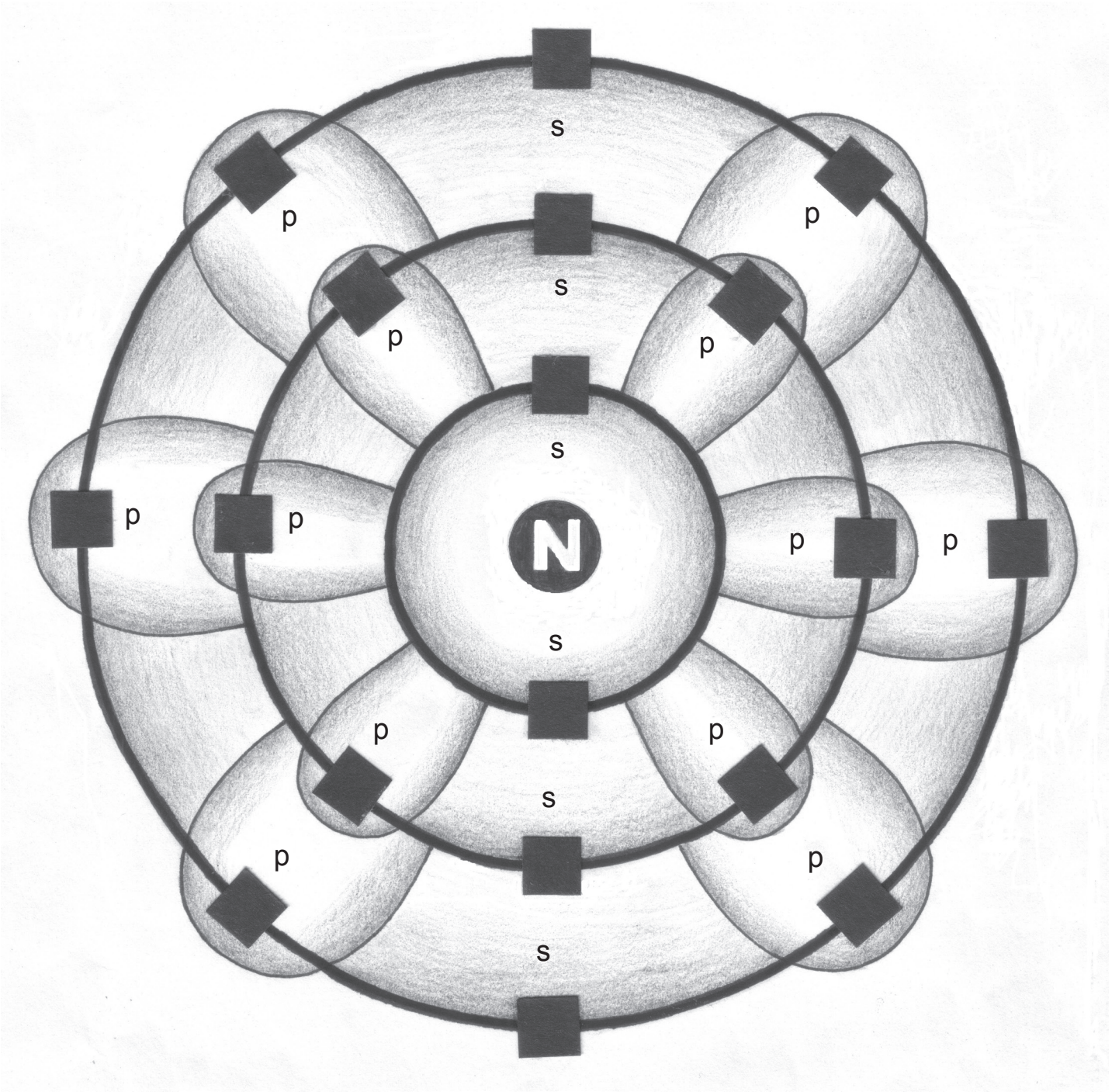
THE QUICK-AND-EASY "ATOM-IZER"

The rules for placing your electron tokens:

1) Always fill smaller rings before larger rings.
2) Always fill "s" orbitals first, before "p" orbitals.

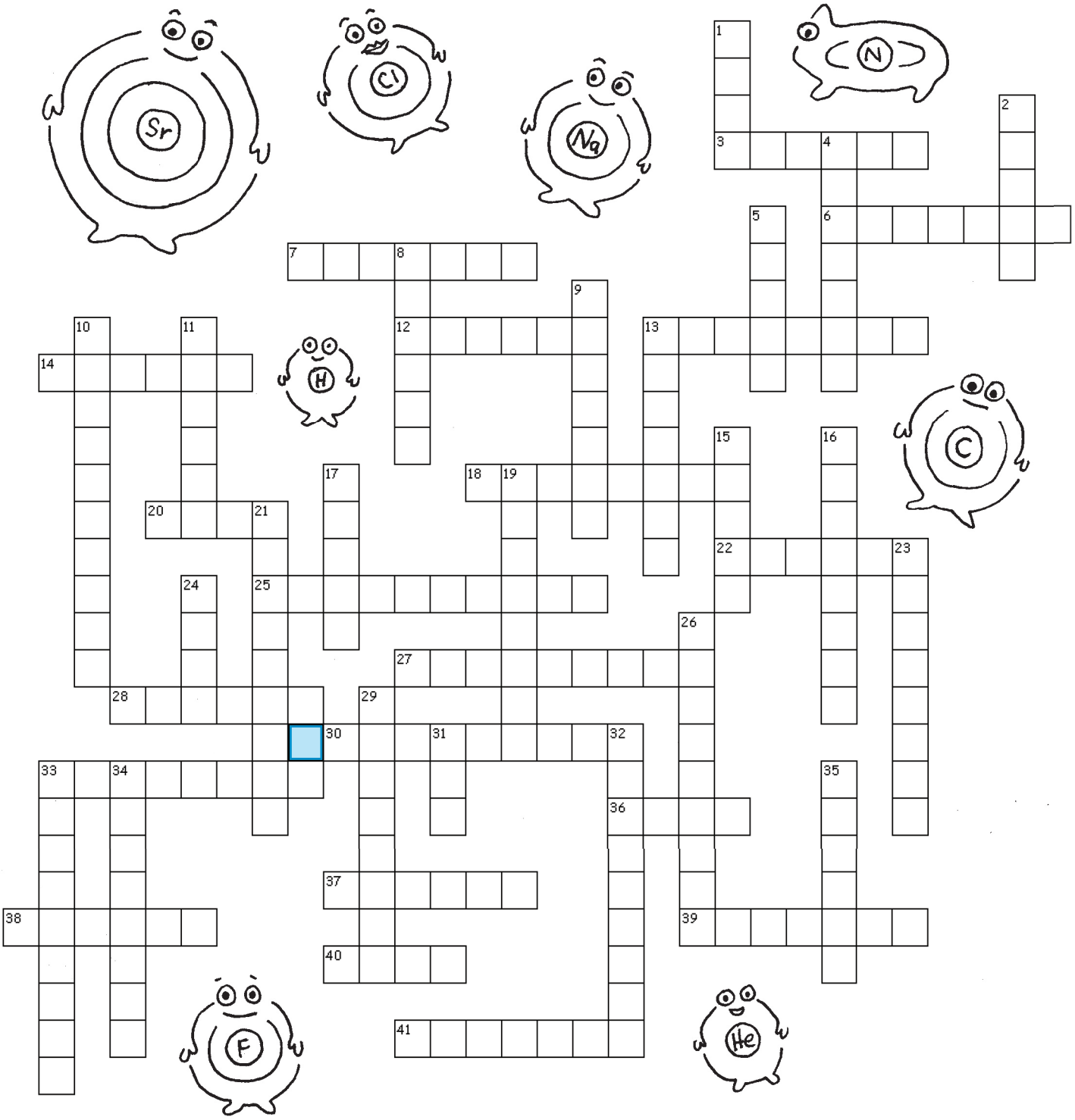


Activity 3.7 Time to review!

Use the symbol clues to write in the names of the elements.

ACROSS: 3) Co 6) Si 7) U 12) Cu 14) Na 13) Cl 20) Fe 22) O 25) P 27) Mn
28) I 30) Pu 33) Pt 36) Au 37) Ag 38) Os 39) Hg 40) Ne 41) Li

DOWN: 1) Zn 2) Rn 4) As 5) Ar 8) Ni 9) Kr 10) Mo 11) S 13) Ca 15) Xe
16) W 17) B 19) H 21) Np 23) N 24) Pb 26) Be 29) F 31) Sn
32) Mg 33) K 34) Al 35) He



5) "MAKE FIVE" A game about mineral recipes

This game is recommended for older students, or those who are very enthusiastic about rocks and minerals. If "Symbol Jars" was enough, you can skip this game. You could also wait and play this game after the next chapter.

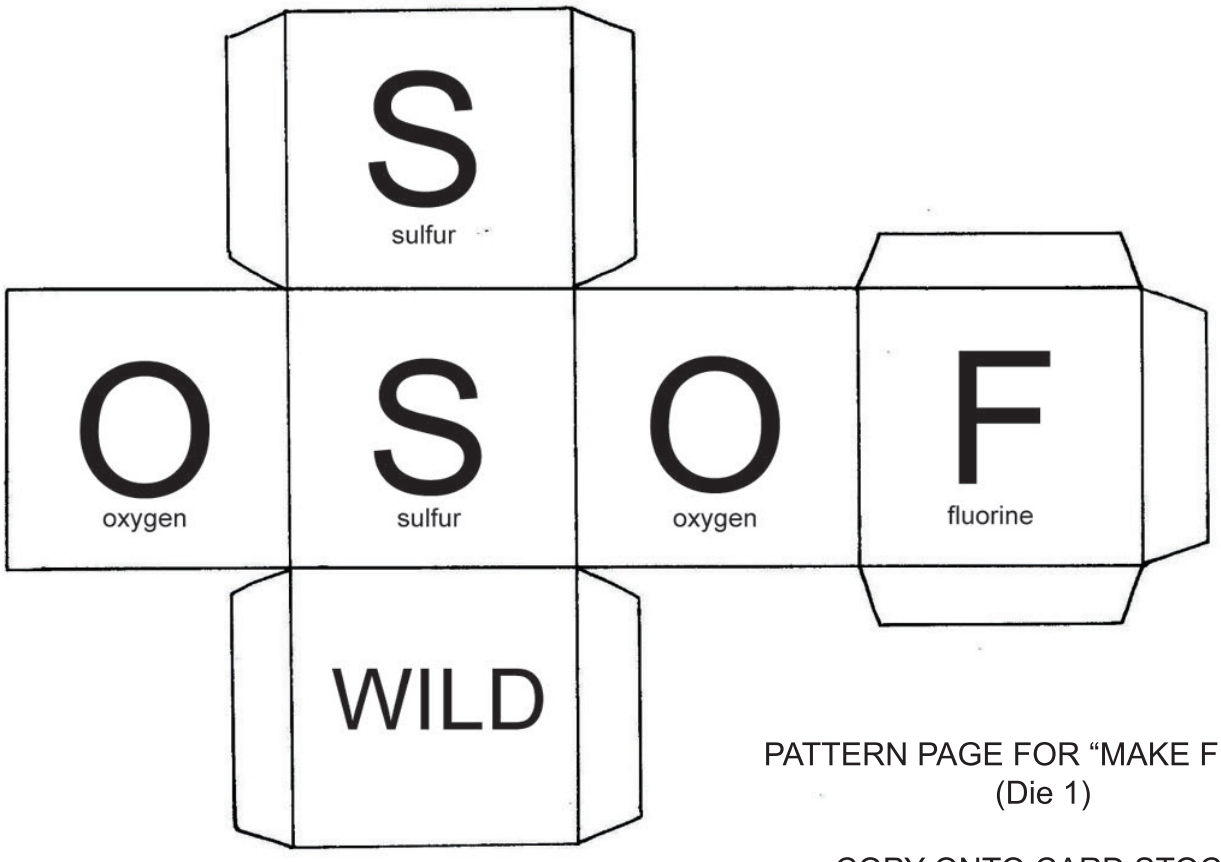
By definition, a mineral has a definite chemical composition (a recipe). In this game you will be introduced to the recipes for some common minerals. It's also an opportunity to keep on learning all those letter abreviations (symbols).

You will need: copies of the pattern pages copied onto card stock, scissors, and white glue (if you are assembling the paper dice) If you are using wooden cubes for the dice, you'll also need one or more markers.
(In a pinch for time, just take a fine point marker (red?) and write on real dice. Everyone can ignore the dots.)

NOTE: If you can get three wooden cubes, this is the best option. Most craft stores sell wooden cubes by the "each" or in small units and fairly inexpensively. If you want this game sturdy enough to survive future uses, consider using wooden cubes.

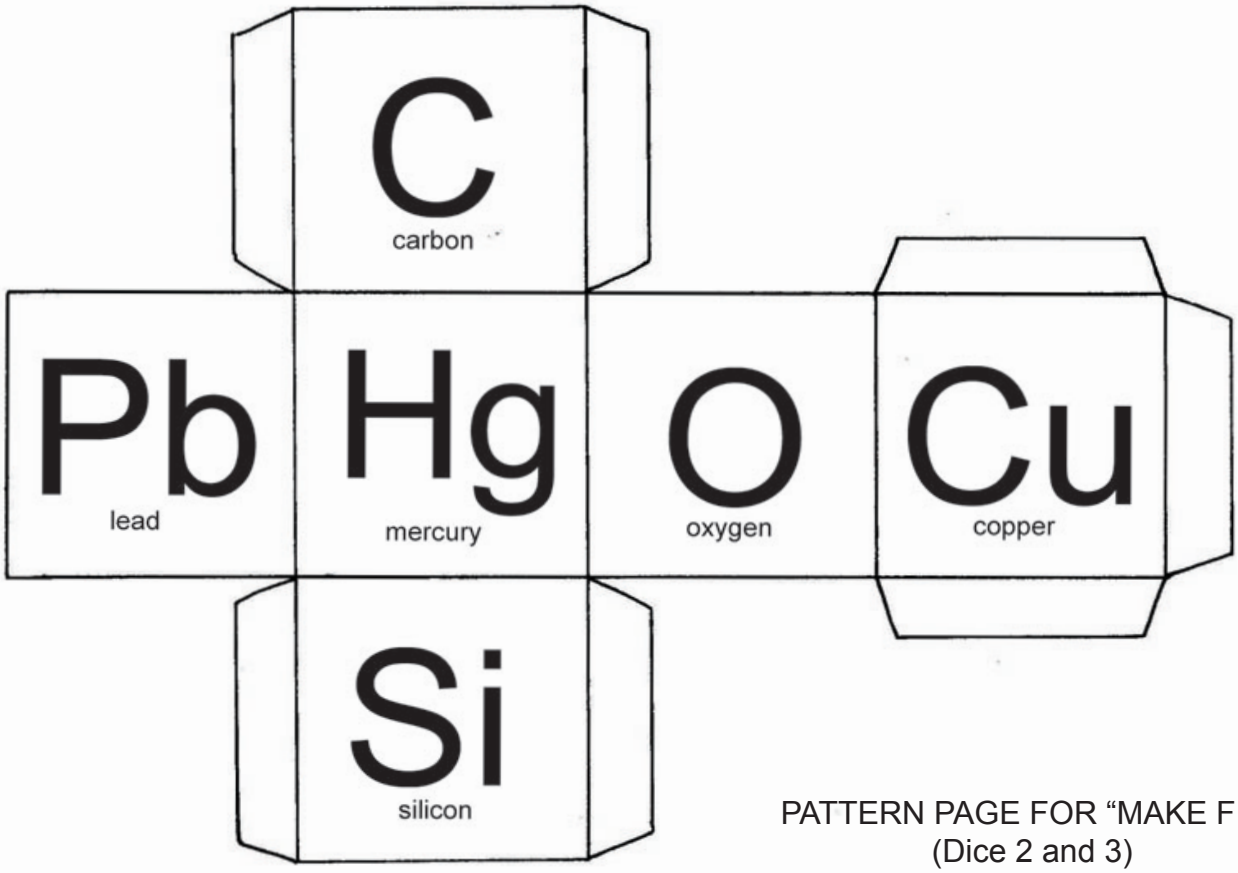
Preparation:
1) Cut out the dice patterns (copied onto heavy card stock) and make into cubes, using small dabs of white glue on the tabs. (Or, write the symbols on wooden dice or even regular dice.)
2) Cut apart the 16 mineral cards.

