SOLAR PAPER

BIG IDEA

Use a special type of paper, which has been treated with a light-sensitive chemical, and the power of our Sun to observe a chemical change.

READY...

Gather materials:

- dishpan or bowl (to place the solar paper in) (from home)
- paper towels (from home)
- pencil
- small items to make shapes (e.g., toys, paper clips, leaves, sticks) (from home)
- solar paper
- water (from home)

SET...

1. Find a sunny spot where the solar paper (with items on it) can be placed in Step 4.
2. Place a dishpan or bowl near that spot and fill it with water.

GO!

1. Look at the size of your packet of solar paper. This is how big your solar paper is—so this is how much space you will have for your design.
2. Choose some sticks, or paper clips, or other small items to make a design on your solar paper.
3. Take a sheet of solar paper out of the packet, and arrange the items you've chosen on it in a way that you like. Be sure to leave space around the items, or you won't be able to see the shapes of the items at the end of the process.
4. Place your solar paper (with the items arranged on top of it) in a sunny spot.
5. Leave your solar paper in the sunlight for about 1-2 minutes, or until the paper turns light blue. Watch the paper so you can see if it changes color.
6. When the paper turns blue, remove the items and submerge your sheet of solar paper in the water to develop the solar print.
7. Once you have rinsed your solar paper, take it out of the water and set it down to dry.

WHY IS THIS SCIENCE?

The special paper used in this activity is coated with a light-sensitive chemical—commonly called Berlin Green—that reacts to light. When exposed to the strong light of the Sun, a chemical reaction takes place and the Berlin Green changes into a chemical commonly called Prussian Blue. The items you placed on your paper blocked the light from reaching this chemical coating. As a result, your paper has white areas (where the items were), while the rest of the paper has turned blue.

CRYSTAL SNOWFLAKE

BIG IDEA

Make a saturated solution with borax and water to form crystals.

READY...

Gather materials:

- borax
- cup*
- paper clip (large)
- periodic table
- pipe cleaner
- Popsicle stick
- scissors (optional)
- water (from home)

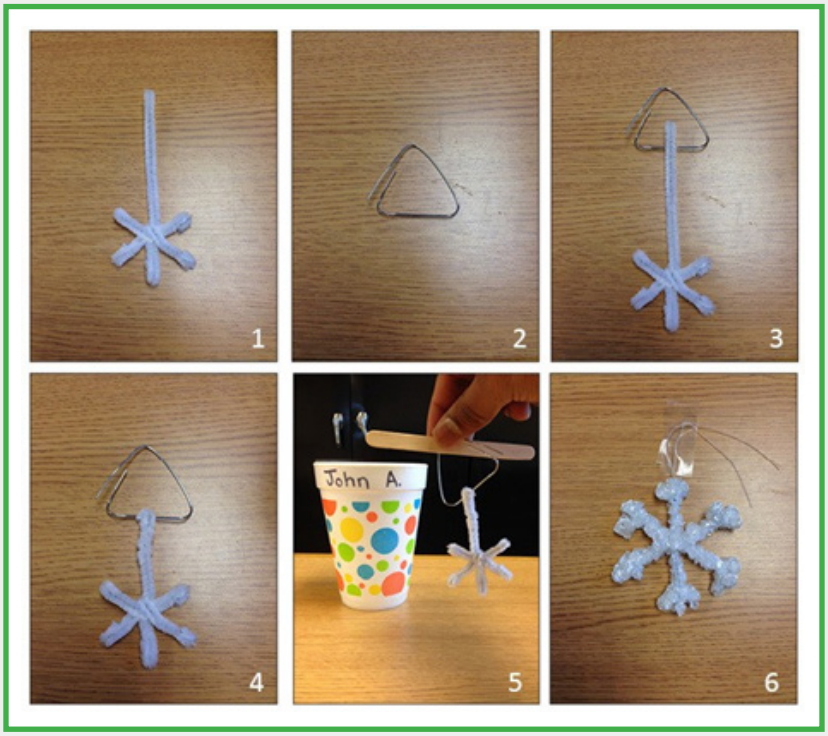
**This cup can be reused.*

SET...

No setup needed!

GO!

1. Make sure you have these items: 3 pipe-cleaner segments, a cup, a Popsicle stick, and a large paper clip.
2. Twist the pipe-cleaner segments together to make a snowflake shape. This will be the "base" on which your crystal will grow. (Photo 1)
3. If you want to, you can use the scissors to trim the ends of the snowflake "arms" so they are all roughly equal. One arm (which will be the top of the snowflake) should be kept long.
4. Untwist the paper clip into a triangle. (Photo 2)
5. Lay the longer snowflake "arm" on top of the triangle and fold the end of the pipe cleaner over the triangle. The triangle is now attached to the snowflake. (Photos 3-4)
6. Put your Popsicle stick through the wire triangle so that the snowflake hangs from it. (Photo 5)



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7. Place the Popsicle stick on top of the cup. The snowflake should be hanging down so that it is in the middle of the cup, but not touching the sides or bottom.
8. Look for boron (B) on your periodic table of elements. You will be using borax to make your snowflake. Borax is a naturally occurring mineral. It is a boron compound, which means that borax contains boron.
9. Pour the 3 tbsps. (tablespoons) of borax in your cup.
10. Ask an adult to add hot water (H_2O) to your cup, filling the cup with enough water that the snowflake will be completely submerged.
11. Stir the mixture in the cup thoroughly. You are making a saturated solution. You will know the solution is saturated when the borax is no longer dissolving.
12. Put your cup in a location where it will not be disturbed. Borax crystals grow relatively quickly, so the snowflake will be fully grown by the next day. (Photo 6)
13. Be sure to wash your hands after handling borax.

