpaste, paints, and in plastics that are white. Just take a moment to think about this: how many items that you see every day contain titanium? This element is everywhere!

TITANIUM GOLF CLUB

Titanium 22

- ● Heat exchanger
- + Airplane motors
- + Bone pins
- c Pigments for paint and paper
- x 47.867

CAMPING UTENSILS
People who climb mountains don't like to carry any extra weight, but they do like to eat. These are lightweight titanium eating utensils.

TITANIUM DIOXIDE *is the white in white paint and the opaque in most other paints.*

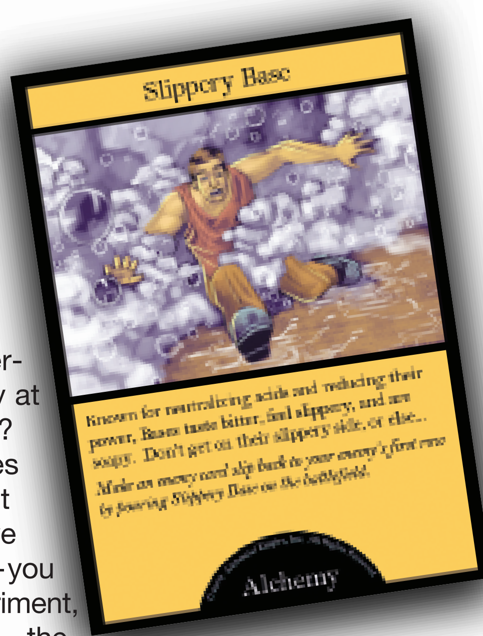
The Adventures of Meg A. Mole, Future Chemist

Meg interviews chemistry game inventor Anshul Samar

For National Chemistry Week 2009, I traveled all the way to California! I met Anshul Samar, a 9th-grade high school student at Bellarmine College Preparatory in San Jose. Anshul is not your typical 9th grader—he is the CEO and founder of Alchemist Empire, Inc., the makers of the Elementeo Chemistry Card Game!

So what is Elementeo all about? Anshul explained that he gives "life and powers to the chemical elements and scientific concepts and adds fun and fantasy into the fascinating world of chemistry!" Anshul started creating the game when he was in the 6th grade, and it was released when he was in the 9th grade. Creating a game isn't just about sales and marketing. He explained that his work involves "researching about the coolest elements, creating element personalities, working with artists from around the world, and using software to create the cards."

I was really interested in learning more about playing the game. Anshul continued, "In Elementeo, elements have their own personalities, and they fight with each other using their properties—oxygen became Oxygen Life Giver, who can rust metals, and helium became Helium Genie, who can lift other elements. Throughout the game, players create compounds, and fight using the element properties and reactions!" Anshul said he even got to present the game at a recent ACS national meeting.



So how did Anshul get so interested in chemistry at such an early age? He told me he likes science because it "doesn't really have strict boundaries—you can explore, experiment, dream, and create…the way science is a part of every single second of our lives got me hooked."

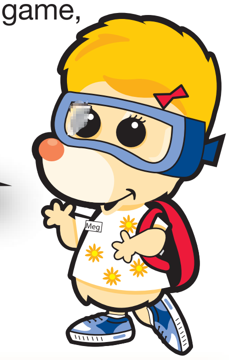
Anshul explained that he mostly works in his own room. That sounds like fun! His work is done mainly with computers. He uses them to do his Internet research, work on the game software, communicate with artists and customers, and update the game website.

Anshul explained he felt it was a big challenge "to make the game appealing to different age levels, all the way from 2nd graders to 9th graders and even older." So he made five difficulty levels!

So, what did creating Elementeo teach Anshul? He told me that he "learned that anyone at any age can create an idea, deal with obstacles…and eventually conquer the world!"

To learn more about the Elementeo game, please visit **www.elementeo.com**.

To read more about my visit with Anshul, visit **www.acs.org/kids**



Personal Profile: Anshul Samar

What is your favorite food? I am a lacto-vegetarian.

Favorite pastime? I've been playing music for a big part of my life and am currently learning and beating on drums. Rock on!

What is an accomplishment you are proud of? Coming first in a regional high school speech competition in "Original Oratory" and going to state competition as a 9th grader!