How to play:
Place the mineral cards on the table, face up, so they form a 4 x 4 square. Each player will have a turn rolling all three dice at once. The goal is to roll the ingredients to form a mineral. (One roll of the three dice per player per turn.) For example, if the first player rolls: Cu, Fe, and S, he should notice that those are the ingredients of chalcopyrite. Therefore, that player picks up the chalcopyrite card. If the next player rolls Ca, C, and WILD, he could make the wild card into O, and be eligible to pick up calcite.
The first player to collect five cards wins the game.



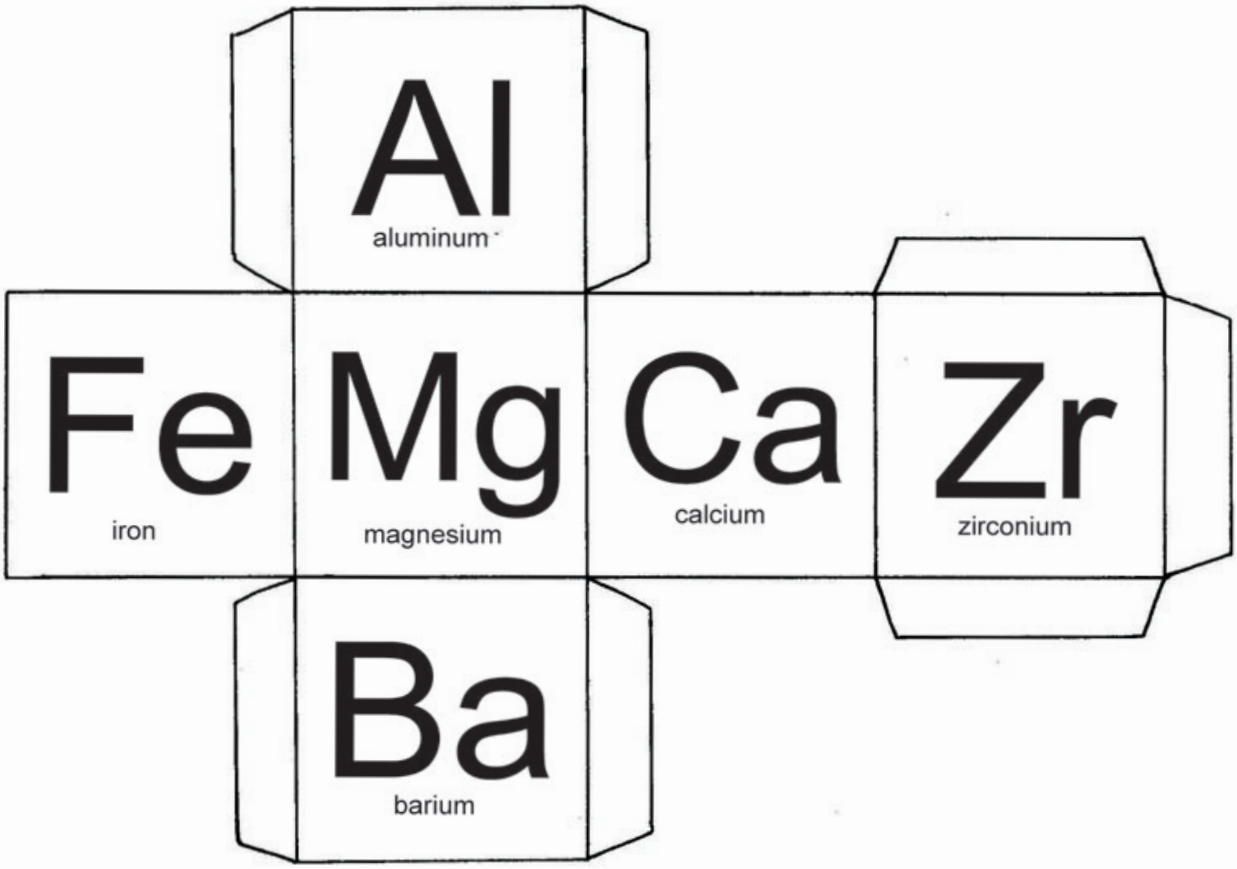
PATTERN PAGE FOR "MAKE FIVE"
(Die 1)

COPY ONTO CARD STOCK

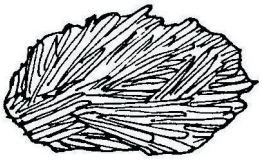


PATTERN PAGE FOR “MAKE FIVE”
(Dice 2 and 3)

COPY ONTO CARD STOCK



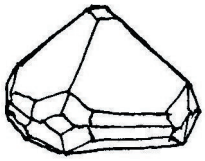
barite



$BaSO_4$

Often found in limestone or hot spring areas. Usually white or light brown. Sometimes crystalizes into rose shapes, which are popular with collectors.

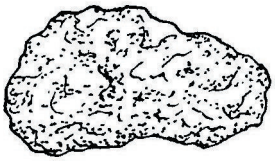
zircon



$ZrSiO_4$

Found in nearly all igneous rocks, although in very small amounts. Because it is so hard, it is often used as a gemstone in jewelry.

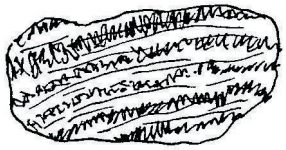
hematite



Fe_2O_3

Hematite is a major ore (source) of iron. The name "hematite" comes from its blood-red color ("hema" means blood).

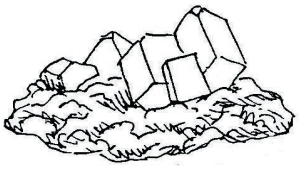
cinnabar



HgS

Cinnabar has a reddish color and is very dense (heavy) because of the mercury (Hg). Pure mercury is a liquid at room temperature, but it is a solid when bound to sulfur.

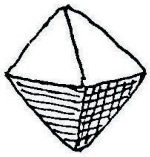
cuprite



Cu_2O

Cuprite forms cubic crystals. It is sometimes called "ruby copper" because of its color. When exposed to air it changes to CuO.

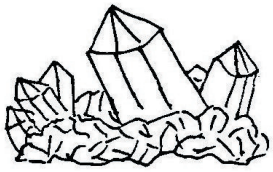
fluorite



CaF_2

Fluorite is used in the production of steel. It has a glassy luster and can look similar to a quartz crystal, except for its tetragonal (4-sided) shape.

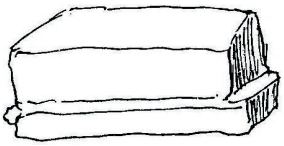
quartz



SiO_2

Quartz is used in electronics, as a gemstone, and in the manufacturing of glass (where it is the main component). Sand is made of very tiny pieces of quartz.

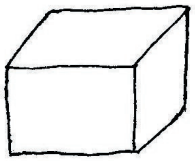
galena



PbS

Galena is very dense (heavy) because of the lead in it. During the era of musket rifles, galena was used as the source of lead to make musket balls.

pyrite



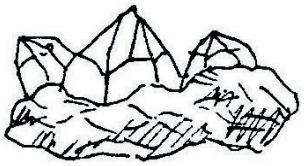
FeS_2

This mineral is often called "fool's gold" because of its golden color and shiny luster. It has no actual gold in it. It leaves a black streak, not gold.

FIRST PATTERN PAGE FOR "MAKE FIVE"

COPY ONTO CARD STOCK

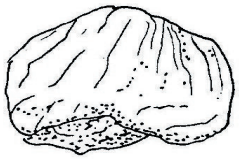
corundum



Al_2O_3

Corundum is very hard. It is so hard that it is used in industry as an abrasive (like sand paper). Blue corundum is called a sapphire and red is a ruby.

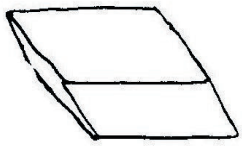
talc



$Mg_3Si_4O_{10}$

Talc is extremely soft. In fact, you can scratch it with your fingernail! Talc is the main ingredient in talcum powder (used to dry off after a shower).

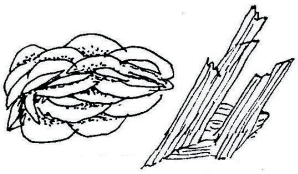
calcite



$CaCO_3$

Calcite is the main ingredient in limestone. It is one of the most common minerals in the world. Caves are made of limestone.

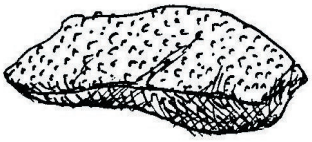
gypsum



$CaSO_4$

Gypsum is a soft mineral. It is one of the main ingredients in plaster and plasterboard. One type of gypsum is called alabaster and was carved by ancient peoples.

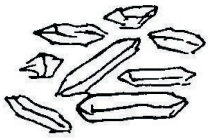
chalcopyrite



$CuFeS_2$

Chalcopyrite is pinkish-purple with flecks of gold. It is found wherever copper is mined. The copper can be taken out of it by using chemical processes.

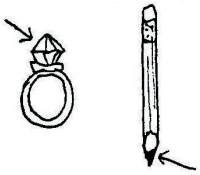
epsom salt



$MgSO_4$

This mineral dissolves into water very easily. It is often used in medical treatment of wounds on hands and feet. It helps in the healing process.

diamond/graphite



C

Strangely enough, both priceless diamonds and the stuff in your pencil are made of the same thing: pure carbon. The difference is how the atoms are bonded together.

SECOND PATTERN PAGE FOR “MAKE FIVE”

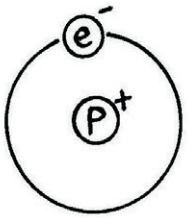
COPY ONTO CARD STOCK

PATTERN PAGE FOR “SYMBOL JARS” COPY ONTO CARD STOCK

H 1

Hydrogen **1.0**

Greek: "hydro–gen" (water-maker)

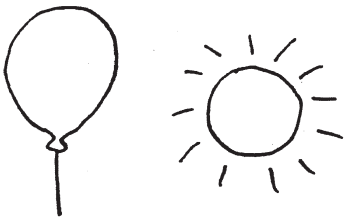


- Has no neutrons.
- Most abundant element in the Universe.
- Used in rocket fuel and fuel cells.

He 2

Helium **4.0**

Greek: "helios" (sun)

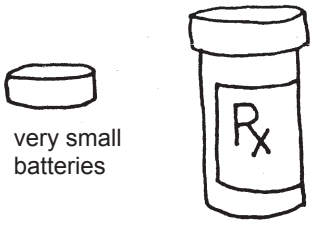


- Used in balloons, blimps and scubing diving tanks.
- Discovered in the sun in 1895 using a spectrometer.

Li 3

Lithium **6.9**

Greek: "lithos" (stone)

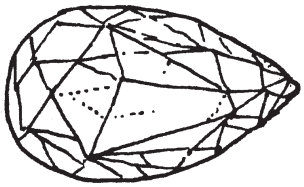


- Used in batteries, lubricants, medicines, and nuclear bombs.
- Is never found by itself in nature (it's always in a compound).

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**

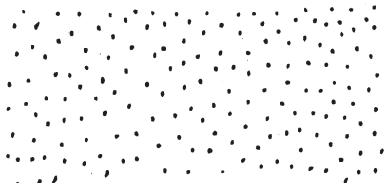
Latin: "carbo" (charcoal)

- 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**

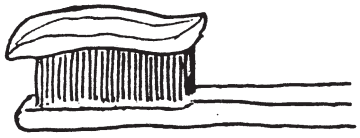
Greek: "oxy-gen" (acid-maker)

- 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)

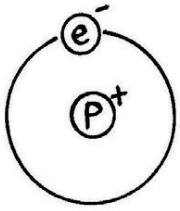


- Found in the mineral fluorite.
- Is put into toothpaste to fight cavities.
- Used as a coolant.
- Used in nuclear power plants.

H 1

Hydrogen **1.0**

Greek: "hydro–gen" (water-maker)

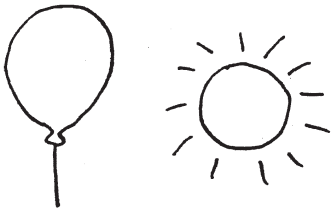


- Has no neutrons.
- Most abundant element in the Universe.
- Used in rocket fuel and fuel cells.

He 2

Helium **4.0**

Greek: "helios" (sun)

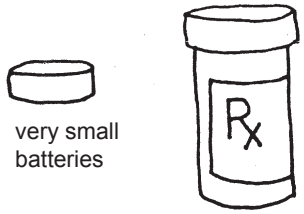


- Used in balloons, blimps and scubing diving tanks.
- Discovered in the sun in 1895 using a spectrometer.

Li 3

Lithium **6.9**

Greek: "lithos" (stone)

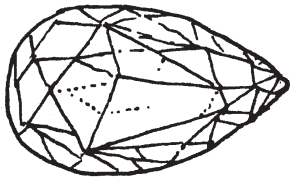


- Used in batteries, lubricants, medicines, and nuclear bombs.
- Is never found by itself in nature (it's always in a compound).

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**

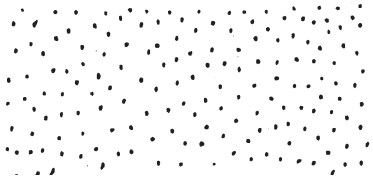
Latin: "carbo" (charcoal)

- 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**

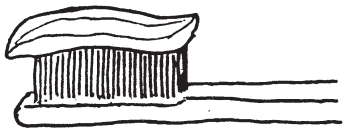
Greek: "oxy-gen" (acid-maker)

- 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)

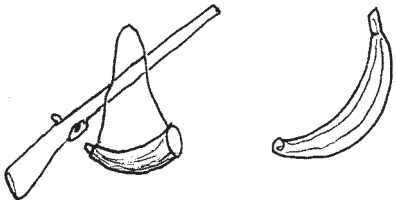


- Found in the mineral fluorite.
- Is put into toothpaste to fight cavities.
- Used as a coolant.
- Used in nuclear power plants.

K 19

Potassium **39.0**

from the word "potash"

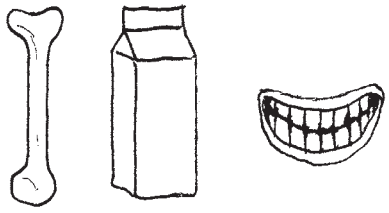


- Used in fertilizers.
- Is an ingredient in gun powder.
- Bananas contain a lot of potassium.
- Can form salts, just like sodium can.

Ca 20

Calcium **40.0**

Latin: "calx" (chalk)

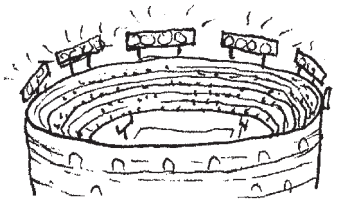


- Found in chalk, limestone, plaster, concrete, bones, and teeth.
- Milk contains a lot of calcium.
- Calcium in water makes it "hard."

Sc 21

Scandium **44.9**

named after Scandinavia

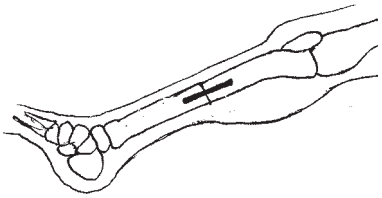


- Used in stadium lighting.
- Used in large television screens.
- Radioactive scandium is used as a "tracer" in petroleum refineries.

Ti 22

Titanium **47.9**

named after the Greek Titan gods

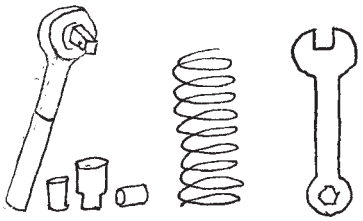


- Used to repair bones.
- Because it is lightweight it is used in airplane motors.
- Is an ingredient in paint pigments.

V 23

Vanadium **50.9**

after the Scandinavian goddess Vanadis

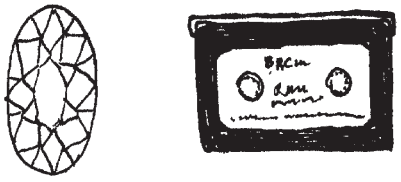


- Used in making steel.
- Is an ingredient in metals that are used to make tools, springs and engines.