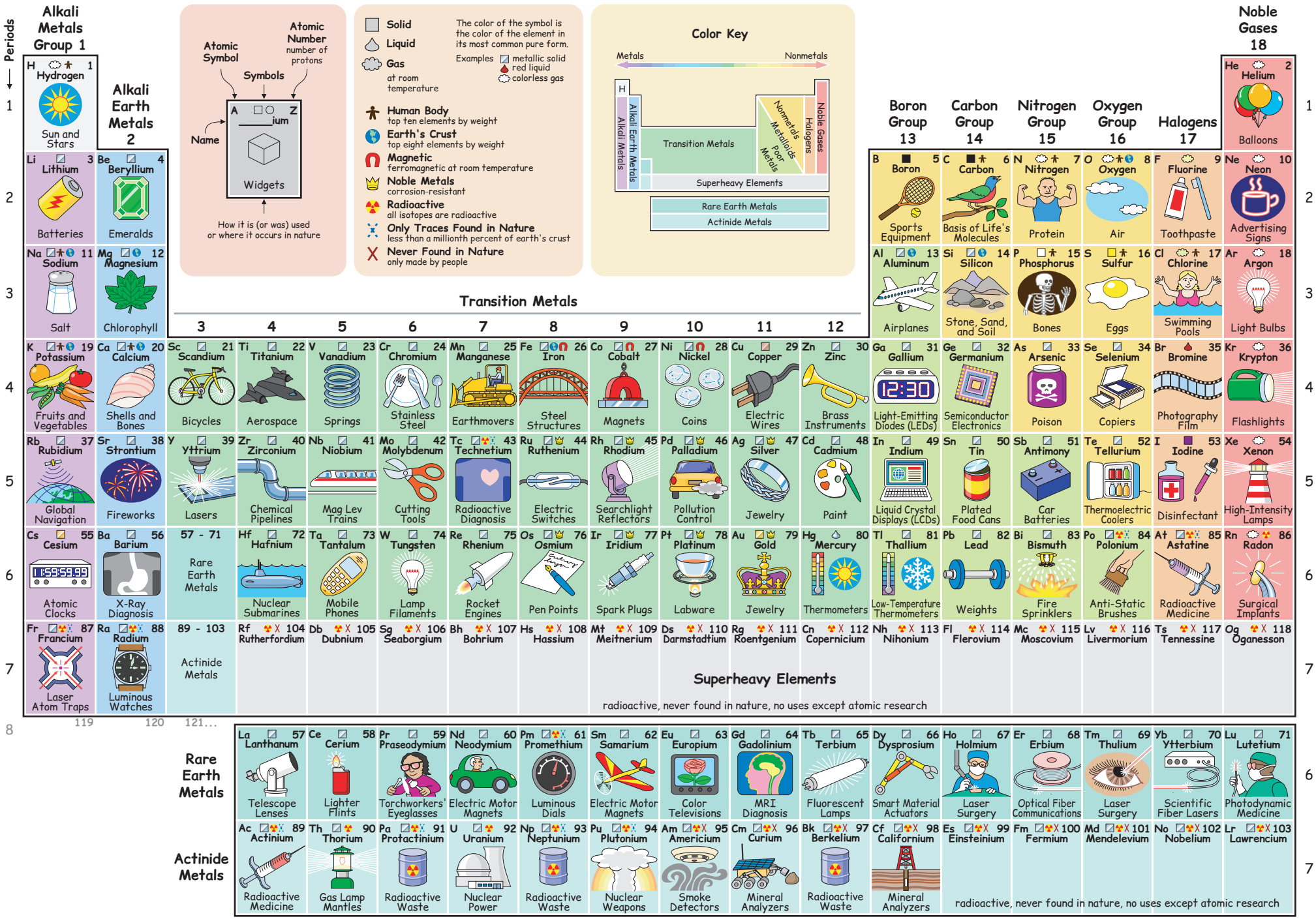
WHY IS THIS SCIENCE?

The shape of a crystal is formed by the regular arrangement of molecules or atoms. The final shape of a crystal is the result of the way the molecules fit together. Each crystal has its own pattern, as can be seen in snowflakes.

The crystal formation in this activity depends on the amount of solute (borax) dissolved in a solvent (water). At some point, the solute no longer dissolves in the solvent; it is a saturated solution. Scientists say that a solution is saturated when it contains the maximum amount of solute (what is being dissolved) that can be dissolved in the solvent (what it is being dissolved in).

Another example of making a saturated solution is to put a lot of sugar (solute) in iced tea (solvent). Even if you keep stirring it, some of the sugar will not dissolve because the iced tea can't hold any more sugar. This means that the tea is a saturated solution.

The Periodic Table of the Elements, in Pictures



PLAQUE ATTACK

BIG IDEA

People tell us to brush our teeth twice a day. But why is that so important? Let's find out how we can stop the chemical reactions involved in tooth decay!

READY...

Gather materials:

- disclosing tablet
- mirror (from home)
- toothbrush (from home)
- toothpaste (from home)

SET...

No setup needed!

GO!

1. Brush your teeth in the morning as normal. Then go about your day.
2. Before brushing your teeth tonight, find the GUM Red-Cote tablets in your materials kit. These are called disclosing tablets. These chewable tablets are often given out in dentists' offices to help people learn to brush better. Because the tablets change plaque to the color red, it is easy to see where the plaque is and to remember to brush those areas.
3. Chew a disclosing tablet and swish it around in your mouth for 60 seconds. Spit out what remains. (Do not swallow!)
4. Look in a mirror and notice how much plaque has built up on your teeth throughout the day. Why do you think it is important to brush your teeth at night?
5. Now brush your teeth, being extra careful to brush the red-colored plaque away.

WHY IS THIS SCIENCE?

During chemical reactions, substances (called reactants) are changed into different substances (called products). Chemical reactions are constantly occurring throughout our body—for instance, in our cells, in our brain, in our stomach, and even in our mouth! Most of these reactions are extremely helpful and ensure that our body functions properly, but some of them can cause problems.

Our teeth are normally covered with a sticky film called plaque. Plaque contains bacteria that feast on sugars in things we eat and drink—and turn them into acids. These acids can react with our tooth enamel (the tooth's hard, protective coating) and cause decay. If plaque builds up, it hardens into a substance called tartar that can also damage our teeth and gums. That is why regularly brushing our teeth to clean away food particles and stop plaque from accumulating is a great way to prevent these chemical reactions that lead to cavities.

Learn more about chemical reactions by trying the "Glow Sticks" and "Solar Paper" activities.

LEAKPROOF BAG

BIG IDEA

What do you think would happen if you poked a pencil into a plastic bag full of water? Learn the science behind the surprising answer to this question!

READY...