Chemistry–It's Elemental

Down

2. A gas used to make red and orange lit-up signs; also the name of a car
3. Symbol for element number 3; a metal
4. Symbol for a noble gas that starts with the same letter as X-ray
5. A shiny, orangish metal used in electrical wires and as coating on pennies
6. Symbol for element 94, named after what used to be our 9th planet
8. United States five cent pieces are made from copper and this metal
10. This is the main metal in steel; it is also magnetic
13. A radioactive metal used in nuclear power plants
14. Soup cans are covered with this metal
16. Symbol for the element is found in stainless steel; in old-fashioned "chrome" car bumpers
18. Symbol for the element named after a physics genius who wrote the equation $E=mc^2$
19. Soda cans are made with this metal
20. A salt made from this element is in anti-cavity toothpaste
21. Symbol for element 56
22. Symbol for element 83; a heavy metal
24. A silvery metal that is right under zinc on the periodic table
25. Type of metal used to weight fishing lines and bullets
26. In a water molecule there are two atoms of this element and one of oxygen
28. Both computer parts and sand have this semi-metal
30. Named after a country in Europe, has cities called Berlin and Munich in it
33. Symbol for element number 60

Across

1. This metal's name starts with the last letter in the alphabet and is found in flashlight batteries
7. When mixed with alcohol, this can be used to kill germs on cuts
9. Found in ordinary table salt and baking soda
11. Symbol for the element named after a woman who won two Nobel prizes; to the right of americium
12. A silvery liquid that used to be found in thermometers
14. Symbol for element number 22
15. This gas is found in ordinary light bulbs
16. Found in vitamin B-12; symbol for element number 27
17. Fifty years ago, dimes were made mostly of this precious metal
20. Symbol for an element named for the country with Paris as its capital
23. Symbol for an element that smells like bleach
24. Milk, cheese, and ice cream are great ways to get this element into your body to build strong bones and teeth
27. From an old word for France; to the right of zinc on the periodic table
29. A silvery metal; element number 12
30. A yellowish precious metal
31. Symbol for element number 25
32. Element 87; a dark red liquid in the group called the halogens

Go to **www.acs.org/ncw** for the solution.

Words to Know

Matter–Anything that has both mass and volume (takes up space). Matter generally exists in one of three physical states: solid, liquid, or gas. All matter is made up of elements.

Element–Any of the more than 100 known chemical building blocks (92 occur naturally) that cannot be separated into simpler substances and that make up all matter.

Atom–The smallest bits (particles) of something that can exist and still be that element.

Mass–The amount of matter in an object.

Atomic Mass–The mass of a single atom of a chemical element.

Atomic Number–A number identifying an element by the number of protons it has.

Nucleus–The hard center of the atom.

Proton–Positively charged particles in the nucleus of the atom.

Neutron–Particles in the nucleus of the atom with no charge.

Electron–Negatively charged particles that spin around the nucleus of the atom.

Molecules and Compounds–Groups of two or more different types of atoms stuck together. For example, a molecule of water has one oxygen and two hydrogen atoms.

Acid–A kind of molecule that usually has a hydrogen atom. When acids are dissolved in water, they lose their hydrogen atoms. Strong acids lose more hydrogen atoms than weak acids.

Starch–A long, stringy molecule of many sugars connected together that is found in some types of plants.

Solar Energy–The use of energy that reaches the Earth from the Sun.

Solar Cell–A device for changing light from the Sun into electricity.

Photosynthesis–The process that plants use to convert sunlight into energy.

Sustainability–To meet the needs of the present with out compromising the ability of future generations to meet their own needs.

Green Chemistry–A more people- and earth-friendly way of using chemistry to design products and processes. The main goal of green chemistry is to prevent pollution at the source.

PRODUCTION TEAM
Clinton Harris, *Editor*
Stacy Jones, *Managing Editor*
Kara Allen, Marilyn Duerst, Theodore Gray, Clinton Harris, Stacy Jones, Ashley Predith, Jill Rockwood, Jennifer Young, *Writers*
Neal Clodfelter, *Layout, Design, Illustration*
Kelley Carpenter, *Copyeditor*

TECHNICAL AND SAFETY REVIEW TEAM
Safe Practices Subcommittee on behalf of the ACS Committee on Chemical Safety