Cr 24

Chromium **51.9**

Greek: "chroma" (color)

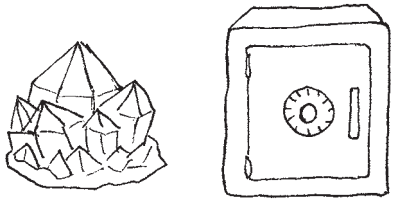


- Gives rubies their red color.
- Used to make red, green and yellow paint.
- Used as a shiny coating for metals.
- Used to make video tapes.

Mn 25

Manganese **54.9**

Latin: "magnes" (magnetic)

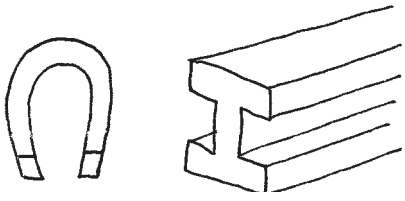


- Added to steel that needs to be very strong (for example: rifle barrels and bank vaults).
- Is necessary for the functioning of vitamin B1 in our bodies.

Fe 26

Iron **55.8**

from Old English "iren"

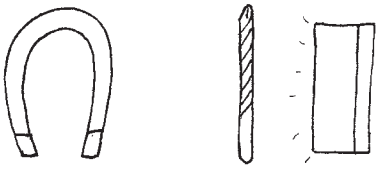


- Discovered in ancient times.
- Used in steel and in magnets.
- Found in red blood cells and in rust.
- Meteorites often contain iron.
- Red rocks usually contain iron.

Co 27

Cobalt **58.9**

German "kobald" (evil gnomes)

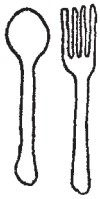


- Miners used to say "kobald" lurked in the mines (and the name stuck).
- Used in "alnico" magnets.
- Used in making drill bits and razors.
- Can be used to color glass deep blue.

Ni 28

Nickel **58.7**

German: "Nickel" (Satan)

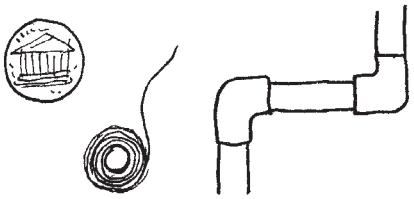


- Name comes from "Kupfernickel," meaning "Satan's copper."
- Used in the coloring of glass.
- Used to make coins and utensils.

Cu 29

Copper **63.5**

Latin: "Cuprum" (from Cyprus)

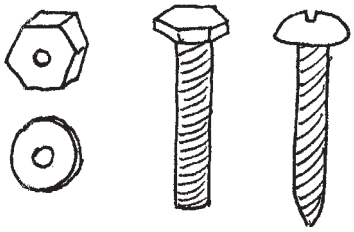


- Used for coins, wires and pipes.
- The Statue of Liberty is made of copper.
- Copper mixed with zinc makes brass.
- Copper mixed with tin makes bronze.

Zn 30

Zinc **65.4**

Greek: "zink"

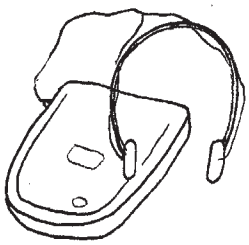


- Used for galvanizing (protecting) metals such as iron and steel.
- Zinc sulfide glows in the dark.
- Zinc oxide is used in photocopiers.

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**

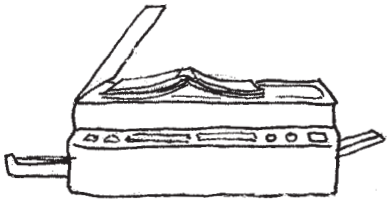
Latin: "arsenicum" (a pigment)

- 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)

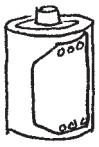


- Used in photocopiers because it conducts electricity in the presence of light.
- Used in robotics and in light meters.
- Selenium is beneficial to our bodies and acts as an anti-oxidant, protecting use from cellular damage.

Br 35

Bromine **79.9**

Greek: "bromos" (stench)

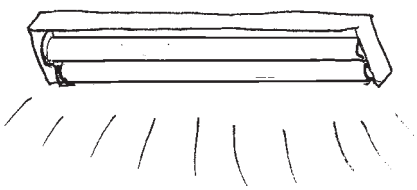


- Bromine is a reddish liquid with a very bad smell.
- Found in sea water and salt mines.
- Used in photographic film.

Kr 36

Krypton **83.8**

Greek: "kryptos" (hidden)

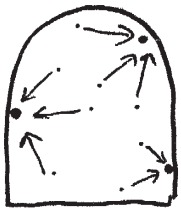


- Used in fluorescent flight, especially photographic bulbs.
- Used in UV lasers and in atomic clocks.

Rb 37

Rubidium **85.5**

Latin: "rubidus" (deep red)



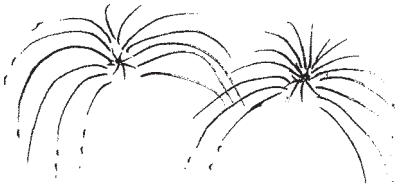
Rubidium captures atoms of gases that should not be in a vacuum jar or tube..

- Is a by-product of the refinement of lithium and cesium.
- Used as a gas "scavenger" (collector) in vacuum tubes.

Sr 38

Strontium **87.6**

after the Scottish village of Strontia

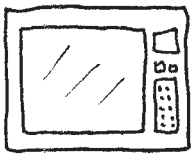


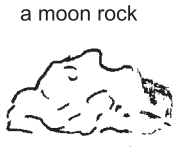
- Used in fireworks (bright red).
- Used in batteries in ocean buoys.
- Used to produce beta radiation.
- Used to research bone structure.

Y 39

Yttrium **88.9**

after the Swedish town of Ytterby



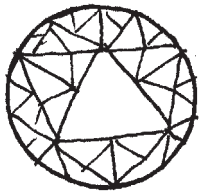


- Used in superconductors and lasers.
- Rocks from the moon contain yttrium.
- Used to make the bright red color in television screens.

Zr 40

Zirconium **91.2**

Arabic: "zargun" (gold color)

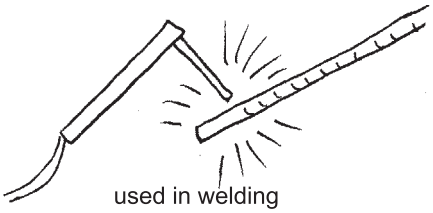


- Made into gemstones.
- Used in catalytic converters in cars.
- Used for heat-resistant parts in nuclear power plants and in space shuttles.

Nb 41

Niobium **92.9**

named after the Greek goddess Niobe



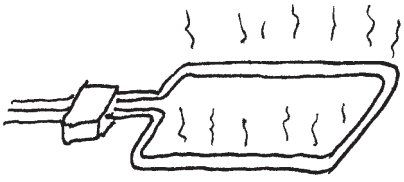
used in welding

- Used in welding rods, cutting tools, and superconducting magnets.
- Is added to steel to make it heat-resistant.

Mo 42

Molybdenum **95.9**

Greek: "molybdos" (lead)



- Used for filaments in heaters.
- is an ingredient in steel that is used to make engines for cars and planes.
- Large deposits of molybdenum are found in Colorado.

Tc 43

Technitium **99.0**

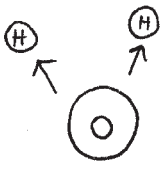
Greek: "teknetos" (artificial)

- Is radioactive.
- Not found in nature. Must be made in a nucluear laboratory.
- Is combined with other elements and used in medical procedures.

Ru 44

Ruthenium **101.1**

Latin: "Ruthenia" (Russia)

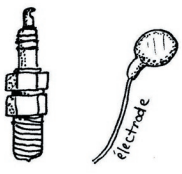


- Used to split water molecules.
- Used in the jewelry making industry.
- Often mixed with titanium and platinum to increase their hardness.

Rh 45

Rhodium **102.9**

Greek: "rhodon" (rose)



- Rhodium salts have a rose color.
- Used in catalytic converters in cars.
- Used in headlight reflectors.
- Used in jewelry to prevent tarnishing of sterling silver.
- Combined with **Pt** and **Pd** to make spark plugs, electrodes, and other electronic parts.

Pd 46

Palladium **106.4**

named after the asteroid Pallas

- Used in dentistry and in jewelry.
- Used in catalytic converters in cars.
- Used to purify hydrogen gas.
- Used for treatment of tumors.

Ag 47

Silver **107.8**

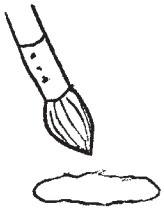
Anglo-Saxon: "soilful" (silver)
Symbol from Latin "argentum"

- Used to make coins, jewelry, mirrors, silverware, photographic film and electronic components.
- Sterling silver contains copper.

Cd 48

Cadmium **112.4**

Greek: "kadmeia" (earth)

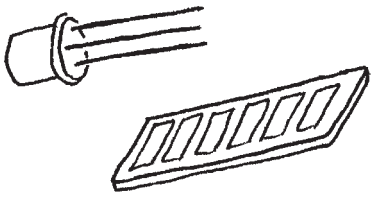


- Used in rechargeable batteries.
- Is a neutron-absorber in nuclear reactors.
- Used to make yellow and red pigments in paints.

In 49

Indium **114.8**

Latin: "indicum" (indigo blue)



- Used in transistors and solar cells.
- Often mixed with other metals to make alloys.
- Its light wave pattern in a spectrometer shows bright purple lines.

Sn 50

Tin **118.7**

Latin: "stannum" (tin)

pewter

bronze

- Is an ingredient of pewter.
- Is mixed with copper to make bronze.
- Turns into powder at low temperatures.

Sb 51

Antimony **121.7**

Greek: "anti-monos" (not alone)
Symbol comes from "stibnium"

- Is also known by the name Stibnium.
- Used in ceramics, glazes, solder, lead batteries and matches.
- Increases hardness in alloys.

Te 52

Tellurium **127.6**

Latin: "tellus" (earth)

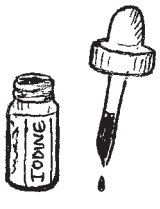
rubber

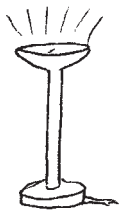
- Used to "vulcanize" rubber (although sulfur is the key ingredient in vulcanization)
- Is one of the few elements that will bond with gold.
- Used to color glass.
- Used in ceramics.

I 53

Iodine **126.9**

Greek: "iodes" (violet)



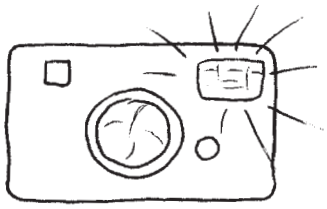


- Used as a disinfectant.
- Used in halogen lamps, ink pigments and photographic film.
- Our thyroid glands need iodine.

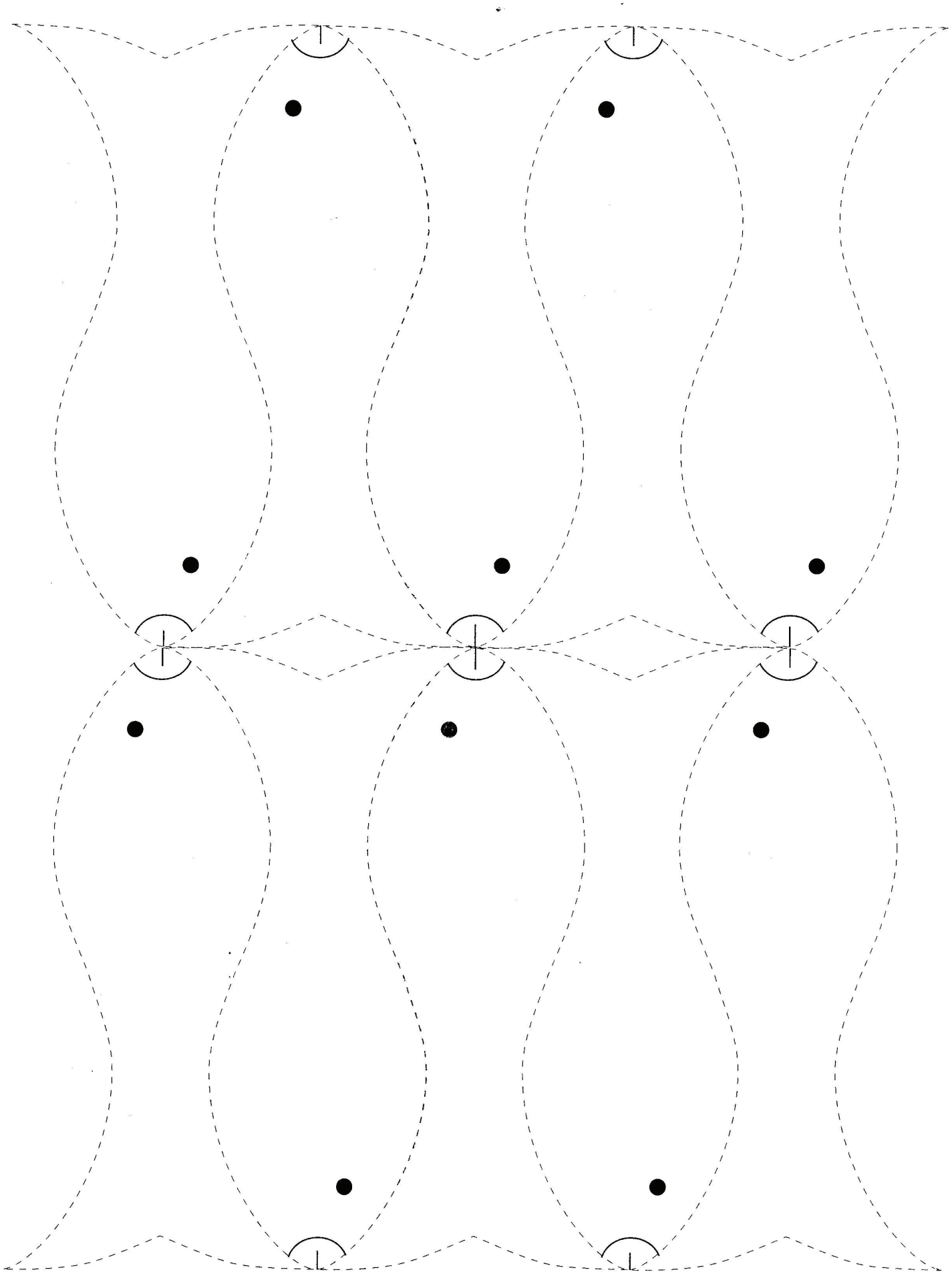
Xe 54

Xenon **131.3**

Greek: "xenos" (strange)



- Used in camera flash bulbs, strobe lights, UV lamps and tanning bed lamps.