Gather materials:

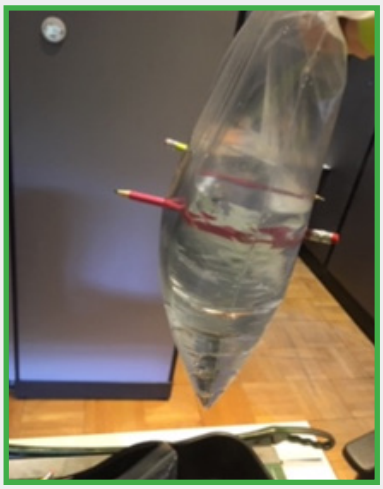
- pencils (sharpened)
- water (from home)
- Ziploc gallon bag

SET...

1. You can add extra pencils. Make sure the pencils are sharp; otherwise, this activity may not work as well.
2. Fill the gallon bag 2/3 full of water and seal it.

GO!

1. Start with one pencil. Poke this pencil through the bag until it goes through both sides (half of the pencil hanging out of one side, and half the pencil hanging out the other side). What happens?
2. Continue to add more pencils (if you have them) through both sides of the bag. What happens now?
3. Make sure not to take the pencils out of the bag until you are over a sink, as that is when the water will begin leaking from the bag!



WHY IS THIS SCIENCE?

The plastic bag is made out of polymers. The word polymer means 'many' (poly) 'parts' (mer), because polymers are made from chains of many identical, microscope parts. These tiny chains can be arranged in all sorts of shapes, which means the polymers can be useful for lots of different things. For instance, they are in rubber used for balls, plastics used for toys, and plastic Ziploc bags.

When the pencil goes through the bag, the sharp tip of the pencil squeezes between the polymer chains without breaking them—and the molecules in the bag seal around the pencil, not allowing the water to leak.

WITH THANKS AND FOR MORE INFORMATION, VISIT:

This activity has been adapted from The STEM Laboratory's "Leak Proof Bag" (https://thestemlaboratory.com/leak-proof-bag/).

GLOW STICKS

BIG IDEA

Experiment with chemiluminescence, chemical reactions, and a variable by exposing glow sticks to different temperatures.

READY...

Gather materials:

- 2 cups (plastic, 9 oz.)
- 2 glow sticks
- water (warm and cold; from home)

SET...

1. Get enough cold water to fill the "Cold" cup in Step 2.
2. An adult helper should heat enough water to fill the "Warm" cup in Step 3. (For safety, do not use boiling water.)

GO!

1. Label one cup "Warm," and label the other cup "Cold."

2. Pour cold water in your cup labeled "Cold."

3. Ask an adult to add warm water to your cup labeled "Warm."

4. Consider turning off the lights. This will allow the glow sticks' light to be seen more clearly.

5. Activate the glow sticks by bending them until you hear a crack.

6. Place one glow stick in the "Warm" cup and one in the "Cold" cup, and then place the cups side by side for observation.

7. After 2-3 minutes, you should notice that the stick in the warm water is glowing much brighter than the one in the cold water. The stick in the cold water will barely appear to be glowing.

WHY IS THIS SCIENCE?

When a glow stick is bent or cracked, it will begin to glow. A chemical reaction occurs. During a chemical change, two chemicals react with each other to form a brand-new chemical. The glow stick has two substances—one inside the plastic case, the other inside a glass tube within the plastic case. When the stick is bent, the smaller glass tube breaks, allowing the two substances to mix and react—and causing the stick to glow. When light is produced from a chemical reaction, like this one, the light is called chemiluminescence.

A variable in an experiment is something that is different. Having just one variable helps the scientist identify the source of any changes in the experiment. In this glow stick experiment, the variable is the temperature of the water: one cup has cold water, and one cup has warm water. All the other elements in the experiment are the same.

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The stick in the warm water glows more brightly than the stick in the cold water. The reaction that causes the stick to glow is happening much faster in the hot water, which makes the glow appear brighter. The cold water is slowing down the reaction. This is the reason people sometimes put glow sticks in the freezer. Freezing the glow stick slows down the reaction until you warm it up again, and it extends how long the stick will glow.

WITH THANKS AND FOR MORE INFORMATION, VISIT:

This activity has been adapted from "Light Sticks—Liquid Light," *Steve Spangler Science* (https://www.stevespanglerscience.com/lab/experiments/light-sticks-the-science-of-liquid-light/).

DIAPER DISSECTION

BIG IDEA

Learn how diaper polymers work. See if they make a gel, snow, or something else when combined with water, and measure how much water they can hold.

READY...

Gather materials:

- bowl (optional)
- disposable diapers (2 different brands)
- notepaper (from home)
- pencil (from home)
- 2 plastic cups (9 oz.)
- plastic spoon
- scissors (from home)
- water (from home)

SET...

No setup needed!

GO!

1. Label one cup "A," and label the other cup "B."
2. Carefully cut or rip through the first diaper, Diaper A. It is best to use the seams at the side of the diaper. Notice how much padding and what type of padding is in the diaper.
3. Use a plastic spoon to scrape down the cotton and outer coating and then to carefully pull out the crystals to put in the cup. The crystals will be tiny—the size of sand. As you get to the powder, try to put as much of it into Cup A as possible. You don't want any of the stuffing, just the powder!

Cutting open a diaper

4. Once you have cut through the whole diaper and gotten as much of the powder as you can, use your plastic spoon to slowly add water to Cup A. Count the number of spoonfuls of water you add. Write this number on your notepaper.
5. Repeat this process to gather information about your second diaper, Diaper B. Write down the number of spoonfuls of water you add to Cup B.
6. What did you notice happening when you added water to the powder in each of your cups? Did the powders react differently? Which cup held the most water?

Extracting polymer crystals

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WHY IS THIS SCIENCE?

The powders in disposable diapers are generally a chemical called sodium polyacrylate, which is often called "diaper polymer." It works by soaking up urine and turning it into a gel.

Sodium polyacrylate is a hydrophilic substance, meaning that it loves water. It can absorb a lot of water—and it absorbs it in a different way than a towel would. When towels soak up water, the water molecules stay the same and just get stuck in the fabric of the towel. When sodium polyacrylate absorbs water, it's actually a chemical reaction. The water molecules join the sodium polyacrylate molecules and make a new (and bigger) chemical.

There are different types of sodium polyacrylate. Some of them puff up into small chunks when they react with water. These polymers are sometimes used to make artificial snow. And some of them stick together and make a solid gel, like the diaper gel.

WITH THANKS AND FOR MORE INFORMATION, VISIT:

This activity has been adapted from "Diaper Discussion," *Experiencing Chemistry*, Oregon Museum of Science and Industry (http://www.omsi.edu/sites/all/FTP/files/chemistry/Side_Displays/U5DiaperDissection_OpGuide.pdf).