DIVISION OF MEMBERSHIP AND SCIENTIFIC ADVANCEMENT
Denise Creech, *Director*
John Katz, *Director, Member Communities*
LaTrease Garrison, *Assistant Director, Local Section and Community Activities*
Clinton Harris, *Manager, Community Activities*
Stacy Jones, *Sr. Membership Associate, Community Activities*

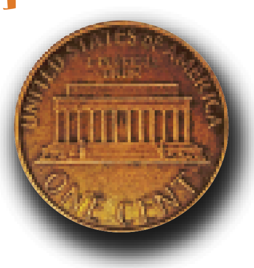
COMMITTEE ON COMMUNITY ACTIVITIES NATIONAL CHEMISTRY WEEK THEME TEAM
Anne Taylor, *Theme Team Chair, National Chemistry Week*
Tracy Halmi, *Program Chair, National Chemistry Week*
Ludy Avila, *Committee on Community Activities*
Marilyn Duerst, *Committee on Community Activities*
Paula Fox, *Committee on Community Activities (Past)*
Theodore Gray, *Author*
Christine Jaworek-Lopes, *Committee on Community Activities*
Sr. Mary Virginia Orna, *Division of History of Chemistry*
Jill Rockwood, *Division of Chemical Education*
Mike Sheets, *Committee on Community Activities*
Ruth Woodall, *Committee on Community Activities*
Lynda Jones, *Division of Chemical Education*

ACKNOWLEDGMENTS
The activities described in this publication were originally modified from *Kids and Chemistry* **(www.acs.org/kids)**, a website created by the ACS Education Division, and *WonderNet*, a publication of the ACS Education Division. The activities described in this publication are intended for elementary school children under the direct supervision of adults. The American Chemical Society cannot be responsible for any accidents or injuries that may result from conducting the activities without proper supervision, from not specifically following directions, or from ignoring the cautions contained in the text.

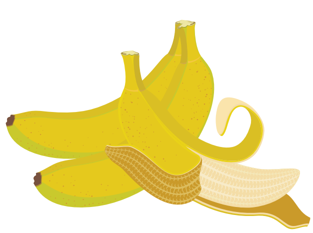
Division of Membership and Scientific Advancement
Office of Comunity Activities
1155 16th Street, NW
Washington, DC 20036
ncw@acs.org
800-227-5558
www.acs.org/ncw

Knowledge Check-Up

Sense about Cents



- *What made the pennies shiny?*
- *What did you do to get the pennies shiny?*
- *What did not make the pennies shiny? Why?*



Iodine Investigators

- *What is a starch?*
- *Do overripe bananas have a lot of starch in them?*
- *How do you know?*

Element Scavenger Hunt

- *Which element is important for strong bones?*
- *How many examples of elements did you find in your home?*

20 **Ca**
Atomic mass 40.078

Celebrating Chemistry

Celebrating Chemistry is a publication of the American Chemical Society (ACS) Office of Community Activities in conjunction with the Committee on Community Activities. The Office of Community Activities is part of the ACS Division of Membership and Scientific Advancement. The National Chemistry Week (NCW) edition of *Celebrating Chemistry* is published annually and is available free of charge through your local NCW Coordinator. NCW is a combined effort among the Office of Community Activities, the Committee on Community Activities, and several ACS Technical Divisions. Please visit **www.acs.org/ncw** to learn more about National Chemistry Week.

National Chemistry Week

Answers to Element Scavenger Hunt:
1. Fluorine, 2. Helium, 3. Phosphorus, 4. Sodium, 5. Copper, 6. Silicon, 7. Calcium, 8. Aluminum, 9. Iron

What is the American Chemical Society?

The American Chemical Society (ACS) is the largest scientific organization in the world. ACS members are mostly chemists, chemical engineers, and other professionals who work in chemistry or chemistry-related jobs. The ACS has more than 154,000 members. Most ACS members live in the United States, but others live in different countries around the world. Members of the ACS share ideas with each other and learn about important discoveries in chemistry during meetings that the ACS holds around the United States several times a year, through the use of the ACS website, and through the journals the ACS publishes.

The members of the ACS carry out many programs that help the public learn about chemistry. One of these programs is National Chemistry Week, held annually the fourth week of October. Another of these programs is Chemists Celebrate Earth Day, held annually on April 22. ACS members celebrate by holding events in schools, shopping malls, science museums, libraries, and even train stations! If you'd like more information about these programs, please contact us at **oca@acs.org.**