ELEMENTS NAMED AFTER PLACES:

Americium: America
Berkelium: Berkeley, CA
Californium: California
Cerium: the asteroid Ceres
Erbium: Swedish town of Ytterby
Europium: Europe
Francium: France
Gallium: France (Gall was the ancient name for France)
Germanium: Germany
Hafnium: Hafnia is Latin for Copenhagen, Denmark
Holmium: Stockholm, Sweden
Neptunium: the planet Neptune
Palladium: the asteroid Pallas
Plutonium: the until-recently-a-planet Pluto
Polonium: Poland
Rhenium: the Rhine area of Germany
Ruthenium: the province of Ruthenia in the Czech Republic
Scandium: Scandinavia
Strontium: Scottish town of Strontian
Tellurium: the planet Earth (the Greek word is Tellus)
Terbium: the Swedish town of Ytterby
Thulium: Scandinavia (the ancient name for Scandinavia was Thule)
Uranium: the planet Uranus
Ytterbium: the Swedish town of Ytterby
Yttrium: again, the Swedish town of Ytterby

ELEMENTS NAMED AFTER PEOPLE:

Curium: Marie Curie, discoverer of radium and polonium
Einsteinium: Albert Einstein
Fermium: Enrico Fermi, a physicist during the World War II era
Gadolinium: Johan Gadolin, a Finnish chemist
Gallium: Lecoq de Boisbaudran, a 19th century chemist (Gallus is Latin for “cock”)
Lawrencium: Ernest O. Lawrence, a 20th century physicist
Mendelevium: Dmitri Mendeleyev, inventor of the Periodic Table
Meitnerium: Lise Meitner, a 20th century physicist
Mercury: Mercury, mythological Roman god
Niobium: Niobe, the daughter of mythological Greek god Tantalus
Nobelium: Alfred Nobel, inventor of dynamite, and namesake of the Nobel Prize
Niels-Bohrium: Niels Bohr, a 20th century chemist and physicist
Promethium: Prometheus, mythological Greek god who gave fire to mankind
Seaborgium: Glenn Seaborg, a 20th century chemist and physicist
Tantalum: Tantalus, mythological Greek god
Tin: Tinia, mythological Etruscan god (“Sn” comes from its Latin name, stannum)
Thorium: Thor, mythological Norse god of thunder
Vanadium: Vanadis, mythological Scandinavian goddess

Start

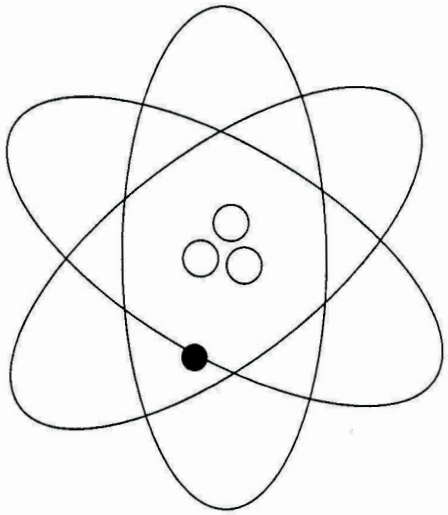
THE Periodic Table Game

Liquid or Gas at Room Temperature > **Roll Again**

Radioactive > **Put up Shields on Either Side** 

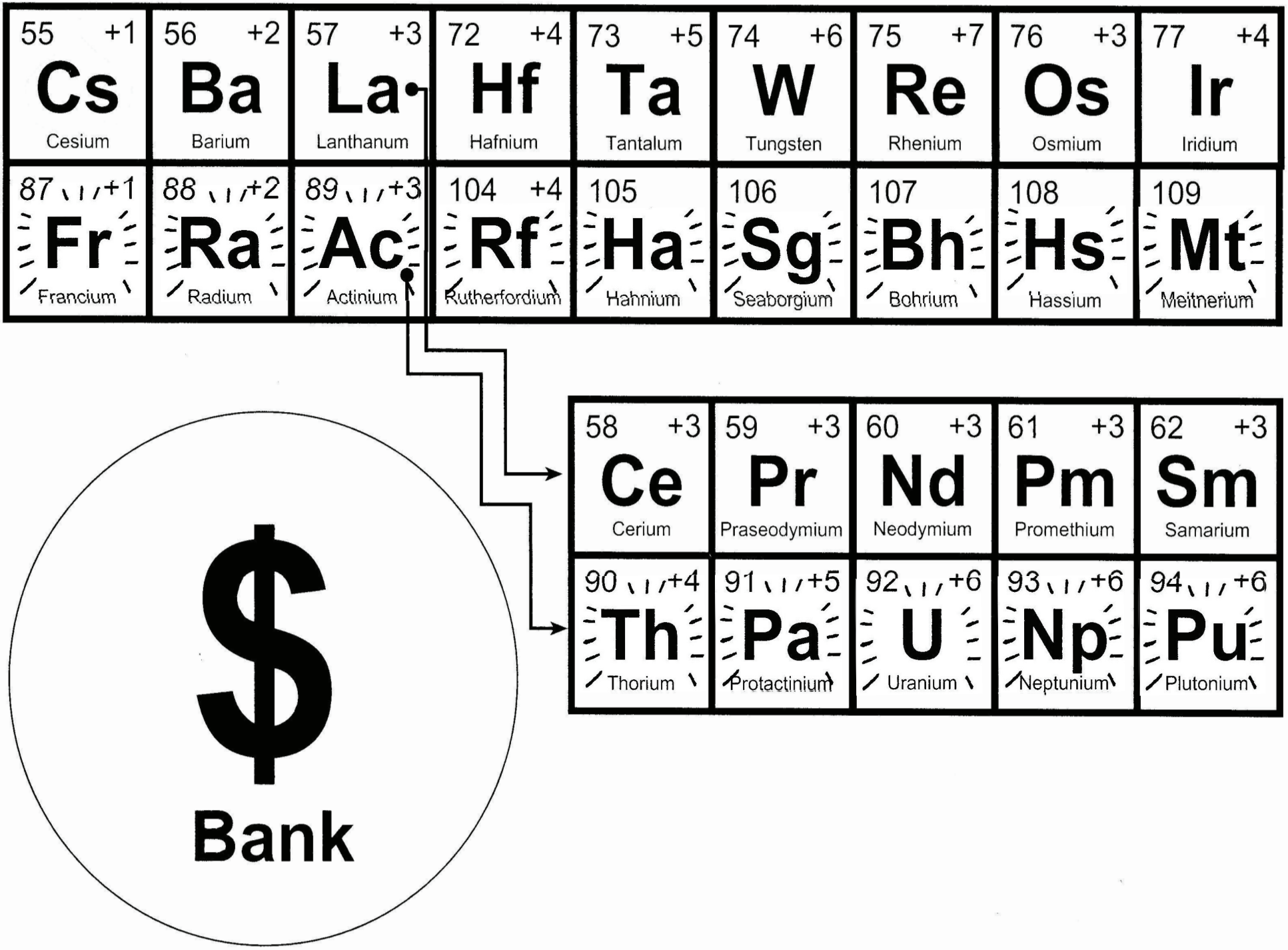
Named After Person or Place > **3 Extra Pennies if You Name It!**

1 +1 **H** Hydrogen								
3 +1 **Li** Lithium	4 +2 **Be** Beryllium							
11 +1 **Na** Sodium	12 +2 **Mg** Magnesium							
19 +1 **K** Potassium	20 +2 **Ca** Calcium	21 +3 **Sc** Scandium	22 +4 **Ti** Titanium	23 +5 **V** Vanadium	24 +6 **Cr** Chromium	25 +7 **Mn** Manganese	26 +3 **Fe** Iron	27 +3 **Co** Cobalt
37 +1 **Rb** Rubidium	38 +2 **Sr** Strontium	39 +3 **Y** Yttrium	40 +4 **Zr** Zirconium	41 +5 **Nb** Niobium	42 +6 **Mo** Molybdenum	43 +7 **Tc** Technetium	44 +3 **Ru** Ruthenium	45 +3 **Rh** Rhodium



Radioactive Shields

								2 0 He Helium	
			5 +3 B Boron	6 +4 C Carbon	7 -3 N Nitrogen	8 -2 O Oxygen	9 -1 F Fluorine	10 0 Ne Neon	
			13 +3 Al Aluminum	14 +4 Si Silicon	15 -3 P Phosphorus	16 -2 S Sulfur	17 -1 Cl Chlorine	18 0 Ar Argon	
28 +3 Ni Nickel	29 +2 Cu Copper	30 +2 Zn Zinc	31 +3 Ga Gallium	32 +4 Ge Germanium	33 -3 As Arsenic	34 -2 Se Selenium	35 -1 Br Bromine	36 0 Kr Krypton	
46 +4 Pd Palladium	47 +1 Ag Silver	48 +2 Cd Cadmium	49 +3 In Indium	50 +4 Sn Tin	51 -3 Sb Antimony	52 -2 Te Tellurium	53 -1 I Iodine	54 0 Xe Xenon	


55 +1
Cs
Cesium
56 +2
Ba
Barium
57 +3
La
Lanthanum
72 +4
Hf
Hafnium
73 +5
Ta
Tantalum
74 +6
W
Tungsten
75 +7
Re
Rhenium
76 +3
Os
Osmium
77 +4
Ir
Iridium
87 +1
Fr
Francium
88 +2
Ra
Radium
89 +3
Ac
Actinium
104 +4
Rf
Rutherfordium
105
Ha
Hahnium
106
Sg
Seaborgium
107
Bh
Bohrium
108
Hs
Hassium
109
Mt
Meitnerium
58 +3
Ce
Cerium
59 +3
Pr
Praseodymium
60 +3
Nd
Neodymium
61 +3
Pm
Promethium
62 +3
Sm
Samarium
90 +4
Th
Thorium
91 +5
Pa
Protactinium
92 +6
U
Uranium
93 +6
Np
Neptunium
94 +6
Pu
Plutonium
$
Bank

78 +4	79 +3	80 +2	81 +3	82 +4	83 -3	84 -2	85 -1	86 0
Pt Platinum	**Au** Gold	**Hg** Mercury	**Tl** Thallium	**Pb** Lead	**Bi** Bismuth	**Po** Polonium	**At** Astatine	**Rn** Radon

Finish

Go to 72 (Hf)

63 +3	64 +3	65 +3	66 +3	67 +3	68 +3	69 +3	70 +3	71 +3
Eu Europium	**Gd** Gadolinium	**Tb** Terbium	**Dy** Dysprosium	**Ho** Holmium	**Er** Erbium	**Tm** Thulium	**Yb** Ytterbium	**Lu** Lutetium
95 +6	96 +4	97 +4	98 +4	99 +3	100 +3	101 +3	102 +3	103 +3
Am Americium	**Cm** Curium	**Bk** Berkelium	**Cf** Californium	**Es** Einsteinium	**Fm** Fermium	**Md** Mendelevium	**No** Nobelium	**Lr** Lawrencium

Go to 104 (Rf)

Start

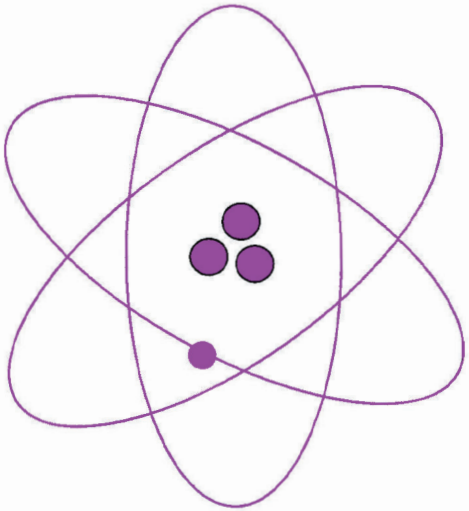
THE Periodic Table Game

Liquid or Gas at Room Temperature > **Roll Again**

Radioactive > **Put up Shields on Either Side** 

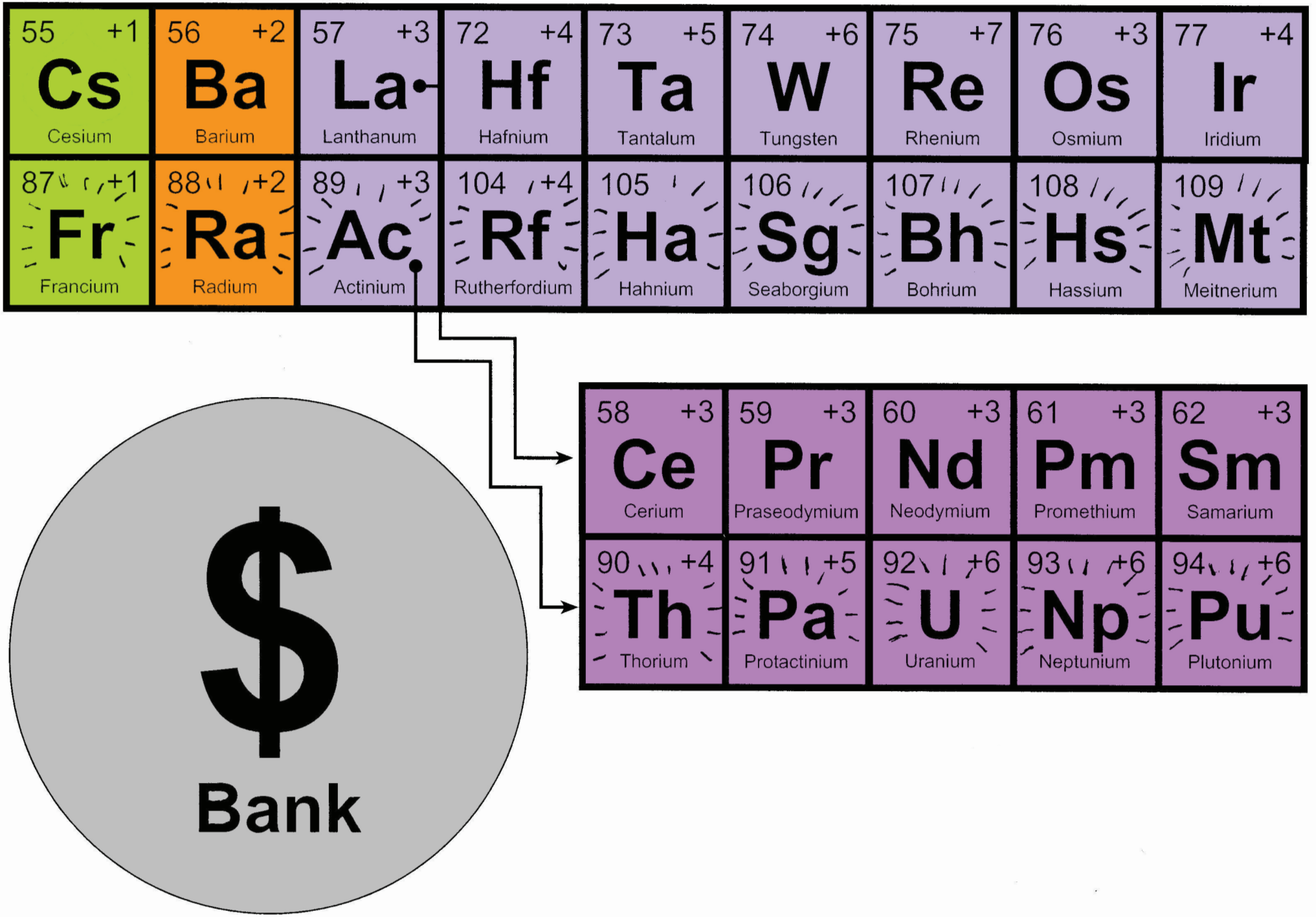
Named After Person or Place > **3 Extra Pennies if You Name It!**

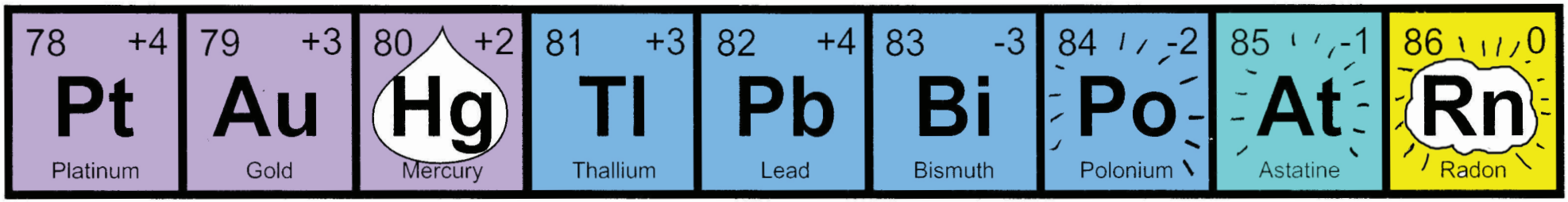
1 +1 H Hydrogen									
3 +1 Li Lithium	4 +2 Be Beryllium								
11 +1 Na Sodium	12 +2 Mg Magnesium								
19 +1 K Potassium	20 +2 Ca Calcium	21 +3 Sc Scandium	22 +4 Ti Titanium	23 +5 V Vanadium	24 +6 Cr Chromium	25 +7 Mn Manganese	26 +3 Fe Iron	27 +3 Co Cobalt	
37 +1 Rb Rubidium	38 +2 Sr Strontium	39 +3 Y Yttrium	40 +4 Zr Zirconium	41 +5 Nb Niobium	42 +6 Mo Molybdenum	43 +7 Tc Technetium	44 +3 Ru Ruthenium	45 +3 Rh Rhodium	