ELEMENTS MATCH

BIG IDEA

Some elements, like gold (Au) and oxygen (O), are familiar to us. But some elements, like scandium (Sc) and gallium (Ga), are unusual. Learn more about elements by playing a game of match with your family!

READY...

Gather materials:

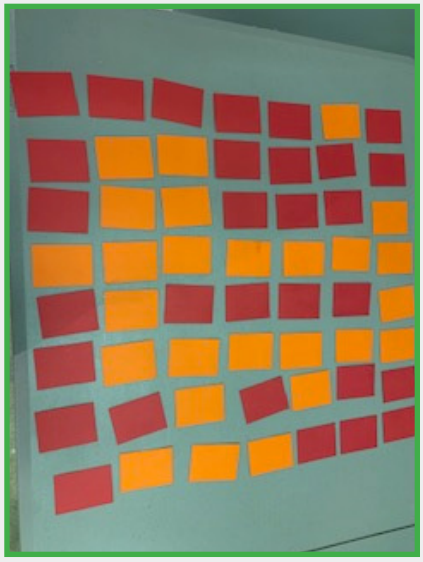
- elements playing cards
- rubber band (for storing the set of cards)
- scissors (from home)

SET...

Cut apart your set of elements playing cards. *(Note: This set of cards does not include all the elements. There are more than 100 known elements on the periodic table!)*

GO!

1. Flip all the cards over, so the picture side of each card is face down on the table. Place the cards in neat rows to make a rectangular grid.
2. The first player turns up any two cards, laying them face up. Everyone should try to say the name of the element as each card is turned up. *(Note: If the name is hard to say, that is fine! Everyone can call out the symbols [the big letters such as H for hydrogen or Au for gold], instead.)*
3. If the two cards turned up match, the player places the match in front of them and reads out one of the facts at the bottom of the card to everyone. This player then takes another turn. This player's turn continues until they fail to make a match.
4. If the cards do not match, the player turns the cards back over, and it is the next player's turn.
5. Play goes to the left.
6. When all the cards have been matched, the player with the most matches wins.



WHY IS THIS SCIENCE?

Elements are the basic materials from which everything—all the "matter"—in the universe is made. Each element is matter made of only one kind of atom. An atom is defined as the smallest particle of an element.

So that we can all learn and understand more about atoms and elements, scientists around the world have worked to discover the elements on the periodic table. Elements with similar chemical and physical properties are grouped together on the periodic table. The periodic table is one of the most useful tools in chemistry.

Do you know some of the elements on the periodic table? What about aluminum (Al), carbon (C), copper (Cu), gold (Au), helium (He), hydrogen (H), iron (Fe), oxygen (O), and silver (Ag)? The one or two-letter abbreviation for

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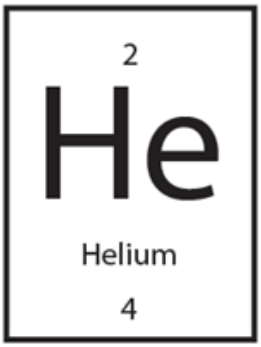
the element name—called the element's "symbol"—typically comes from the name of the element in English or Latin.

The periodic table can change as new elements are discovered. As of June 2020, the table contains 118 elements. Most elements are found in nature, while a small number have been developed by scientists. The element most recently discovered is oganesson (118; Og), which was first created in a laboratory in 2002.



ELEMENTS GO FISH

BIG IDEA

Play this matching game with your family to learn about elements, the basic materials from which everything in the universe is made.

READY...

Gather materials:

- elements playing cards
- rubber band
- scissors (from home)

SET...

1. Cut apart the set of elements playing cards. *(Note: This set of cards does not include all the elements. There are more than a 100 known elements on the periodic table!)*
2. Shuffle the cards.

GO!

1. Pick someone to be the dealer. The dealer will pass out five cards, face down, to each player.
2. The remaining cards are placed face down in the middle of the players to be the draw pile.
3. The player to the dealer's left will go first. This player (Player 1) will pick an element card from their hand. They will choose any other player (Player 2) to ask if they have that given card. For example: "Do you have carbon?" or "Do you have C?" *(Note: The names of the elements can be hard to say. If anyone has trouble, that is fine! They can call out the symbols [the big letters such as H for hydrogen or Au for gold], instead.)*
4. If Player 2 has the card asked for, they must give that card to Player 1. Before setting down their match face up in front of them, Player 1 will read one of the facts at the bottom of the card to everyone.
5. Player 1 then continues to ask for cards until they no longer are able to receive a card from a player. They may ask any of the players for a card.
6. If a player does not have the card they are asked for, they will say "Go Fish!"—causing Player 1 to pick up a card from the top of the draw pile. If the card picked matches any card in Player 1's hand, Player 1 will lay that match down in front of them. If the card does not match, Player 1 adds the card to their hand.
7. Play then continues with the player on the left.
8. The game ends when one player has matched all the cards in their hand, or the draw pile is empty, whichever comes first. The person with the most matches wins the game.
9. After the game is over, you can shuffle the cards and play again if you would like to.
10. Use a rubber band to keep the cards together before storing them.

WHY IS THIS SCIENCE?

Elements are the basic materials from which everything—all the "matter"—in the universe is made. Each element is matter made of only one kind of atom. An atom is defined as the smallest particle of an element.

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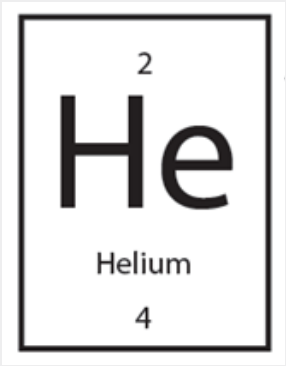
So that we can all learn and understand more about atoms and elements, scientists around the world have worked to discover the elements on the periodic table. Elements with similar chemical and physical properties are grouped together on the periodic table. The periodic table is one of the most useful tools in chemistry.



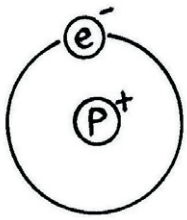
Do you know some of the elements on the periodic table? What about aluminum (Al), carbon (C), copper (Cu), gold (Au), helium (He), hydrogen (H), iron (Fe), oxygen (O), and silver (Ag)? The one or two-letter abbreviation for the element name—called the element's "symbol"—typically comes from the name of the element in English or Latin.