Radioactive Shields

						2 0 **He** Helium
		5 +3 **B** Boron	6 +4 **C** Carbon	7 -3 **N** Nitrogen	8 -2 **O** Oxygen	9 -1 **F** Fluorine	10 0 **Ne** Neon
		13 +3 **Al** Aluminum	14 +4 **Si** Silicon	15 -3 **P** Phosphorus	16 -2 **S** Sulfur	17 -1 **Cl** Chlorine	18 0 **Ar** Argon
28 +3 **Ni** Nickel	29 +2 **Cu** Copper	30 +2 **Zn** Zinc	31 +3 **Ga** Gallium	32 +4 **Ge** Germanium	33 -3 **As** Arsenic	34 -2 **Se** Selenium	35 -1 **Br** Bromine	36 0 **Kr** Krypton
46 +4 **Pd** Palladium	47 +1 **Ag** Silver	48 +2 **Cd** Cadmium	49 +3 **In** Indium	50 +4 **Sn** Tin	51 -3 **Sb** Antimony	52 -2 **Te** Tellurium	53 -1 **I** Iodine	54 0 **Xe** Xenon

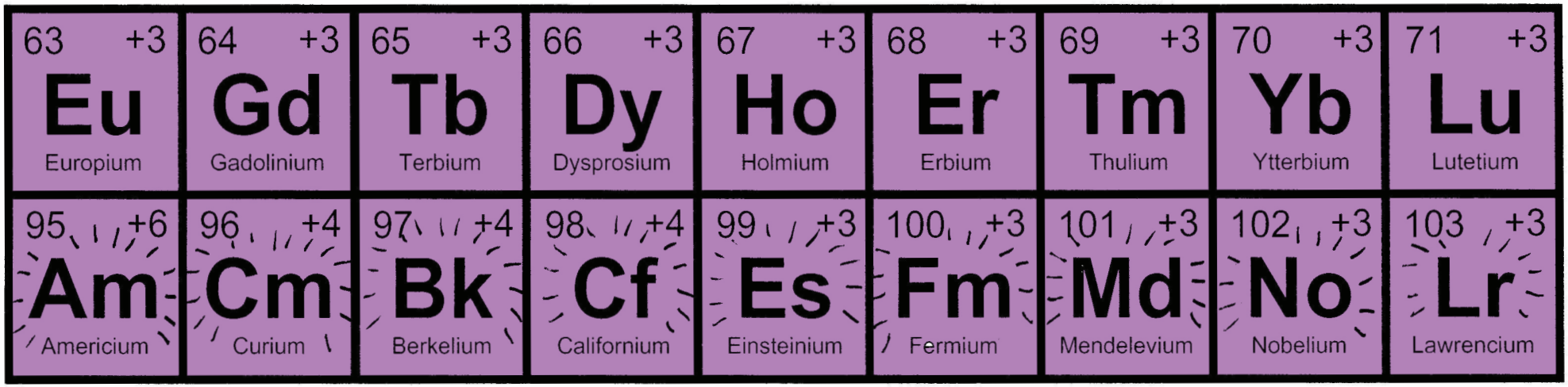

55 +1
Cs
Cesium
56 +2
Ba
Barium
57 +3
La
Lanthanum
72 +4
Hf
Hafnium
73 +5
Ta
Tantalum
74 +6
W
Tungsten
75 +7
Re
Rhenium
76 +3
Os
Osmium
77 +4
Ir
Iridium
87 +1
Fr
Francium
88 +2
Ra
Radium
89 +3
Ac
Actinium
104 +4
Rf
Rutherfordium
105
Ha
Hahnium
106
Sg
Seaborgium
107
Bh
Bohrium
108
Hs
Hassium
109
Mt
Meitnerium
58 +3
Ce
Cerium
59 +3
Pr
Praseodymium
60 +3
Nd
Neodymium
61 +3
Pm
Promethium
62 +3
Sm
Samarium
90 +4
Th
Thorium
91 +5
Pa
Protactinium
92 +6
U
Uranium
93 +6
Np
Neptunium
94 +6
Pu
Plutonium
$
Bank



Finish

Go to 72 Hf

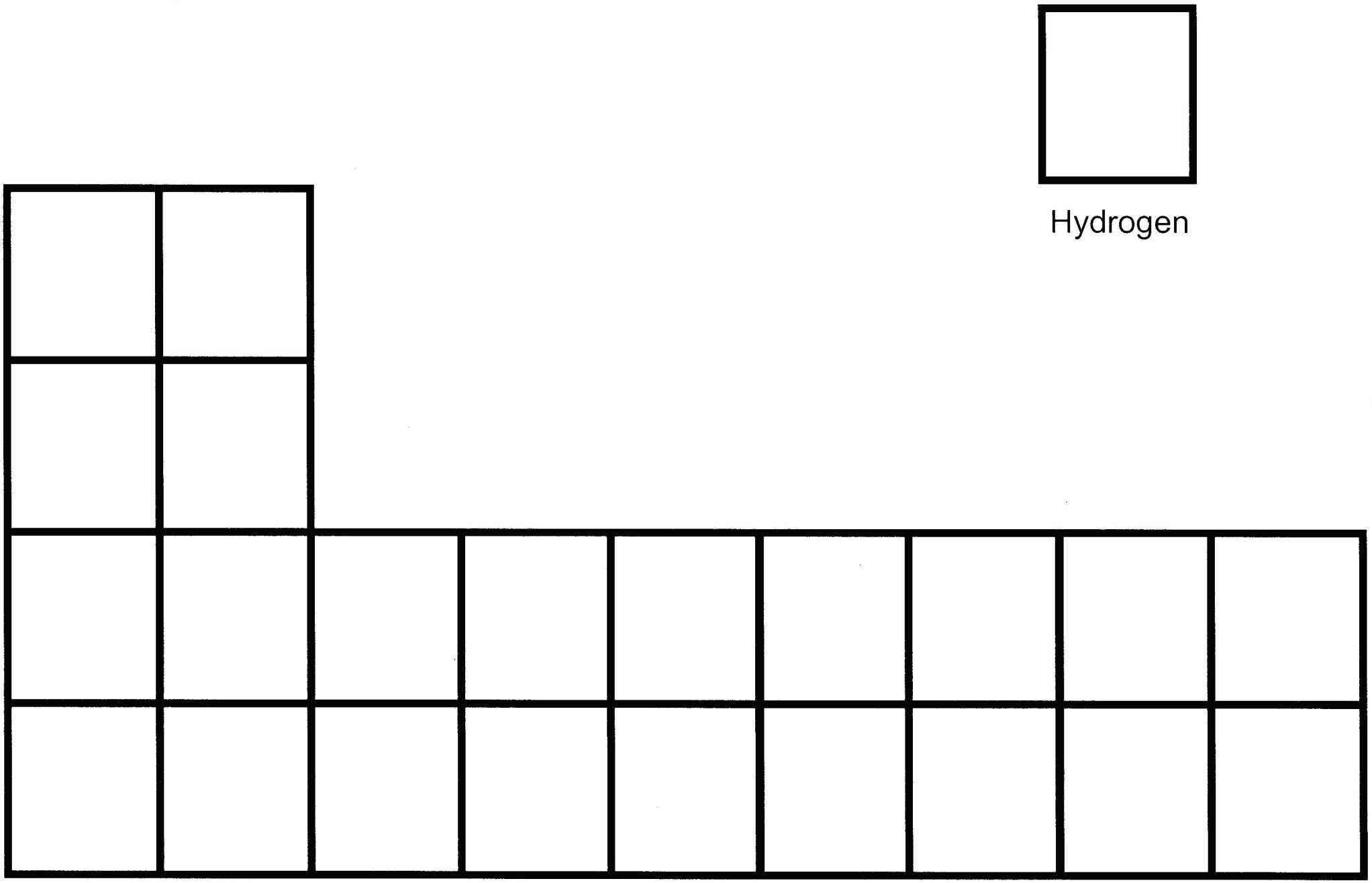
This top row is call the Lanthanide Series because it follows Lanthanum



This bottom row is call the Actinide Series because it follows Actinium

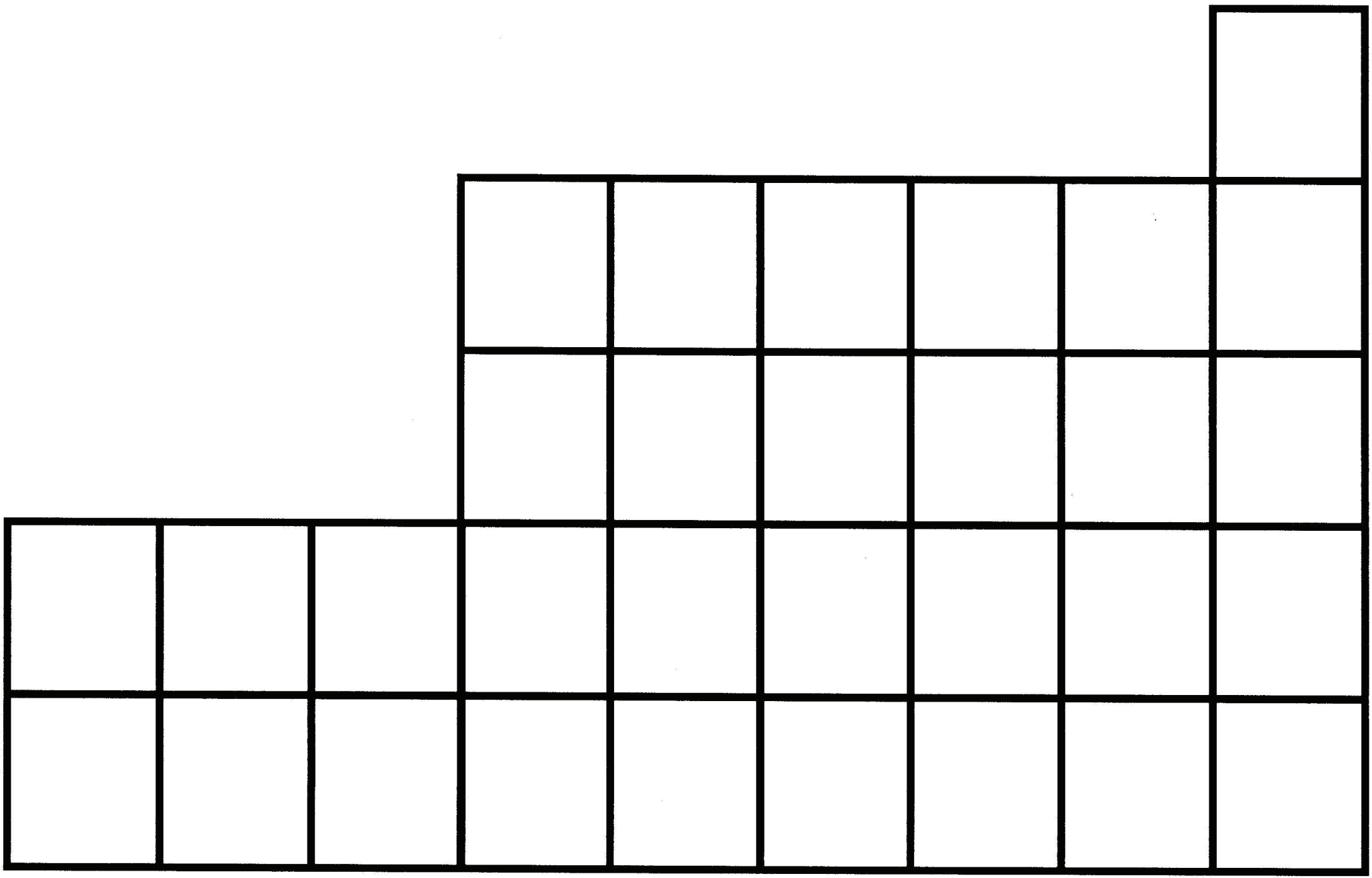
Go to 104 Rf

Upper Left

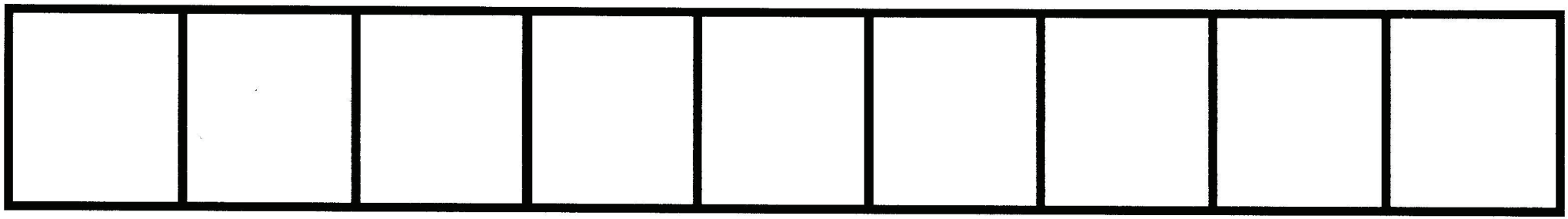


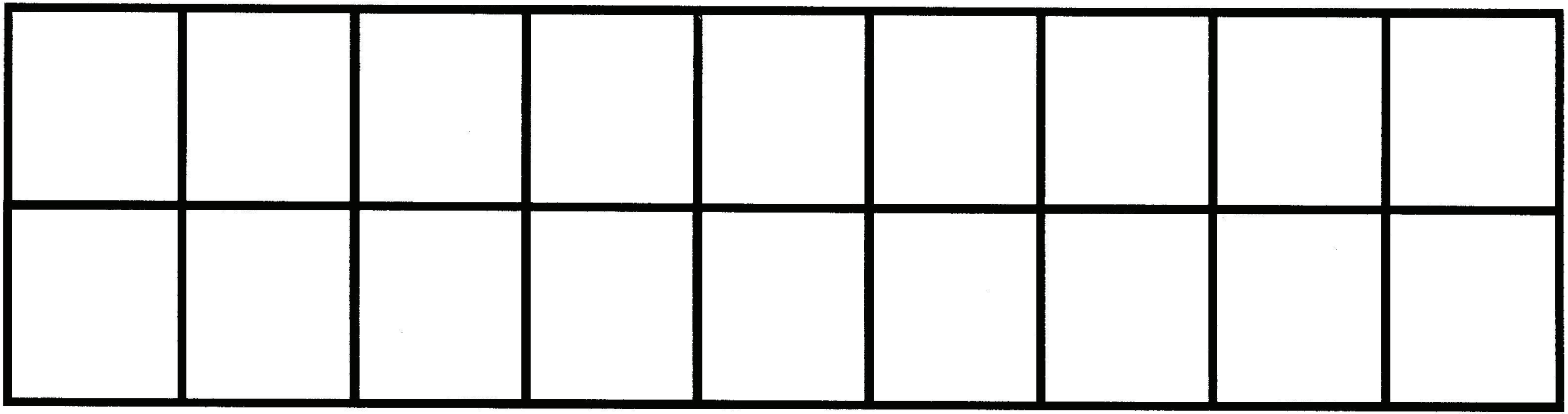
Hydrogen

Upper Right



Lower Left



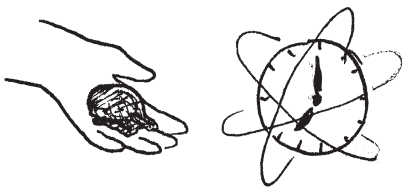


Lower Right

Cs 55

Cesium **132.9**

Latin: "caesius" (sky blue)

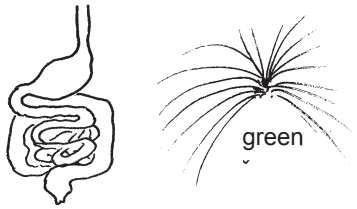


- Will melt in your hand.
- Used in atomic clocks.
- Used as a "scavenger" (collector) of unwanted atoms of gas in vacuum tubes.

Ba 56

Barium **137.3**

Greek: "barys" (heavy)

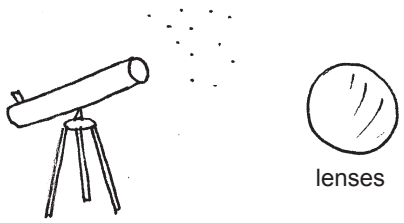


- Used for X-rays of digestive systems.
- Used in fireworks (green color), magnetic recording tapes, and spark plugs.

La 57

Lanthanum **138.9**

Greek: "lanthanein" (to lie hidden)

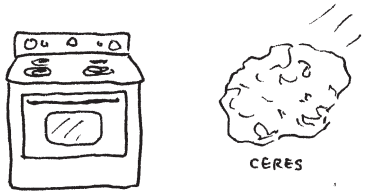


- Used in telescope and camera lenses.
- Used for electrodes in high intensity lights (example: search lights).

Ce 58

Cerium **140.1**

named after the asteroid Ceres

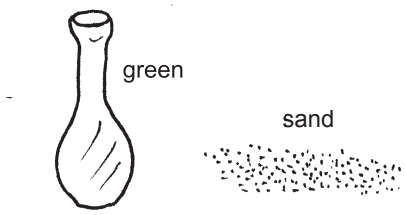


- Found in sand along the coasts of California, Florida, India and Brazil ("monazite sand").
- Used in self-cleaning ovens.
- Used in electrodes in lights.

Pr 59

Praseodymium **140.9**

Greek: "prasios-didymos" (green twin)

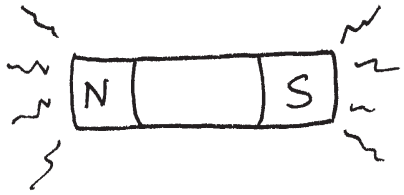


- Found in sand along the coasts of California, Florida, India and Brazil ("monazite sand").
- Used to color glass green.
- Used in electrodes in lights.

Nd 60

Neodymium **144.2**

Greek: "neos-didymos" (new twin)

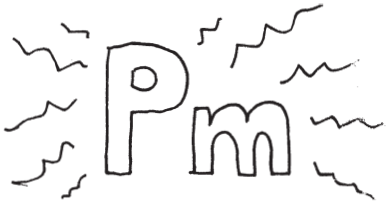


- Found in sand along the coasts of California, Florida, India and Brazil ("monazite sand").
- Used to make very strong magnets.
- Used to color glass and to make rubies.

Pm 61

Promethium **147.0**

named after Greek god Prometheus

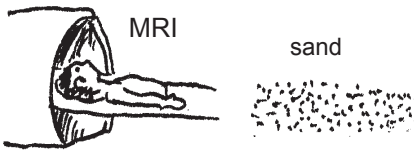


- Is a synthetic element made in nuclear reactors.
- Can be a source of X-rays in portable X-ray machines.

Sm 62

Samarium **150.3**

named after the mineral "samarskite" which was named for Col. Samarski, a Russian army engineer

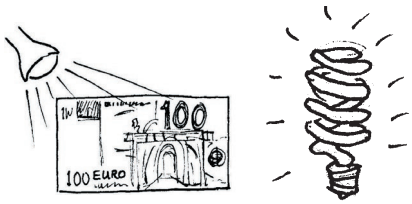


- Found in sand along the coasts of California, Florida, India and Brazil ("monazite sand").
- Used in magnets for MRI machines, and in infra-red absorbing glass.

Eu 63

Europium **151.9**

named after Europe

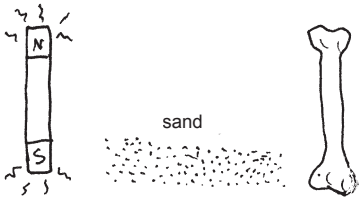


- Used to make red color in televisions.
- Used in mercury lamps and energy-saving fluorescent bulbs.
- Used to identify counterfeit Euros.
- Used to study formation of igneous rocks.

Gd 64

Gadolinium **157.2**

named for chemist Johann Gadolin

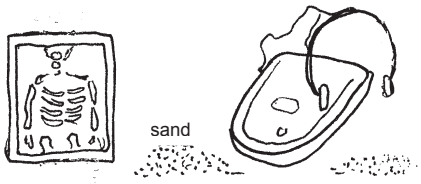


- Found in sand along the coasts of California, Florida, India and Brazil ("monazite sand").
- Used in magnets and TV tubes.
- Used to diagnose osteoporosis.

Tb 65

Terbium **158.9**

named after Swedish village of Ytterby

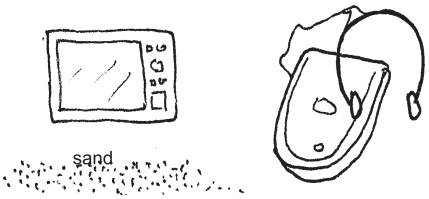


- Found in sand along the coasts of California, Florida, India and Brazil ("monazite sand").
- Used in TV tubes and X-ray screens.
- Used in metal alloys for CD players.

Dy 66

Dysprosium **162.5**

Greek: "dysprositos" (difficult to obtain)

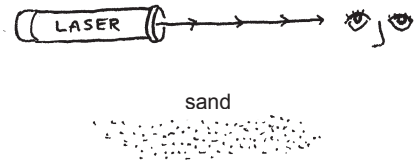


- Found in sand along the coasts of California, Florida, India and Brazil ("monazite sand")..
- Used in TV tubes, mercury lamps, and magnets inside CD players.

Ho 67

Holmium **164.9**

named for Stockholm, Sweden

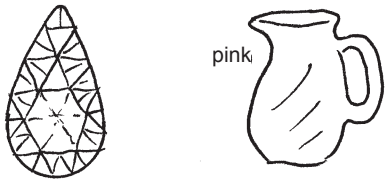


- Found in sand along the coasts of California, Florida, India and Brazil ("monazite sand").
- Used in eye-safe medical lasers.
- Used to color glass.

Er 68

Erbium **167.3**

named after Sweidish village of Ytterby

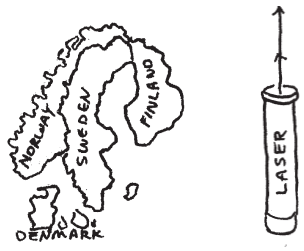


- Used in alloys with vanadium, to make the texture less brittle (easier to shape).
- Used for pink coloring in glass.
- Used to make artificial gemstones.
- Superconducts at low temperatures.

Tm 69

Thulium **168.9**

Thule is the ancient name for Scandinavia

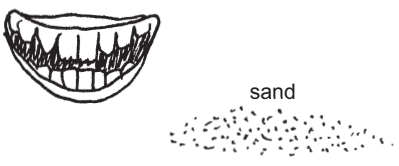


- Found in sand along the coasts of California, Florida, India and Brazil ("monazite sand").
- Used in lasers and in medical imaging.
- Is very rare.

Yb 70

Ytterbium **173.0**

named after Swedish village of Ytterby



- Found in sand along the coasts of California, Florida, India and Brazil ("monazite sand").
- Used in dentures (artificial teeth).
- Is added to stainless steel to improve strength.

Lu 71

Lutetium **174.9**

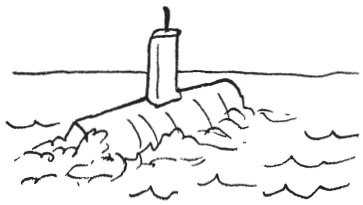
Lutetia is the ancient name for Paris

- Found in sand along the coasts of California, Florida, India and Brazil ("monazite sand").
- Is the only naturally-occurring element discovered in America.
- Used in temperature-sensing optics.

Hf 72

Hafnium **178.5**

Hafnia is the ancient name for Copenhagen

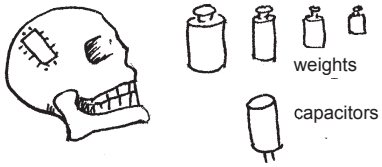


- Usually found with zirconium.
- Used in nuclear submarines and nuclear reactors.
- Used as a gas "scavenger" (collector) in vacuum tubes (to get rid of unwanted atoms of gas).

Ta 73

Tantalum **180.9**

named after the Greek god Tantalus

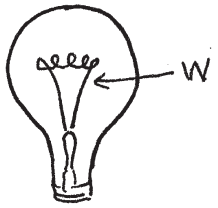


- Used to repair bones, especially in the skull.
- Used to make tools and weights.
- Used for capacitors in electronics.

W 74

Tungsten **183.8**

Swedish: "Tung stem" (heavy stone)
Used to be called Wolframite

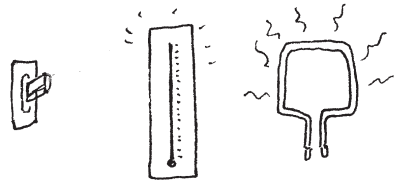


- Used for filaments in light bulbs.
- Used for high-speed cutting tools.
- Has the highest melting point of all the metals.

Re 75

Rhenium **186.2**

Latin: "Rhenus" (Rhine River)

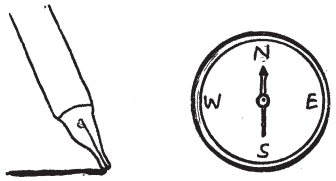


- Used in alloys, especially for electrical switches and contacts.
- Used for high-temp thermometers.
- Used for oven filaments.

Os 76

Osmium **190.2**

Greek: "osme" (smell)

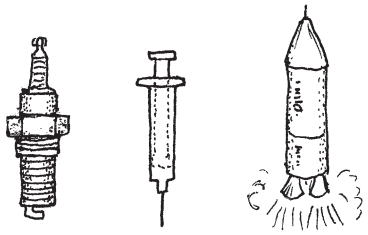


- Used in pen points and compass needles.
- Mixed with platinum and iridium to make alloys.
- Is the most dense element, twice as dense as lead.

Ir 77

Iridium **192.2**

Latin: "iris" (rainbow)



- Iridium salts are highly colored.
- Used in helicopter spark plugs, hypodermic needles and rocket engines.
- Is often mixed with platinum.

Pt 78

Platinum **195.1**

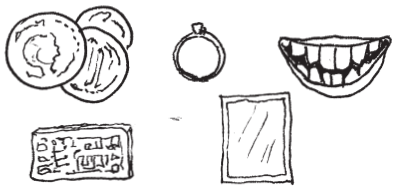
Spanish: "platina" (silver)

- Used in jewelry and dentistry.
- Used in the petroleum and electronic industries.
- Most platinum comes from South Africa and Russia.

Au 79

Gold **196.9**

Old English: "gold"
"Au" comes from Latin: "aurum"

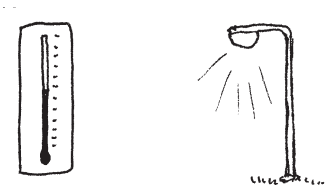


- Used for coins, jewelry, dentistry, and electrical parts that need to conduct electricity.
- Used as a reflective coating on the outside of large glass windows.

Hg 80

Mercury **200.6**

named after the Roman god Mercury



- The symbol **Hg** comes from the Latin "hydragyrum" meaning "liquid silver."
- Used in thermometers, barometers, and street lights.
- Found primarily in the mineral ore "cinnabar," mined in Spain and Italy.

Tl 81

Thallium **204.4**

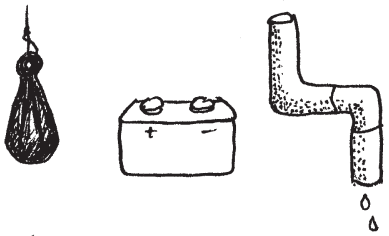
Greek: "thallos" (green twig)

- Looks like lead and is poisonous.
- Was once used in insecticides.
- Used to diagnose heart disease.
- Used in infrared detectors.

Pb 82

Lead **207.2**

Ancient Anglo-Saxon: "lead"
"Pb" comes from Latin: "Plumbum"

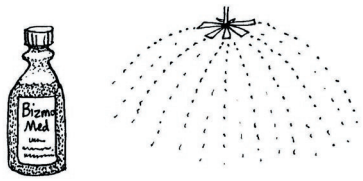


- Used for fishing weights, in batteries, and for protection against X-rays.
- Romans used lead for their water pipes.

Bi 83

Bismuth **208.9**

German" "weisse masse" (white mass)

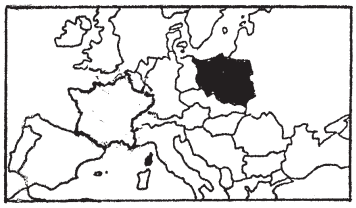


- Used in stomach medicines such as Pepto-bismol®
- Used in indoor sprinkler systems (fire safety for commercial buidings).
- Used in the manufacturing of rubber, fuses, and cosmetics

Po 84

Polonium **210**

named after Poland

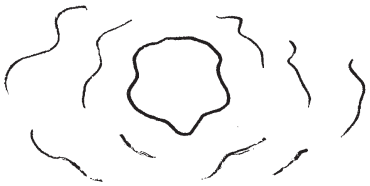


- Discovered by Marie Curie, who was born in Poland.
- Is very radioactive. Can be used as a source of radiation.

At 85

Astatine **210**

Greek: "astatos" (instable)



- Very little is known about this element.
- The total amount of astatine that exists is estimated to be only about an ounce!
- Is radioactive.

Rn 86

Radon **222**

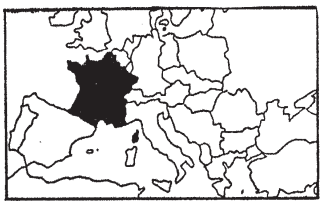
named after the element radium

- Is the heaviest gaseous element.
- It is radioactive and probably causes lung cancer.
- Used in earthquake prediction.

Fr 87

Francium **223**

named after France

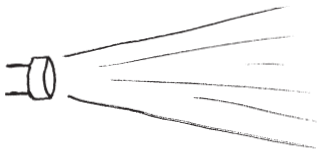


- Discovered in France.
- Is very active.
- Comes from the decay of uranium and thorium.
- Is too unstable to be used for anything.

Ra 88

Radium **226.0**

Latin: "radius" (ray)

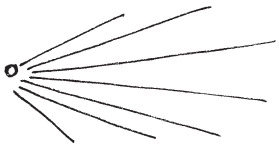


- Discovered with the spectrometer, as an impurity in uranium ores.
- Was once used to make glow-in-the-dark watches.
- Can be used to make radon, for use in medical procedures.

Ac 89

Actinium **227**

Greek: "actinos" (ray or beam)



- Is radioactive.
- Comes from the decay of uranium and thorium.
- No commercial use.

Th 90

Thorium **232**

after the ancient Scandinavian god Thor, god of lightning and thunder

- More common than uranium.
- Used as a source of electrons in some electronic devices.
- Used in the "mantles" of camping lanterns (that little bag-like thing that glows)

Pa 91

Protactinium **231**

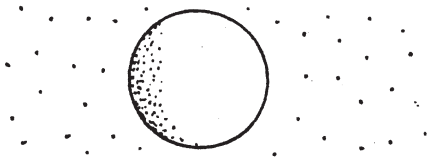
Greek: "protos" (first), plus "actinium"

- Was given this name because it always decays into actinium.
- Not much is known about it.
- Has no commercial use.

U 92

Uranium **238**

named after the planet Uranus

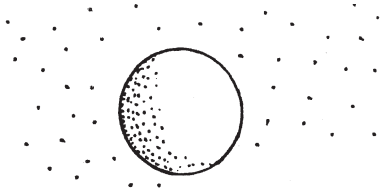


- Is radioactive.
- Was discovered just after Uranus was.
- Used as fuel in nuclear reactors.
- Depleted uranium (which is much less radioactive) is used to color glass and to make metals for military vehicles.

Np 93

Neptunium **237**

named after the planet Neptune

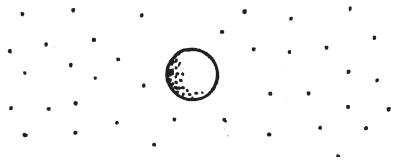


- Is radioactive.
- Is produced as a by-product of nuclear fission.
- Very small quantities of naturally-occurring neptunium have recently been discovered in uranium ores.

Pu 94

Plutonium **242**

named after Pluto



- Is made from uranium inside "breeder" nuclear reactors.
- Used in nuclear weapons.
- Was used to power the lunar modules.
- The element barium was almost named plutonium!

Am 95

Americium **243**

named after America

- Is radioactive.
- Used in smoke detectors.
- Used in crystal research.
- Used as a source of neutrons.

Cm 96

Curium **247**

named after Marie Curie

- Is radioactive.
- Used in pacemakers in heart, and also in ocean buoys.
- Has been used as an energy source on space missions.

Bk 97

Berkelium **247**

named after Berkeley, California

- Is radioactive; was made in Berkeley, Ca.
- Has no commerical use.
- BkCl3 (berkeliium trichloride) was the first compound to be made with this element. The quantity produced was very small-- only.000000003 of a gram!

Cf 98

Californium **251**

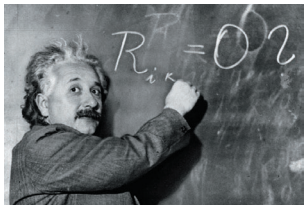
named after California

- Is radioactive.
- Can be used as a portable source of neutrons.
- Named after California because that's where it was made/discovered.