The periodic table can change as new elements are discovered. As of June 2020, the table contains 118 elements. Most elements are found in nature, while a small number have been developed by scientists. The element most recently discovered is oganesson (118; Og), which was first created in a laboratory in 2002.

H 1

Hydrogen **1.0**

Greek: "hydro–gen" (water-maker)

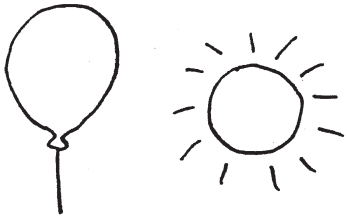


- Has no neutrons.
- Most abundant element in the Universe.
- Used in rocket fuel and fuel cells.

He 2

Helium **4.0**

Greek: "helios" (sun)

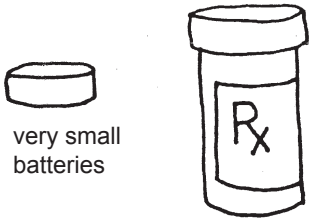


- Used in balloons, blimps and scubing diving tanks.
- Discovered in the sun in 1895 using a spectrometer.

Li 3

Lithium **6.9**

Greek: "lithos" (stone)

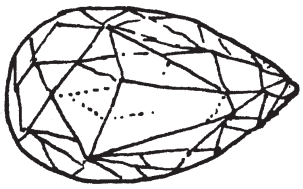


- Used in batteries, lubricants, medicines, and nuclear bombs.
- Is never found by itself in nature (it's always in a compound).

Be 4

Beryllium **9.0**

from the mineral "beryl"



- Found in emeralds.
- Is mixed with copper to make "beryllium bronze," an alloy that will not create sparks.

B 5

Boron **10.8**

from the compound "borax"

- Used to make heat-resistant glass.
- Used to make boric acid, which is used as an antiseptic eye wash.
- Used in nuclear power plants.

C 6

Carbon **12.0**

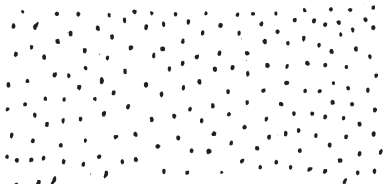
Latin: "carbo" (charcoal)

- Diamonds, graphite and coal are all made of carbon.
- Carbon makes long chains (polymers) that are the basis of fossil fuels and plastics.
- Carbon is necessary for organic molecules found in living organisms.

N 7

Nitrogen **14.0**

Greek: "nitron" (the mineral saltpetre)



- Most of the air we breathe is nitrogen.
- Used in air bags in cars.
- Doctors use liquid nitrogen to treat skin conditions.
- Proteins and DNA contain nitrogen.

O 8

Oxygen **15.9**

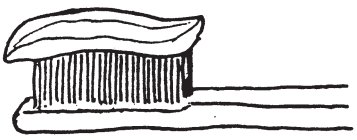
Greek: "oxy-gen" (acid-maker)

- Found in air, water and sand.
- Necessary for respiration and combustion.
- Ozone is made of pure oxygen.

F 9

Fluorine **18.9**

Latin: "fluere" (to flow)

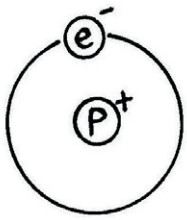


- Found in the mineral fluorite.
- Is put into toothpaste to fight cavities.
- Used as a coolant.
- Used in nuclear power plants.

H 1

Hydrogen **1.0**

Greek: "hydro–gen" (water-maker)



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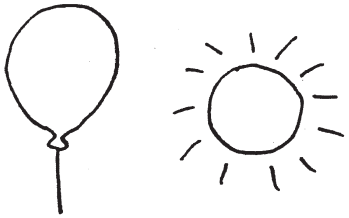

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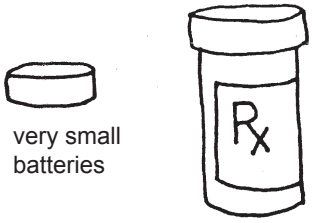

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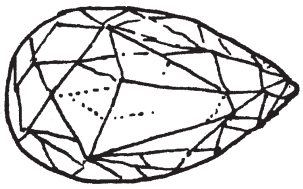

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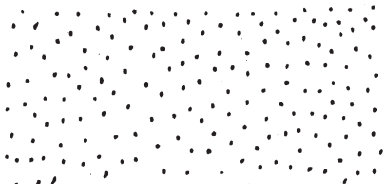
- Diamonds, graphite and coal are all made of carbon.
- Carbon makes long chains (polymers) that are the basis of fossil fuels and plastics.
- Carbon is necessary for organic molecules found in living organisms.

N 7

Nitrogen **14.0**

Greek: "nitron" (the mineral saltpetre)



- Most of the air we breathe is nitrogen.
- Used in air bags in cars.
- Doctors use liquid nitrogen to treat skin conditions.
- Proteins and DNA contain nitrogen.

O 8

Oxygen **15.9**

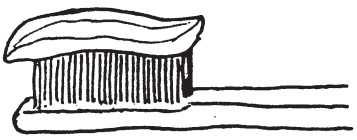
Greek: "oxy-gen" (acid-maker)

- Found in air, water and sand.
- Necessary for respiration and combustion.
- Ozone is made of pure oxygen.

F 9

Fluorine **18.9**

Latin: "fluere" (to flow)

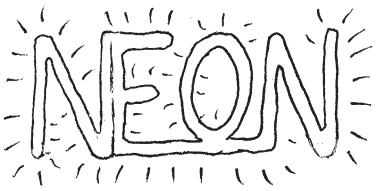


- Found in the mineral fluorite.
- Is put into toothpaste to fight cavities.
- Used as a coolant.
- Used in nuclear power plants.

Ne 10

Néon **20.1**

Greek: “neo” (new)

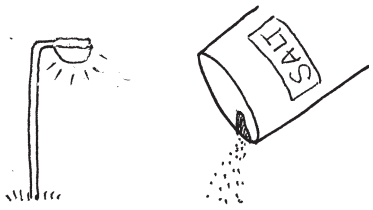


- Used in neon lights and lasers.
- Neon never bonds to any other elements.