Es 99

Einsteinium **252**

named after Albert Einstein

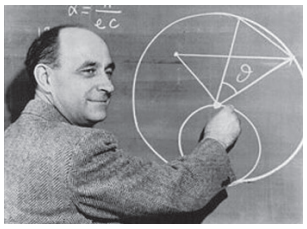


- Discovered during the investigation of debris from the first atomic bomb.
- Extremely radioactive and unstable.
- Einstein is famous for his equation that shows the relationship of matter to energy ($e=mc^2$).

Fm 100

Fermium **257**

named after Enrico Fermi



- Discovered during investigation of the debris from the first atomic bomb.
- Extremely radioactive and unstable.
- No commerical use.
- Fermi was a physicist who studied atomic structure and radioactivity.

Md 101

Mendelevium **256**

named after Dmitri Mendeleyev

- Radioactive and very unstable.
- Made in nuclear reactors.
- No commerical use.
- Mendeleyev invented the Periodic Table.

No 102

Nobelium **259**

named after Alfred Nobel

- Very radioactive and very unstable.
- Made in nuclear reactors.
- No commerical use.
- Alfred Nobel established the Nobel Prizes.

Lr 103

Lawrencium **262**

named after Ernest Lawrence

- Is radioactive and very unstable. It only exits for a few minutes after it is created.
- Lawrence was the inventor of the cyclotron machine that was used to discover elements heavier than uranium.

Rf 104

Rutherfordium **261**

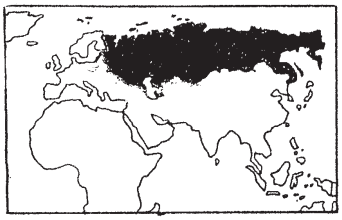
named after Ernest Rutherford

- Is very radioactive and unstable.
- Is made in nuclear reactors.
- No commerical use.
- Rutherford was a famous physicist.

Db 105

Dubnium **262**

named after Dubna, Russia



- Was made in a reactor in Russia.
- Is very radioactive and very unstable.
- Only exits for a few minutes.

Sb 106

Seaborgium **263**

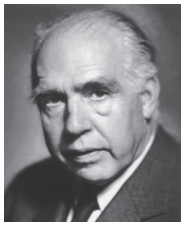
named after Glenn T. Seaborg

- Is very radioactive and unstable
- Is made in nuclear reactors.
- No commerical use.
- Only exits for a few seconds.
- Seaborg and his team discovered Pu, Am, Cm, Bk, Cf, Es, Fm, Md and No.

Bh 107

Bohrium **262**

named after Niels Bohr

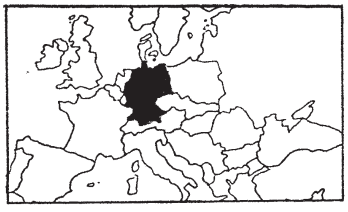


- Extremely radioactive and unstable.
- No commercial use.
- Only exists for a fraction of a second.
- Niels Bohr figured out atomic structure and also studied the nature of light.

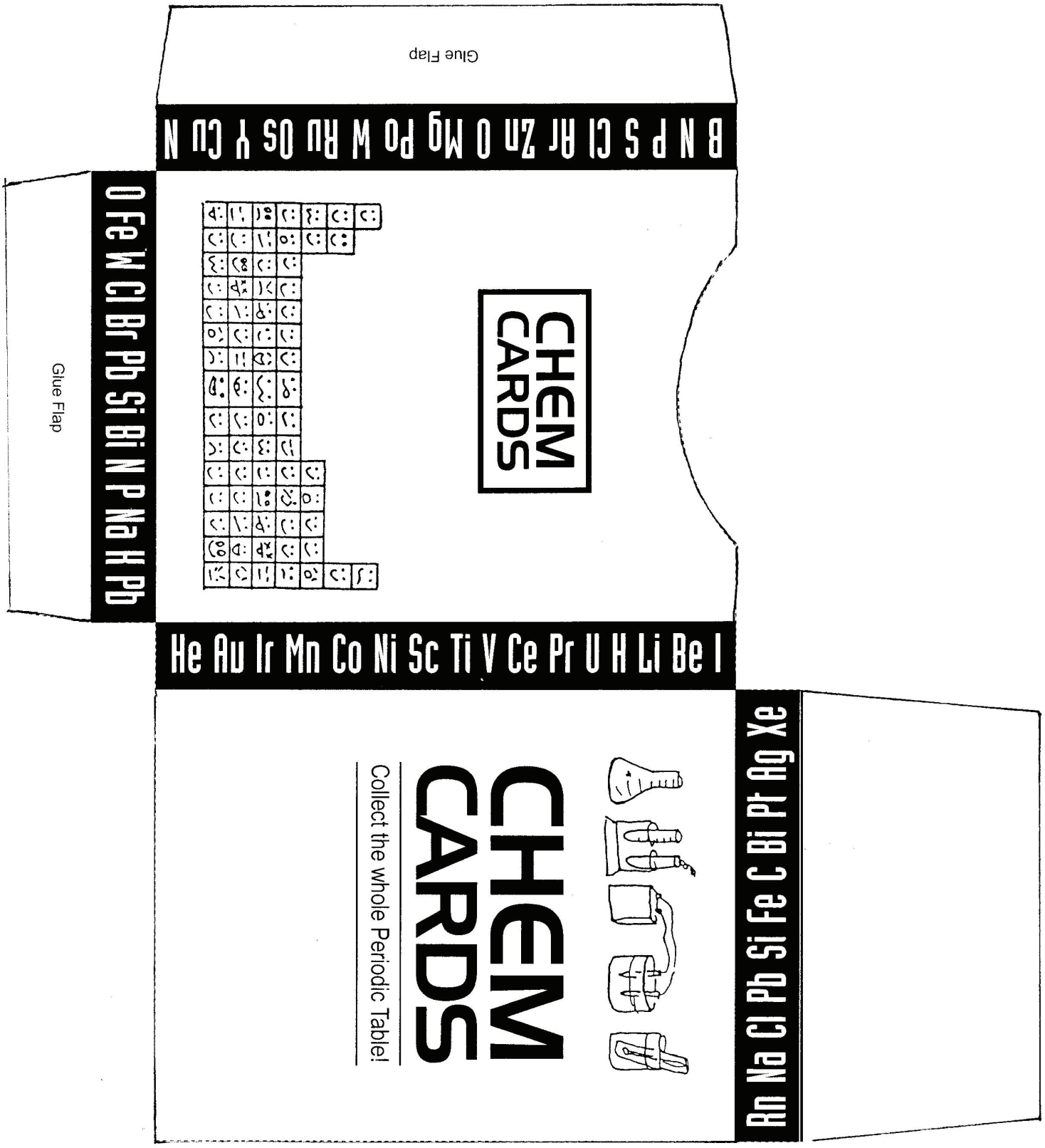
Hs 108

Hassium **265**

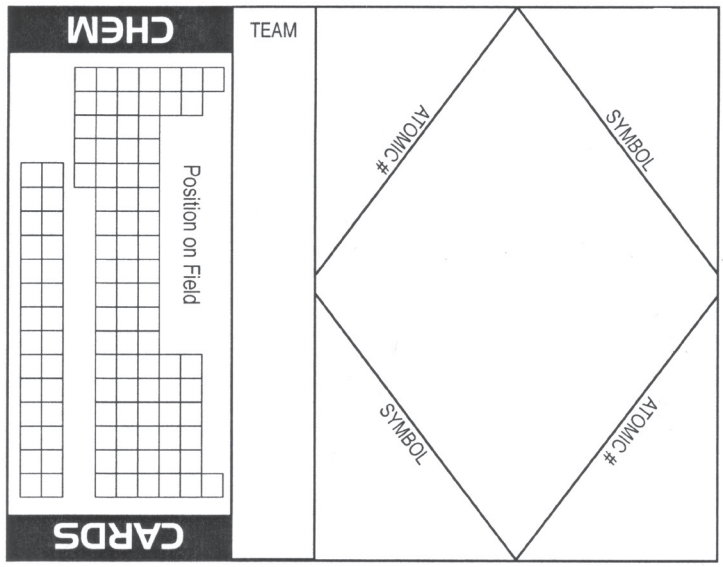
named after Hesse, Germany

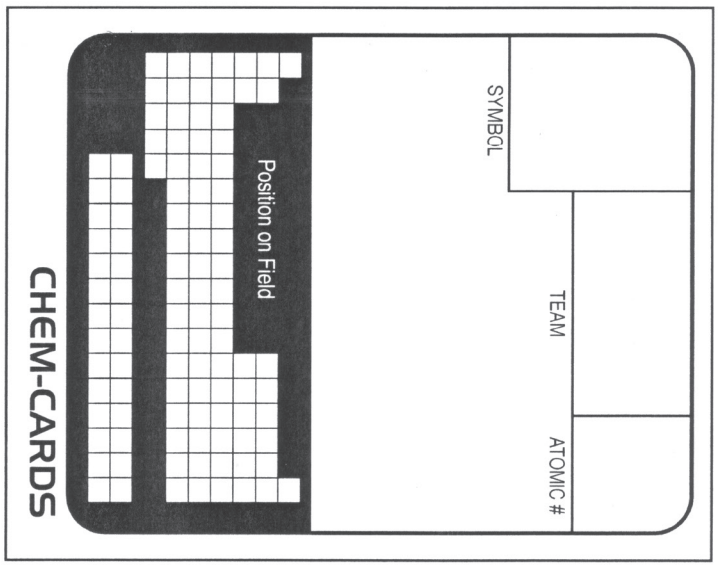


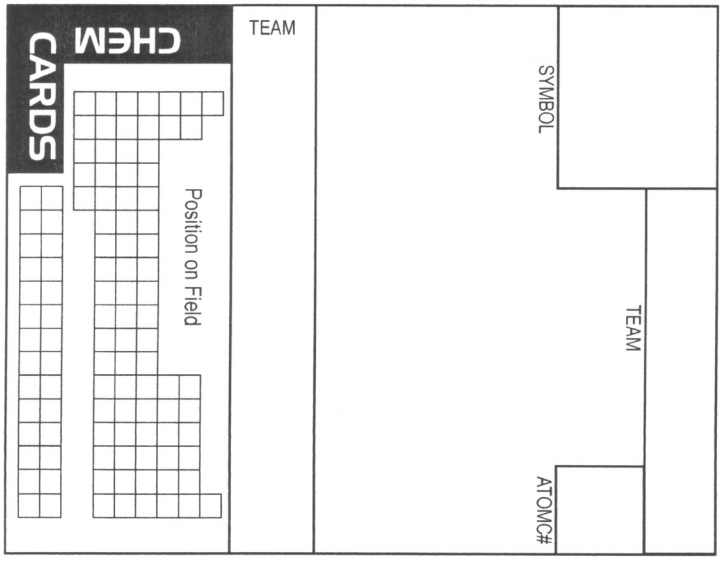
- Extremely radioactive and unstable.
- Made in nuclear reactors.
- No commericial use.
- Only exists for a fraction of a second.

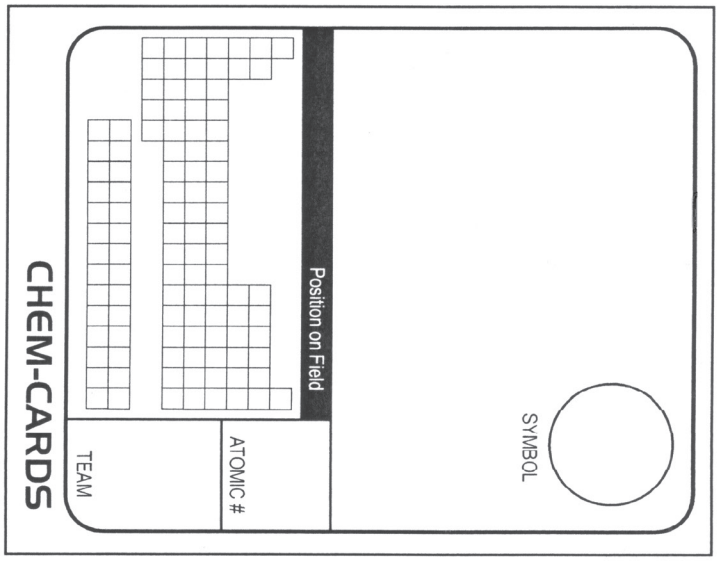


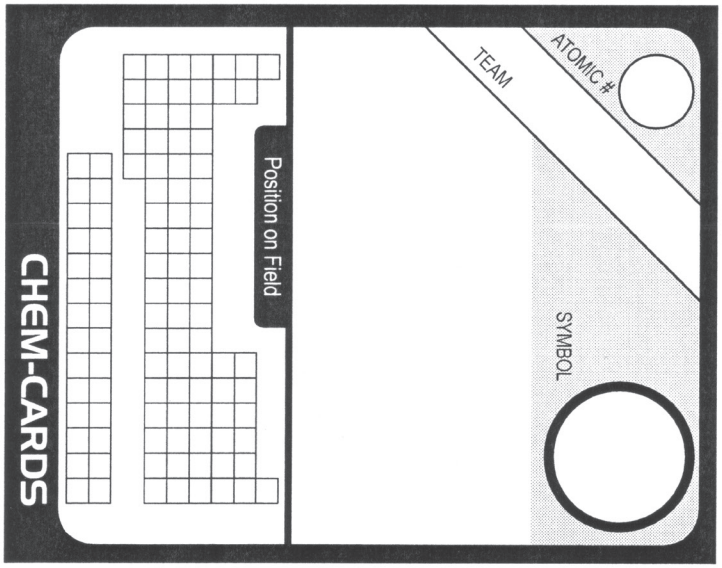
Holder for trading cards. Copy one per student onto heavy card stock (any color).

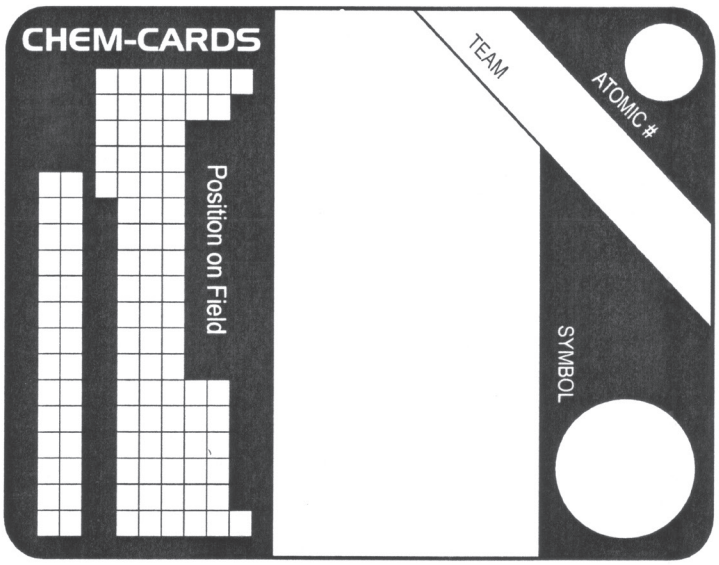












Pattern for trading cards

Copy onto white card stock.

Copy this onto the reverse side of cards.

_____
name of element

_____ _____ _____
symbol atomic # weight

Interesting facts:

Card designed by: _____
your name

_____
name of element

_____ _____ _____
symbol atomic # weight

Interesting facts:

Card designed by: _____
your name

_____
name of element

_____ _____ _____
symbol atomic # weight

Interesting facts:

Card designed by: _____
your name

_____
name of element

_____ _____ _____
symbol atomic # weight

Interesting facts:

Card designed by: _____
your name

_____
name of element

_____ _____ _____
symbol atomic # weight

Interesting facts:

Card designed by: _____
your name

_____
name of element

_____ _____ _____
symbol atomic # weight

Interesting facts:

Card designed by: _____
your name

symbol

name of element

atomic mass

number of protons

number of neutrons

number of electrons

atomic number

At standard temperature and pressure (STP), this element is a:

- □ solid
- □ liquid
- □ gas

Where did this element get its name?

At what temperature will this element boil?

At what temperature will this element melt or freeze?

What group does this element belong to?

- □ alkali metals
- □ alkali earth metals
- □ transition metals
- □ true metals
- □ semi-metals (metalloids)
- □ non-metals

Is this element found in the Earth's crust? □ yes □ no
If so, where?