Na 11

Sodium **22.9**

from soda ash

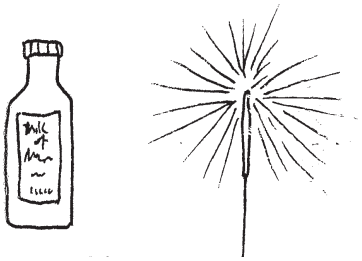


- Bonds with chlorine to make table salt.
- Used in street lights and in household cleaning products.
- Sodium is never found by itself in nature; it is always in a compound.

Mg 12

Magnesium **24.3**

from Magnesia, in Greece

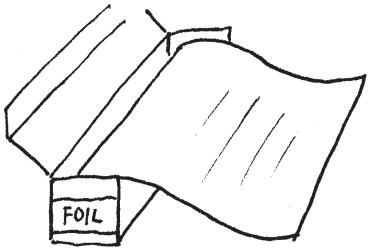


- Used in sparklers.
- Found in Epsom salts and “milk of Magnesia”
- Plants and animals need magnesium.

Al 13

Aluminum **26.9**

from the compound “alumina”

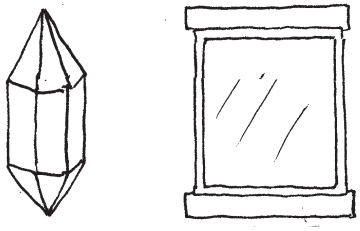


- Used in airplanes because it is so light and strong.
- Used for foil, tubes and cables.
- Used in fireworks.

Si 14

Silicon **28.0**

Latin: “silex” (hard stone, boulder)

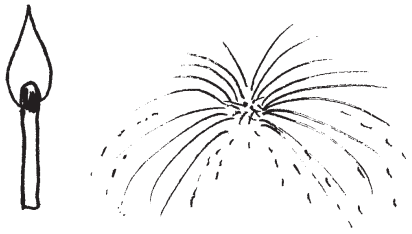


- Found in sand, clay, lava, glass and the mineral quartz.
- Used to make computer chips.

P 15

Phosphorus **30.9**

Greek: “phosphoros” (bringer of light)



- Used in matches, fireworks, fertilizers and detergents.
- Discovered by an alchemist in 1669 as he was boiling down urine!

S 16

Sulfur **32.0**

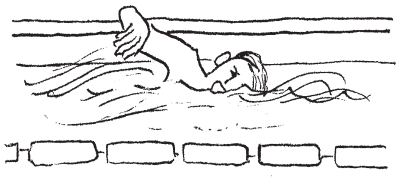
Latin: “sulfur” (stone that burns)

- Found in matches and fireworks.
- Used to vulcanize rubber.
- Volcanoes produce sulfur dioxide gas (a gas that’s also produced by some factories and forms a large part of air pollution).

Cl 17

Chlorine **35.4**

Greek: “kloros” (light green)

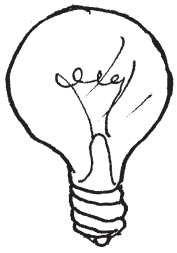


- Bonds with sodium to make table salt.
- Used to disinfect swimming pools.
- Is an ingredient in PVC plastics.
- Combines with hyrdogen to make HCl, an acid that your stomach produces to help with digestion.

Ar 18

Argon **39.9**

Greek: “argos” (lazy)



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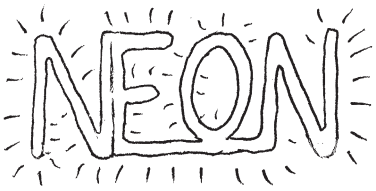
Greek: “neo” (new)



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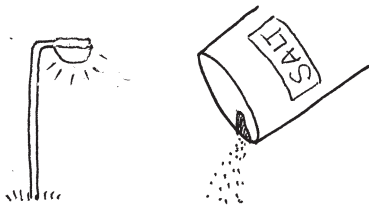

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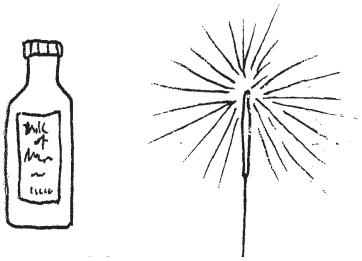

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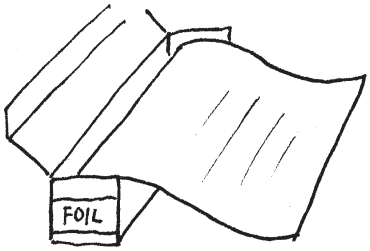

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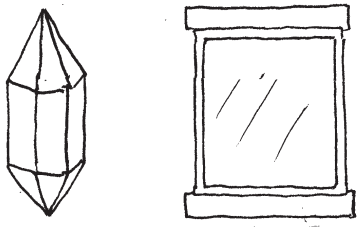

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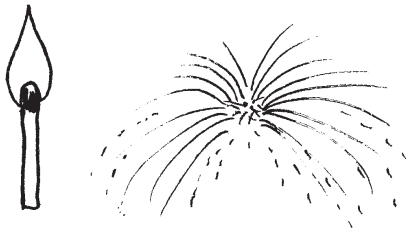

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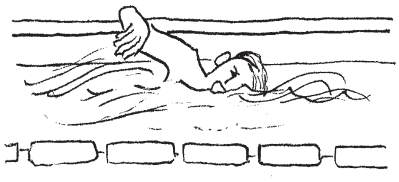

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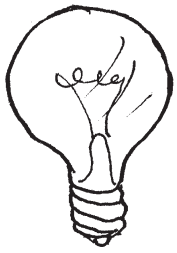

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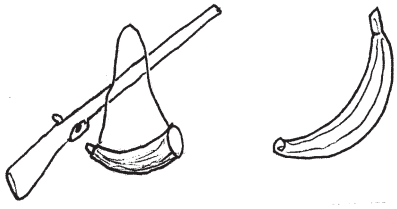
Potassium **39.0**

from the word "potash"

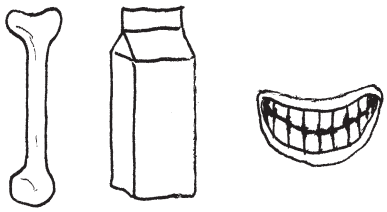


- Used in fertilizers.
- Is an ingredient in gun powder.
- Bananas contain a lot of potassium.
- Can form salts, just like sodium can.

Ca 20

Calcium **40.0**

Latin: "calx" (chalk)

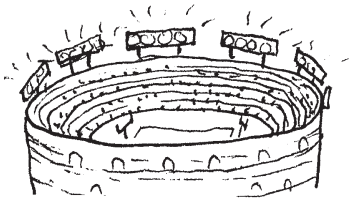


- Found in chalk, limestone, plaster, concrete, bones, and teeth.
- Milk contains a lot of calcium.
- Calcium in water makes it "hard."

Sc 21

Scandium **44.9**

named after Scandinavia

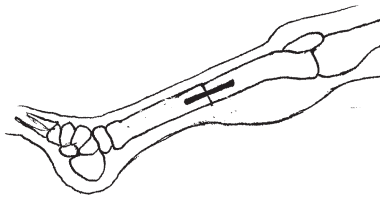


- Used in stadium lighting.
- Used in large television screens.
- Radioactive scandium is used as a "tracer" in petroleum refineries.

Ti 22

Titanium **47.9**

named after the Greek Titan gods

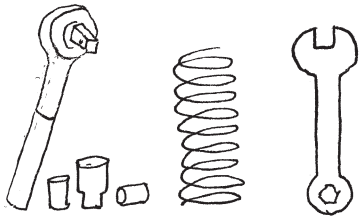


- Used to repair bones.
- Because it is lightweight it is used in airplane motors.
- Is an ingredient in paint pigments.

V 23

Vanadium **50.9**

after the Scandinavian goddess Vanadis

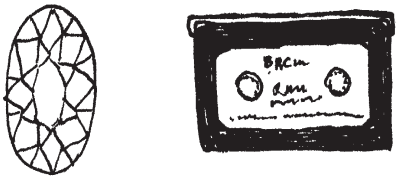


- Used in making steel.
- Is an ingredient in metals that are used to make tools, springs and engines.

Cr 24

Chromium **51.9**

Greek: "chroma" (color)

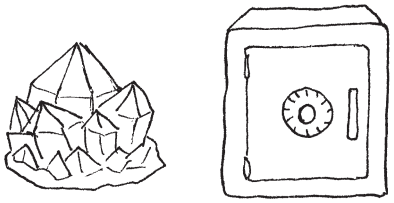


- Gives rubies their red color.
- Used to make red, green and yellow paint.
- Used as a shiny coating for metals.
- Used to make video tapes.

Mn 25

Manganese **54.9**

Latin: "magnes" (magnetic)

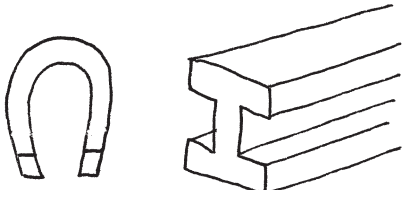


- Added to steel that needs to be very strong (for example: rifle barrels and bank vaults).
- Is necessary for the functioning of vitamin B1 in our bodies.

Fe 26

Iron **55.8**

from Old English "iren"

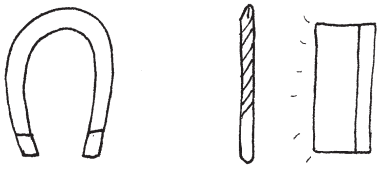


- Discovered in ancient times.
- Used in steel and in magnets.
- Found in red blood cells and in rust.
- Meteorites often contain iron.
- Red rocks usually contain iron.

Co 27

Cobalt **58.9**

German "kobald" (evil gnomes)



- Miners used to say "kobald" lurked in the mines (and the name stuck).
- Used in "alnico" magnets.
- Used in making drill bits and razors.
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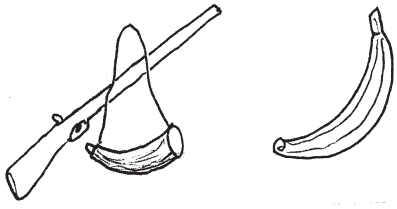

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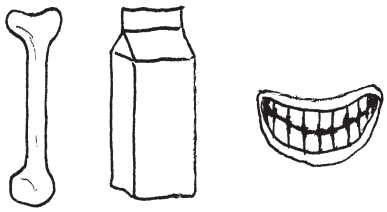

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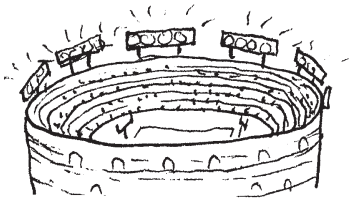

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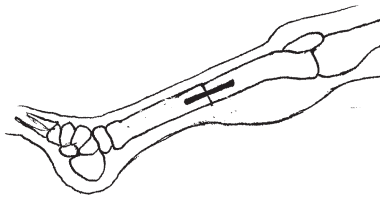

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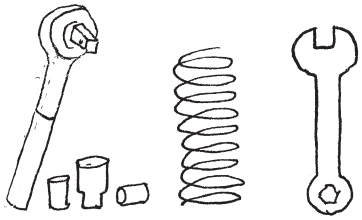

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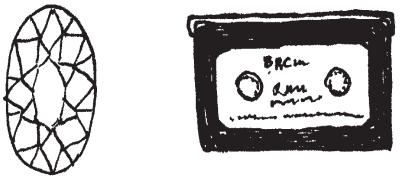

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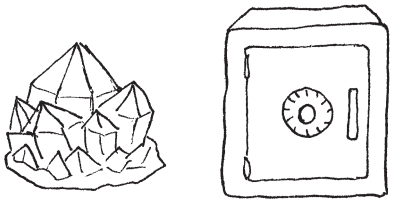

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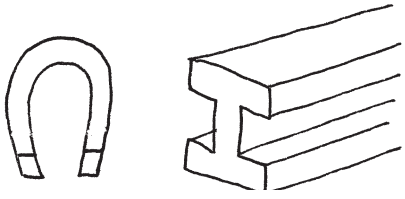

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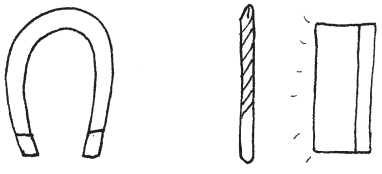

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- Used in "alnico" magnets.
- Used in making drill bits and razors.
- Can be used to color glass deep blue.

Ni 28

Nickel **58.7**

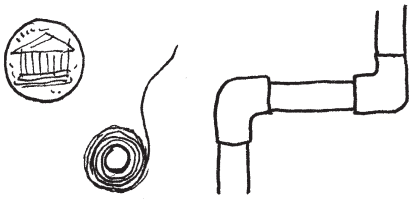
German: "Nickel" (Satan)

- Name comes from "Kupfernickel," meaning "Satan's copper."
- Used in the coloring of glass.
- Used to make coins and utensils.

Cu 29

Copper **63.5**

Latin: "Cuprum" (from Cyprus)

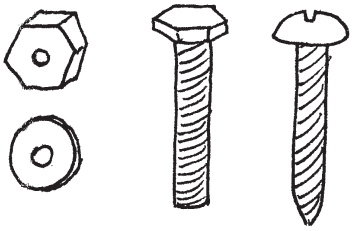


- Used for coins, wires and pipes.
- The Statue of Liberty is made of copper.
- Copper mixed with zinc makes brass.
- Copper mixed with tin makes bronze.

Zn 30

Zinc **65.4**

Greek: "zink"

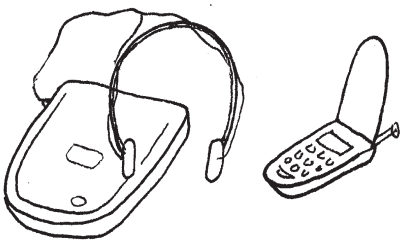


- Used for galvanizing (protecting) metals such as iron and steel.
- Zinc sulfide glows in the dark.
- Zinc oxide is used in photocopiers.

Ga 31

Gallium **69.7**

Latin: "Gallia" (France)



- Gallium arsenide is used in lasers and in compact disc players.
- Used in cell phones and in medical devices.

Ge 32

Germanium **72.6**

Latin: "Germania" (Germany)

semi-conductor

lens

- Is a semi-conductor and therefore is used in transitors.
- Used in lenses and fiberoptics.

As 33

Arsenic **74.9**

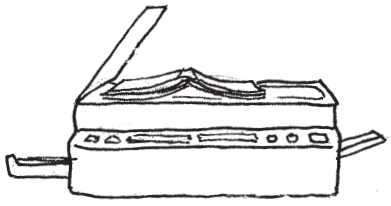
Latin: "arsenicum" (a pigment)

- Famous for its use as a poison.
- Is an ingredient in weed killers and insecticides.
- Used in lasers and LED's.

Se 34

Selenium **78.9**

Greek: "selene" (moon)

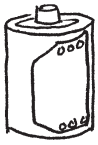


- Used in photocopiers because it conducts electricity in the presence of light.
- Used in robotics and in light meters.
- Selenium is beneficial to our bodies and acts as an anti-oxidant, protecting use from cellular damage.

Br 35

Bromine **79.9**

Greek: "bromos" (stench)

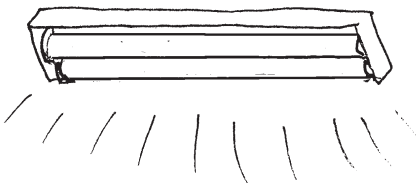


- Bromine is a reddish liquid with a very bad smell.
- Found in sea water and salt mines.
- Used in photographic film.

Kr 36

Krypton **83.8**

Greek: "kryptos" (hidden)



- Used in fluorescent flight, especially photographic bulbs.
- Used in UV lasers and in atomic clocks.

Ni 28

Nickel **58.7**

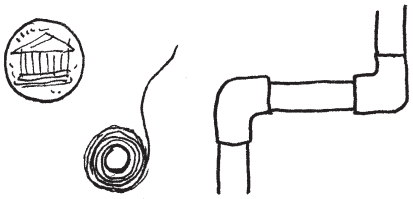
German: "Nickel" (Satan)

- Name comes from "Kupfernickel," meaning "Satan's copper."
- Used in the coloring of glass.
- Used to make coins and utensils.

Cu 29

Copper **63.5**

Latin: "Cuprum" (from Cyprus)

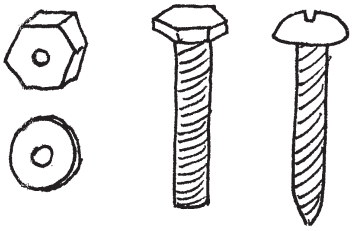


- Used for coins, wires and pipes.
- The Statue of Liberty is made of copper.
- Copper mixed with zinc makes brass.
- Copper mixed with tin makes bronze.

Zn 30

Zinc **65.4**

Greek: "zink"

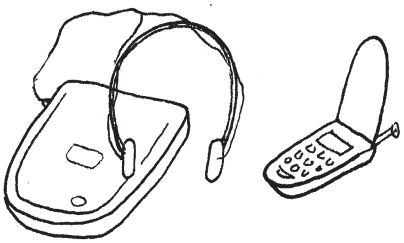


- Used for galvanizing (protecting) metals such as iron and steel.
- Zinc sulfide glows in the dark.
- Zinc oxide is used in photocopiers.

Ga 31

Gallium **69.7**

Latin: "Gallia" (France)



- Gallium arsenide is used in lasers and in compact disc players.
- Used in cell phones and in medical devices.

Ge 32

Germanium **72.6**

Latin: "Germania" (Germany)

semi-conductor

lens

- Is a semi-conductor and therefore is used in transitors.
- Used in lenses and fiberoptics.

As 33

Arsenic **74.9**

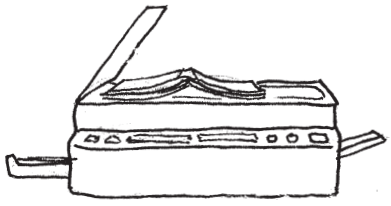
Latin: "arsenicum" (a pigment)

- Famous for its use as a poison.
- Is an ingredient in weed killers and insecticides.
- Used in lasers and LED's.

Se 34

Selenium **78.9**

Greek: "selene" (moon)

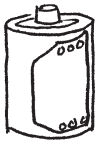


- Used in photocopiers because it conducts electricity in the presence of light.
- Used in robotics and in light meters.
- Selenium is beneficial to our bodies and acts as an anti-oxidant, protecting use from cellular damage.

Br 35

Bromine **79.9**

Greek: "bromos" (stench)



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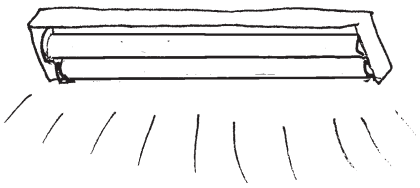

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