□ rocks □ dirt □ lava
□ water □ gemstones
□ sand □ _____

When was this element first discovered?

Who discovered it?

Is this element ever found all by itself (not part of a compound)? □ yes □ no

What color is this element? (Or, if it is never found by itself, what color is its most common compound?)

Other colors?

Is this element used in industry? □ yes □ no
If so, what is it used for?

Is this element found in the human body? □ yes □ no
Is it part of the structure of the body? □ yes □ no
Can this element be harmful to the body? □ yes □ no
If it is harmful, how might you ingest it or come into contact with it?

Is this element used in any art or craft? □ yes □ no
What type of art uses it?

□ painting □ sculpture □ pottery
□ printing □ coins □ jewelry
□ _____

Is this element used in medicine or dentistry? □ yes □ no
If so, how is it used?

Give one historical fact about this element other than the date of its discovery:

What do you think is the most interesting fact about this element?

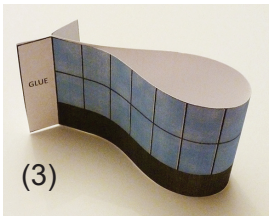
Draw a picture of a molecule containing this element:

Name of molecule:

Can you use these shapes to make a Periodic Table?

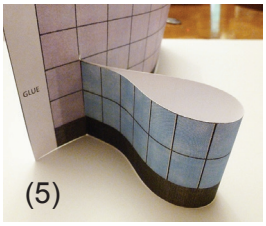
1) Write the atomic symbols and atomic numbers of the elements on the squares. The word "GLUE" should be right-side up as you work. In other words, you can use the word GLUE as your guide to make sure you don't have the rectangles upside down.

2) Cut out all three rectangles.



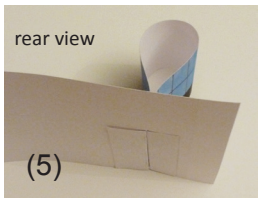
3) Fold the thinnest one into a loop and fold the end flaps back.

4) Cut the red line on the purple rectangle. You might want to trim out the whole red line (a strip about a millimeter wide) so that the fit won't be too tight when you insert the looped piece. (In other words, you want the red color to be completely gone.)



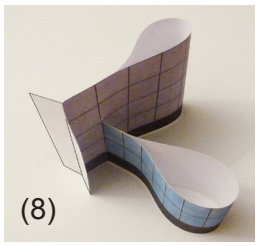
5) Insert the loop and glue in place.

6) Now make the purple rectangle into a loop, glue the end and fold back the flaps (the same thing you did to the first piece).

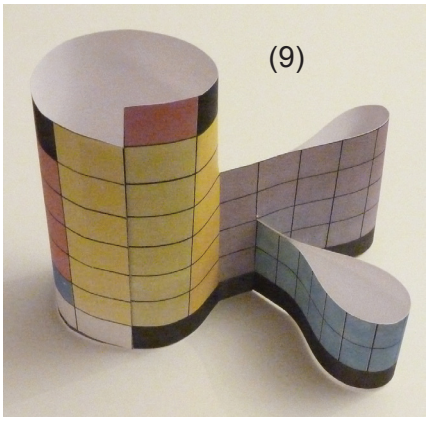


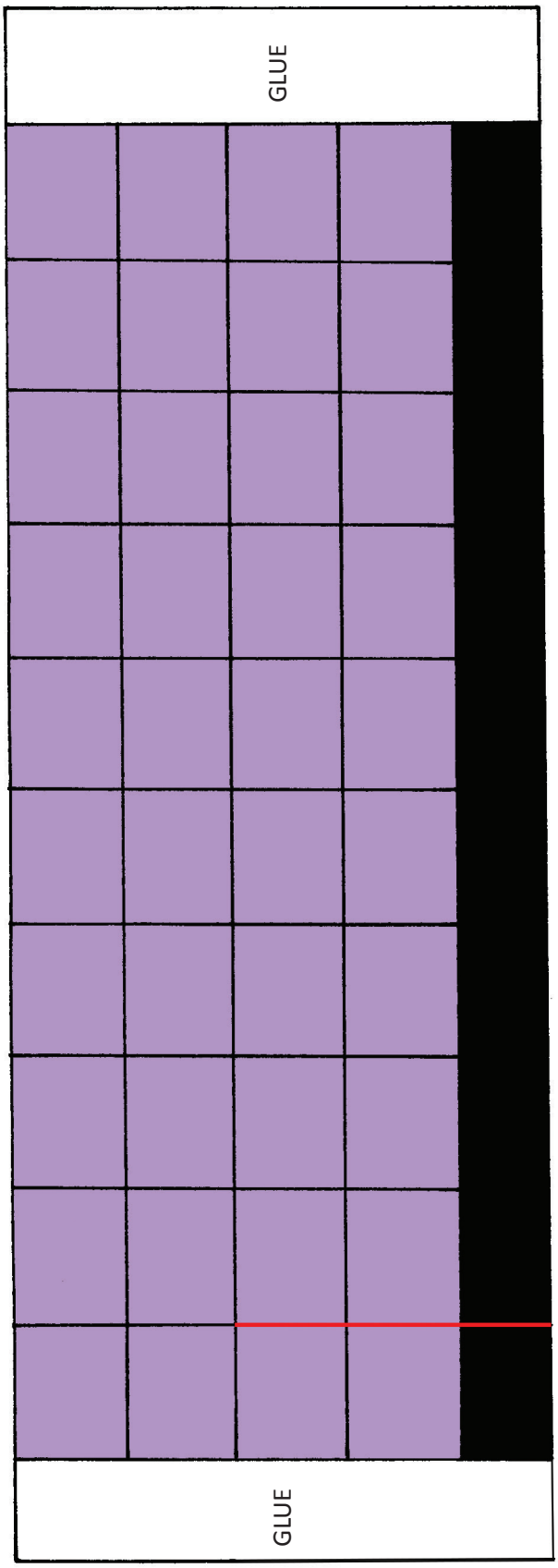
7) Cut the red line on the large rectangle. Trim out the whole red line (about a millimeter wide strip) to give enough space to insert the purple piece.

8) Insert the purple loop and glue in place.



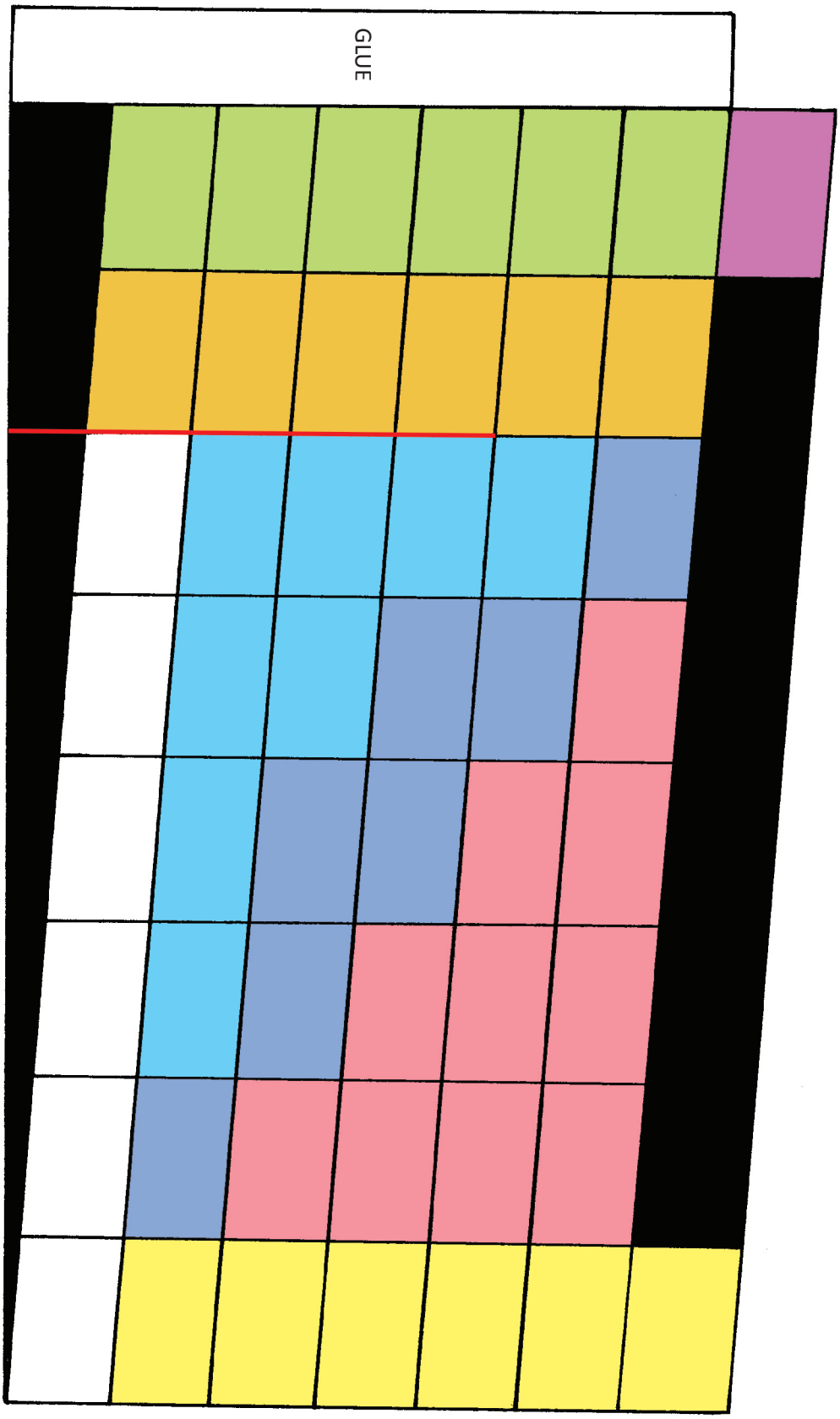
9) Bend the large rectangle into a cylinder and secure with glue on glue tab.

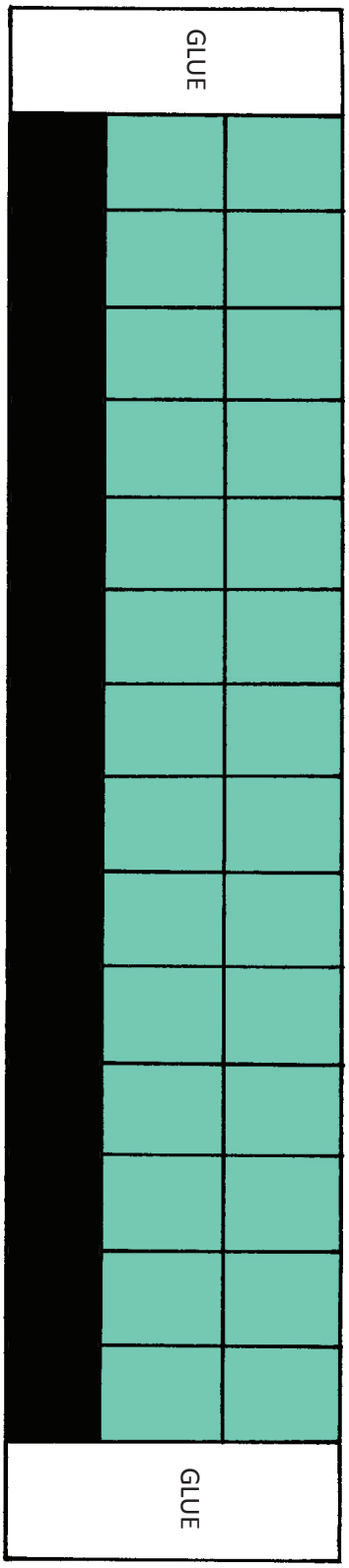




These patterns were developed completely from scratch by Ellen McHenry and have no connection to the official Alexander Arrangement. To see (or to purchase) the official model of Alexander's arrangement, visit allperiodictables.com.

COPY THIS PAGE ONTO CARD STOCK





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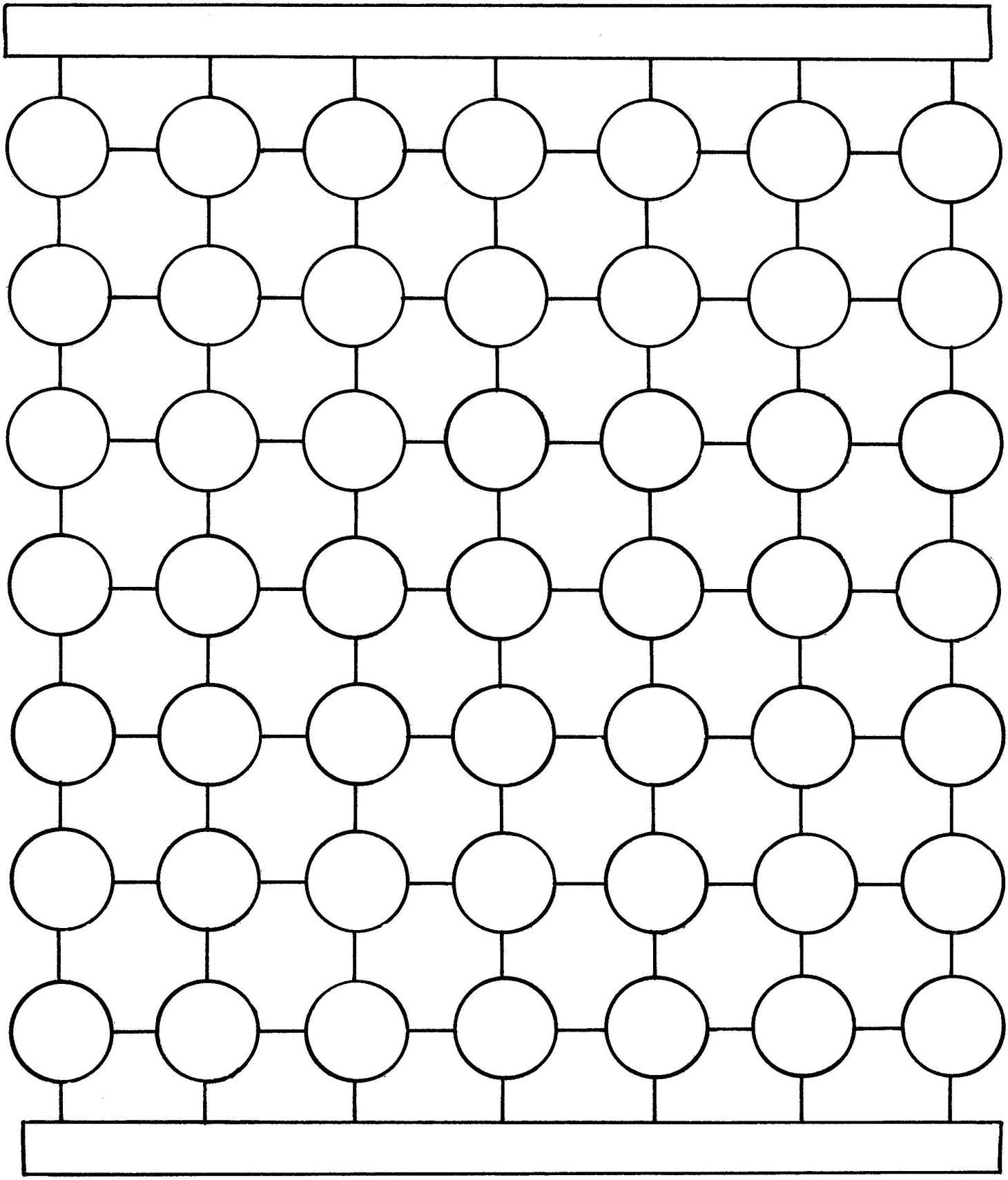
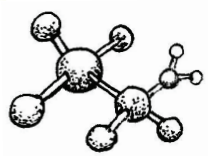
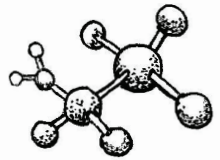
ELEMENT CONNECTIONS



Fill in each circle with the symbol of an element. Use only the elments in the rows that begin with H, Li, Na, K, Rb, and Cs. Don't use any lanthanides or actinides.)





_____
name

recited the Periodic Table from memory (up to the element indicated)

on _____
date

_____
signature of supervisor

H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	*La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	†Ac	Rf	Db	Sg	Bh	Hs	Mt									

*	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
†	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr