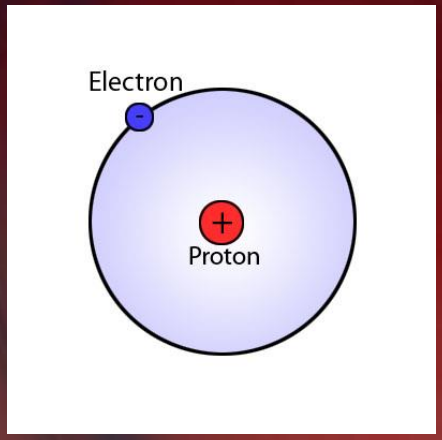
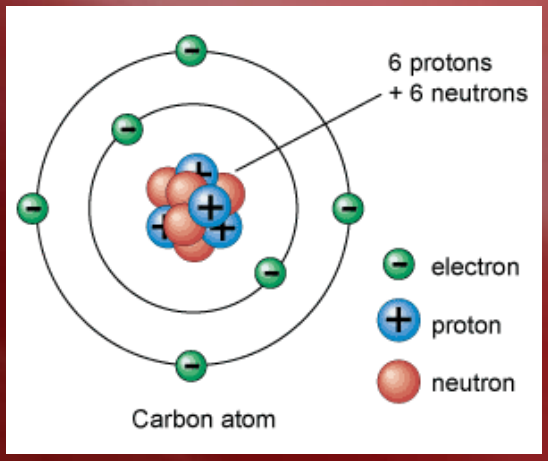
Atoms, Elements & Matter

Atoms -

The basic unit of matter. All atoms are made up of protons (+), electrons (-) and neutral neutrons.



atom of hydrogen



atom of carbon

Elements -

A substance made up of only one kind of atom that cannot be broken down further.

Each element has a symbol that can be used to identify it.

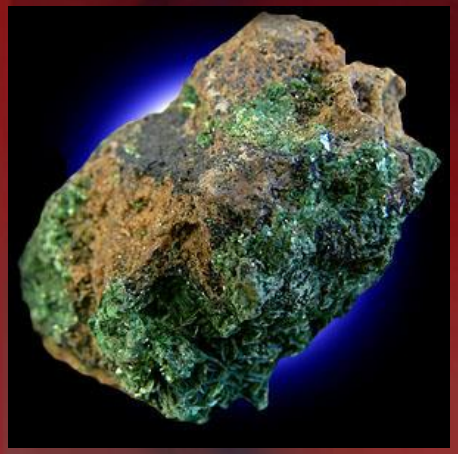
There are 92 naturally occurring elements in the world.

Examples of Elements

gold (Au)

mercury (Hg)

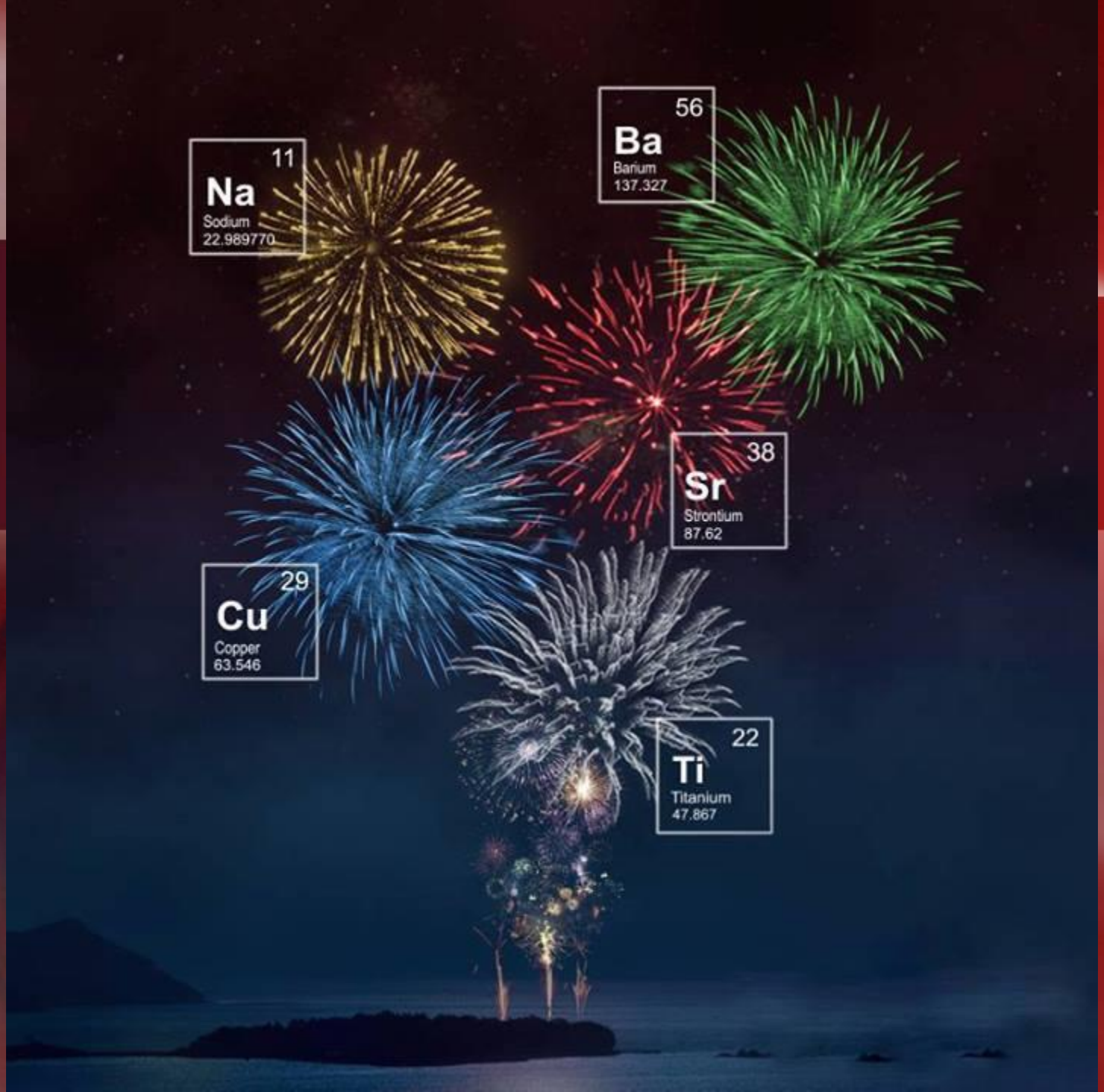
argon (Ar)



uranium (U)

platinum (Pt)

carbon (C)


11
Na
Sodium
22.989770
56
Ba
Barium
137.327
38
Sr
Strontium
87.62
29
Cu
Copper
63.546
22
Ti
Titanium
47.867

Physical Change -

A change that affects only the physical properties of something.

Ex of physical change -

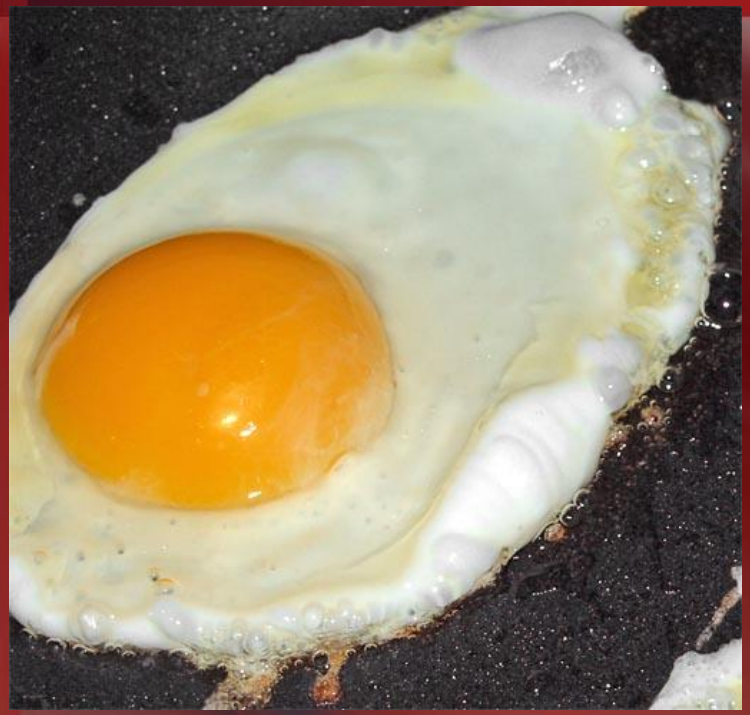
Bending, melting, freezing, dissolving, cutting, boiling.

Chemical Change -

A change that creates a totally new substance.

Ex of chemical change -

Burning, baking, rusting, fizzing, foaming, etc.



Mixtures -

When two or more substances are combined without a chemical reaction.

This means that mixtures involve a physical change.

Examples of mixtures -

Saltwater and Kool-aid.

Compounds -

A substance made up of two or more elements chemically combined.

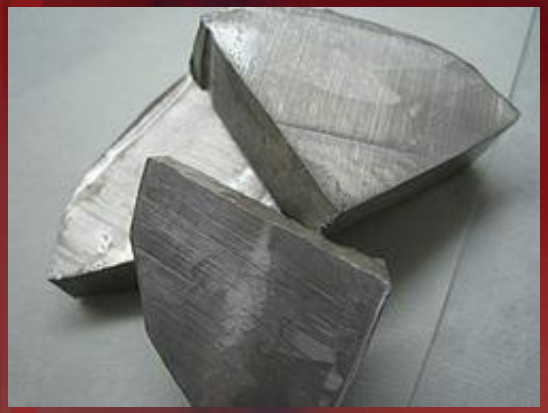
A compound makes something new, meaning it is a chemical change.

For example, hydrogen is a gas at room temperature that will catch fire. Oxygen is also a gas at room temperature that will catch on fire. What compound do two hydrogen atoms and one oxygen atom make?

Water (H_2O)

Water is a liquid at room temperature that puts out fires.

Sodium is a silver metal that burns when it gets wet. Chlorine is a poisonous gas. When you add one atom of sodium to one atom of chlorine what do you get?



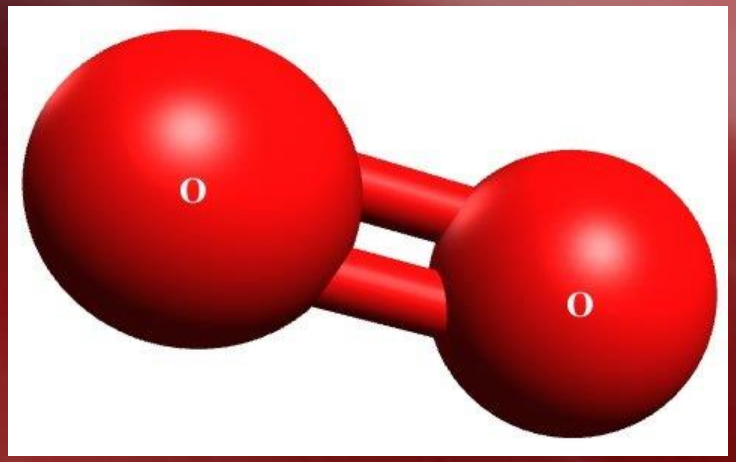
Salt (NaCl)

Molecule -

Two or more atoms chemically combined.

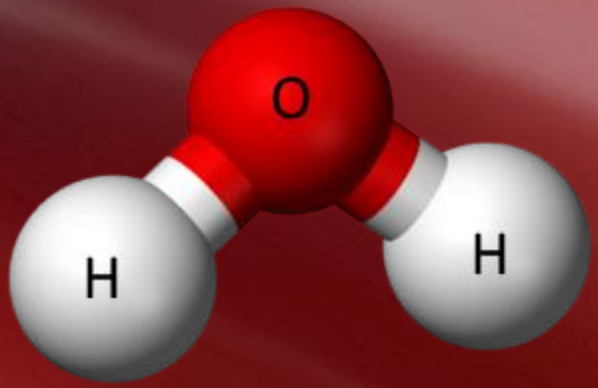
You can have a molecule of an element.

Ex. Oxygen gas (O_2)



You can have a molecule of a compound.

Ex. Water (H_2O)



One color = Element

Not connected = Mixture

Two or more colors connected = Compound

Put atoms in pan. Take apart each time.

Solubility -

How easily a substance can dissolve.

Soluble substances:

Dissolve easily.

Ex. Sugar and salt in water.

Insoluble substances:

<u>Do not dissolve</u> at all.
Ex. Sand and oil in water.

Solution -

A mixture where one or more substances is totally dissolved in another.

Solutions never settle out.

Ex of a solution -

Salt water and air.

Solute -

The substance or substances being dissolved. (Always less.)

Solvent -

The substance doing the dissolving. (Always more.)

Ex. Red food coloring goes into water. Name the solute and solvent.

The solute is food coloring.
The solvent is water.

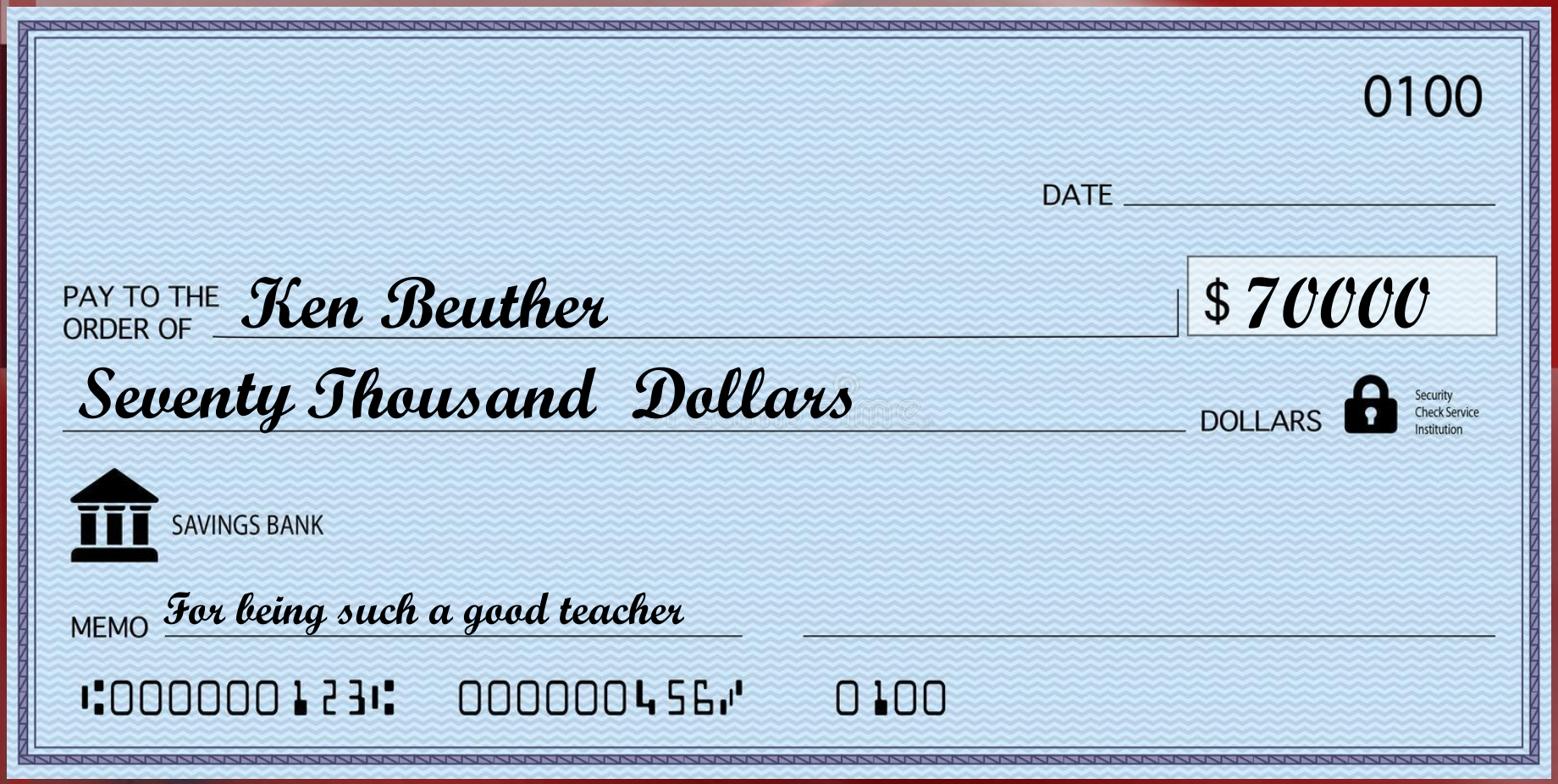
Ex. Kool aid is made from sugar, flavoring and water. Name the solutes and solvent.

The solutes are sugar and flavoring. Water is the solvent.

Usually, as a liquid solvent gets warmer:

It holds more solute. It holds less as it gets colder.

Rock candy


0100
DATE
PAY TO THE ORDER OF
Ken Beuther
$ 70000
Seventy Thousand Dollars
DOLLARS
Security Check Service Institution
SAVINGS BANK
MEMO
For being such a good teacher
⑈000000123⑈ 000000456⑈ 0100

Suspension -

A mixture of a liquid and solid where the solid will settle out over time.

Ex of a suspension -

Snow globes.

Colloid -

A mixture where the substance is not dissolved but is too small to settle out.

Ex of a colloid -

Fog in air, bubbles in pop.

The bubbles stay as long as the pop isn't opened.

A beam of light will show in a colloid and suspension, but not in a solution.

Law of Conservation of Matter -

The total amount of matter cannot change, even with chemical or physical changes.

When mixtures or compounds are formed, the number of atoms does not change. So, the mass does not change.

For example (physical change):

+

+

=

100 g of sugar

600 g of water

10 g of grape flavor

710 grams of Kool-Aid

For example (chemical change):

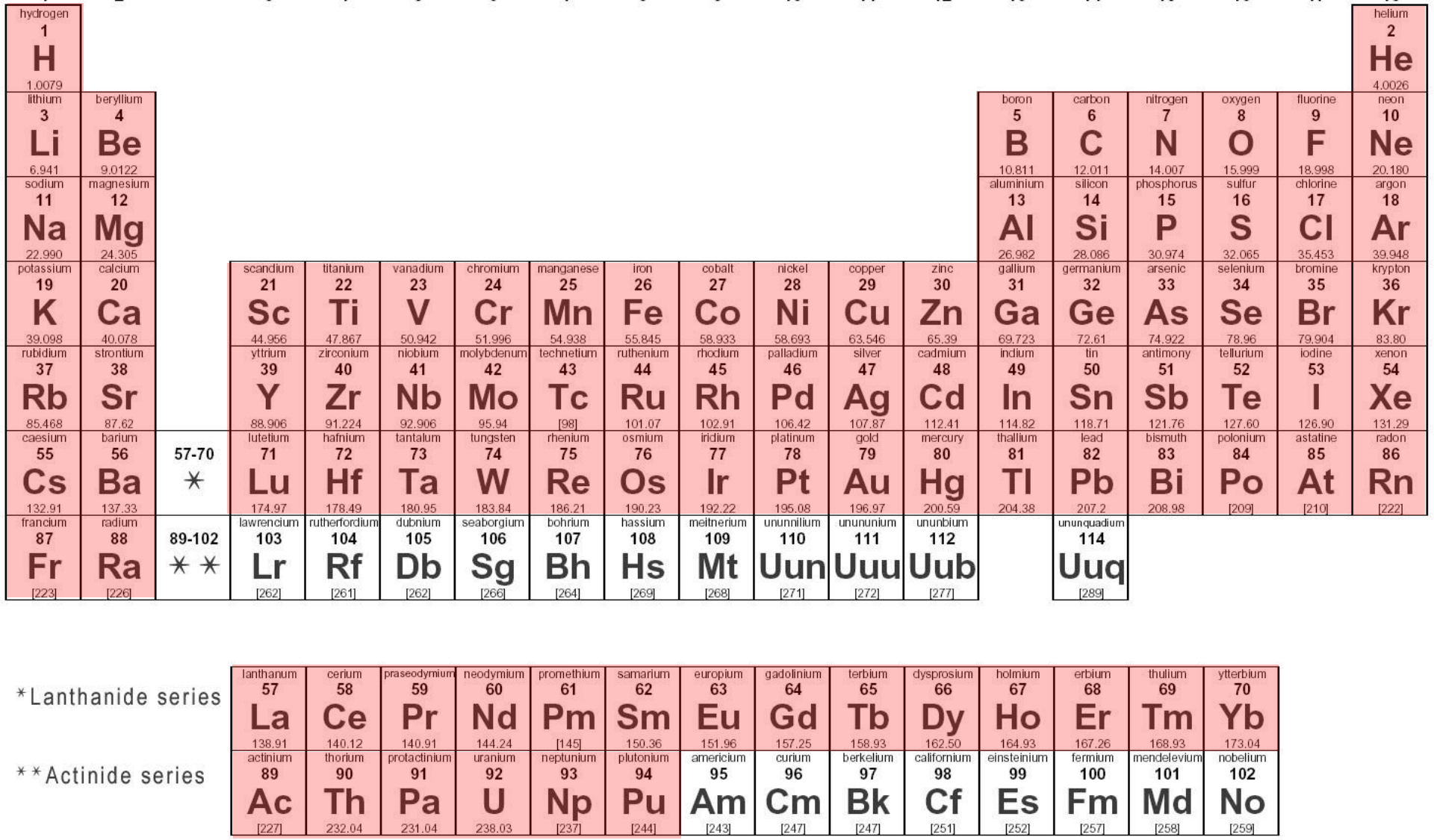
Cremating a 100 pound body will make...

Exactly 100 pounds of ashes and smoke.

The Periodic Table

The Periodic Table -

A table where all of the elements in the world are grouped according to their properties.



There are 94 naturally occurring elements.

How are the elements arranged on the Periodic Table? -

By the number of protons, from small to large.

How many protons does oxygen (O) have? How many protons does the element has.

hydrogen 1 H 1.0079																	helium 2 He 4.0026
lithium 3 Li 6.941	beryllium 4 Be 9.0122											boron 5 B 10.811	carbon 6 C 12.011	nitrogen 7 N 14.007	oxygen 8 O 15.999	fluorine 9 F 18.998	neon 10 Ne 20.180
sodium 11 Na 22.990	magnesium 12 Mg 24.305											aluminium 13 Al 26.982	silicon 14 Si 28.086	phosphorus 15 P 30.974	sulfur 16 S 32.065	chlorine 17 Cl 35.453	argon 18 Ar 39.948
potassium 19 K 39.098	calcium 20 Ca 40.078		scandium 21 Sc 44.956	titanium 22 Ti 47.867	vanadium 23 V 50.942	chromium 24 Cr 51.996	manganese 25 Mn 54.938	iron 26 Fe 55.845	cobalt 27 Co 58.933	nickel 28 Ni 58.693	copper 29 Cu 63.546	zinc 30 Zn 65.39	gallium 31 Ga 69.723	germanium 32 Ge 72.61	arsenic 33 As 74.922	selenium 34 Se 78.96	bromine 35 Br 79.904	krypton 36 Kr 83.80
rubidium 37 Rb 85.468	strontium 38 Sr 87.62		yttrium 39 Y 88.906	zirconium 40 Zr 91.224	niobium 41 Nb 92.906	molybdenum 42 Mo 95.94	technetium 43 Tc [98]	ruthenium 44 Ru 101.07	rhodium 45 Rh 102.91	palladium 46 Pd 106.42	silver 47 Ag 107.87	cadmium 48 Cd 112.41	indium 49 In 114.82	tin 50 Sn 118.71	antimony 51 Sb 121.76	tellurium 52 Te 127.60	iodine 53 I 126.90	xenon 54 Xe 131.29
caesium 55 Cs 132.91	barium 56 Ba 137.33	57-70 *	lutetium 71 Lu 174.97	hafnium 72 Hf 178.49	tantalum 73 Ta 180.95	tungsten 74 W 183.84	rhenium 75 Re 186.21	osmium 76 Os 190.23	iridium 77 Ir 192.22	platinum 78 Pt 195.08	gold 79 Au 196.97	mercury 80 Hg 200.59	thallium 81 Tl 204.38	lead 82 Pb 207.2	bismuth 83 Bi 208.98	polonium 84 Po [209]	astatine 85 At [210]	radon 86 Rn [222]
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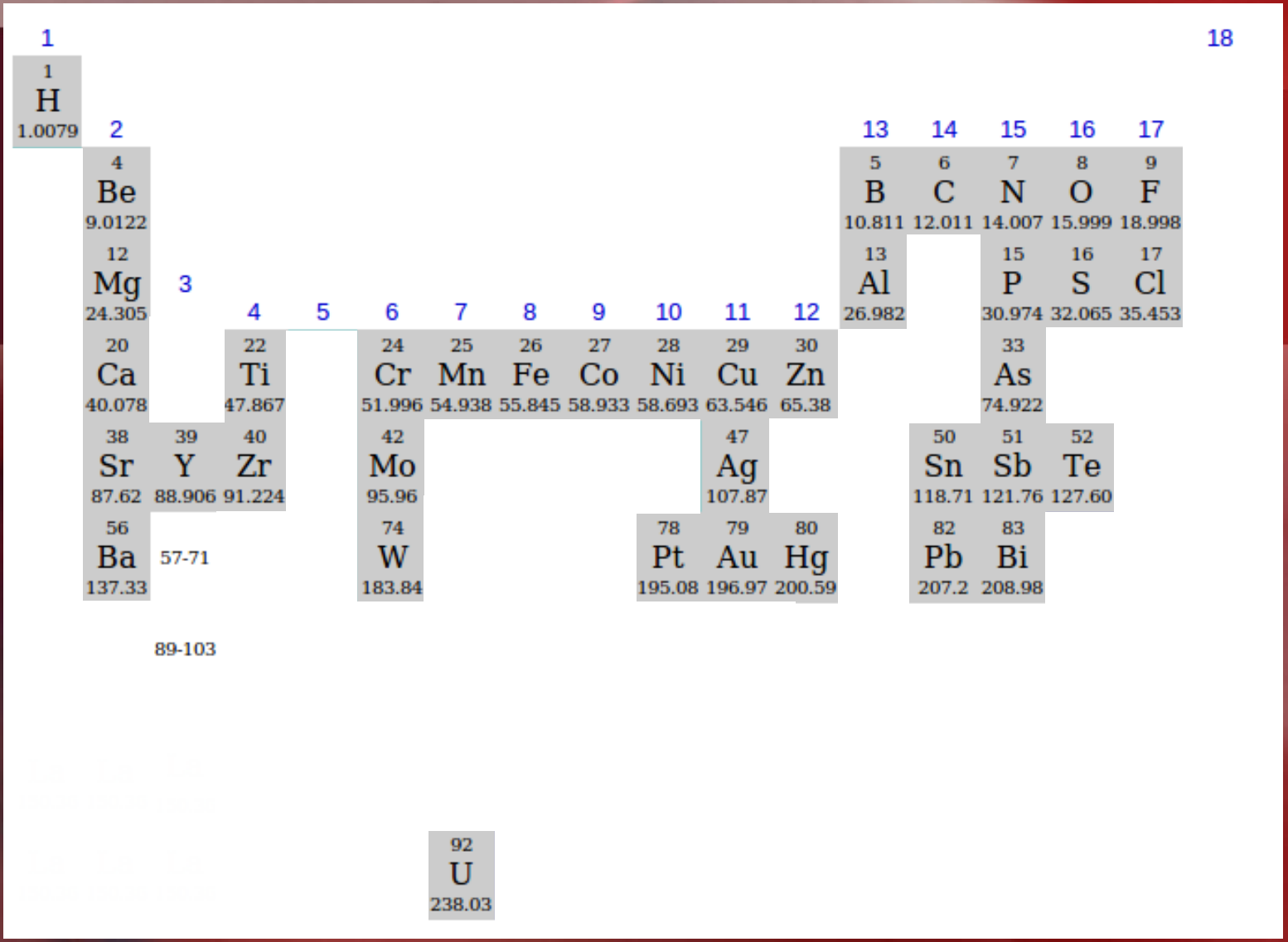
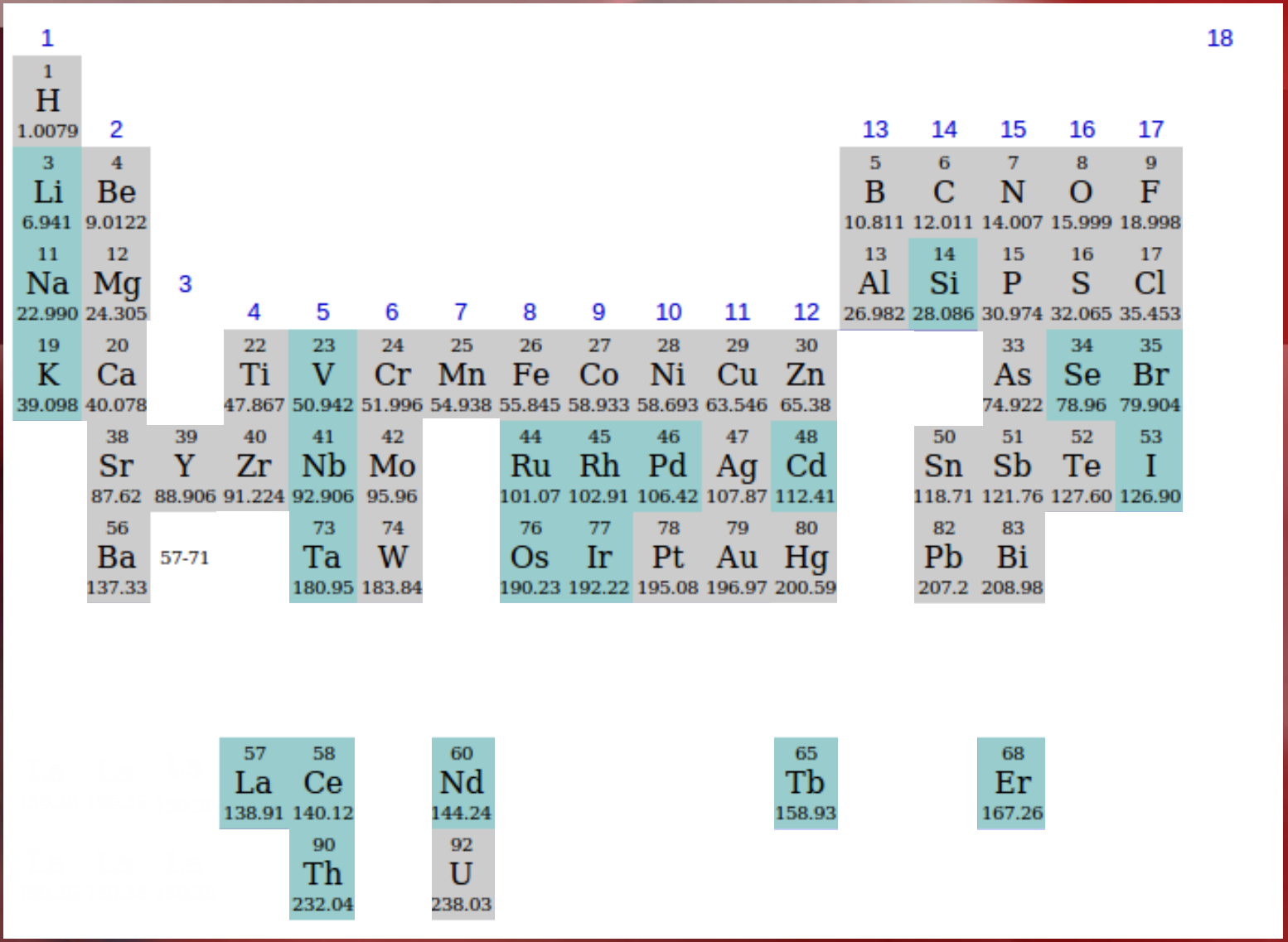
The elements were not all discovered at the same time. So, just like with the activity you did, scientists had an incomplete periodic table for many years. They used it to predict what the undiscovered elements had to be like.

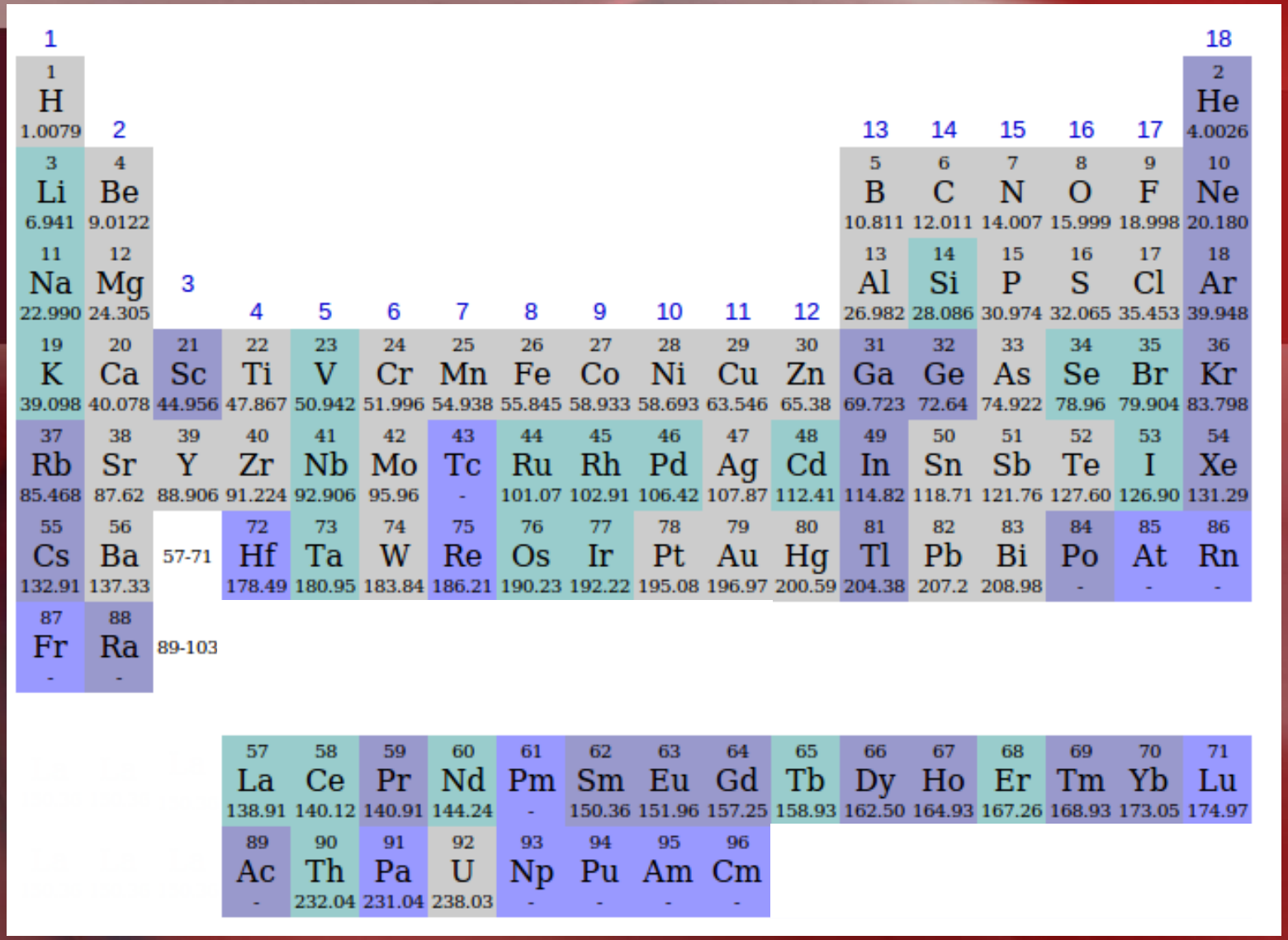
Only 38 elements were discovered before 1800.



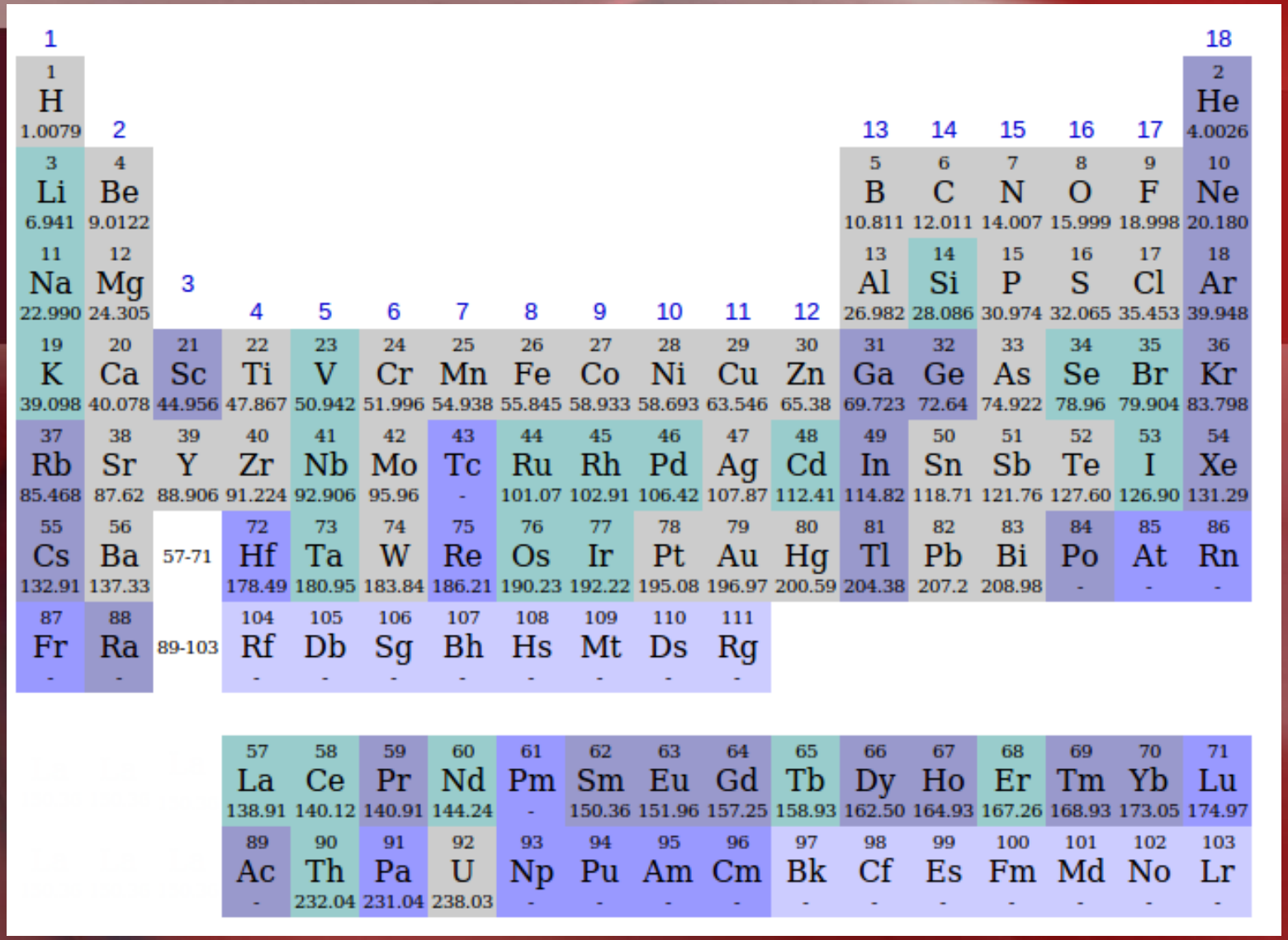
From 1800 to 1849 22 more elements were discovered.



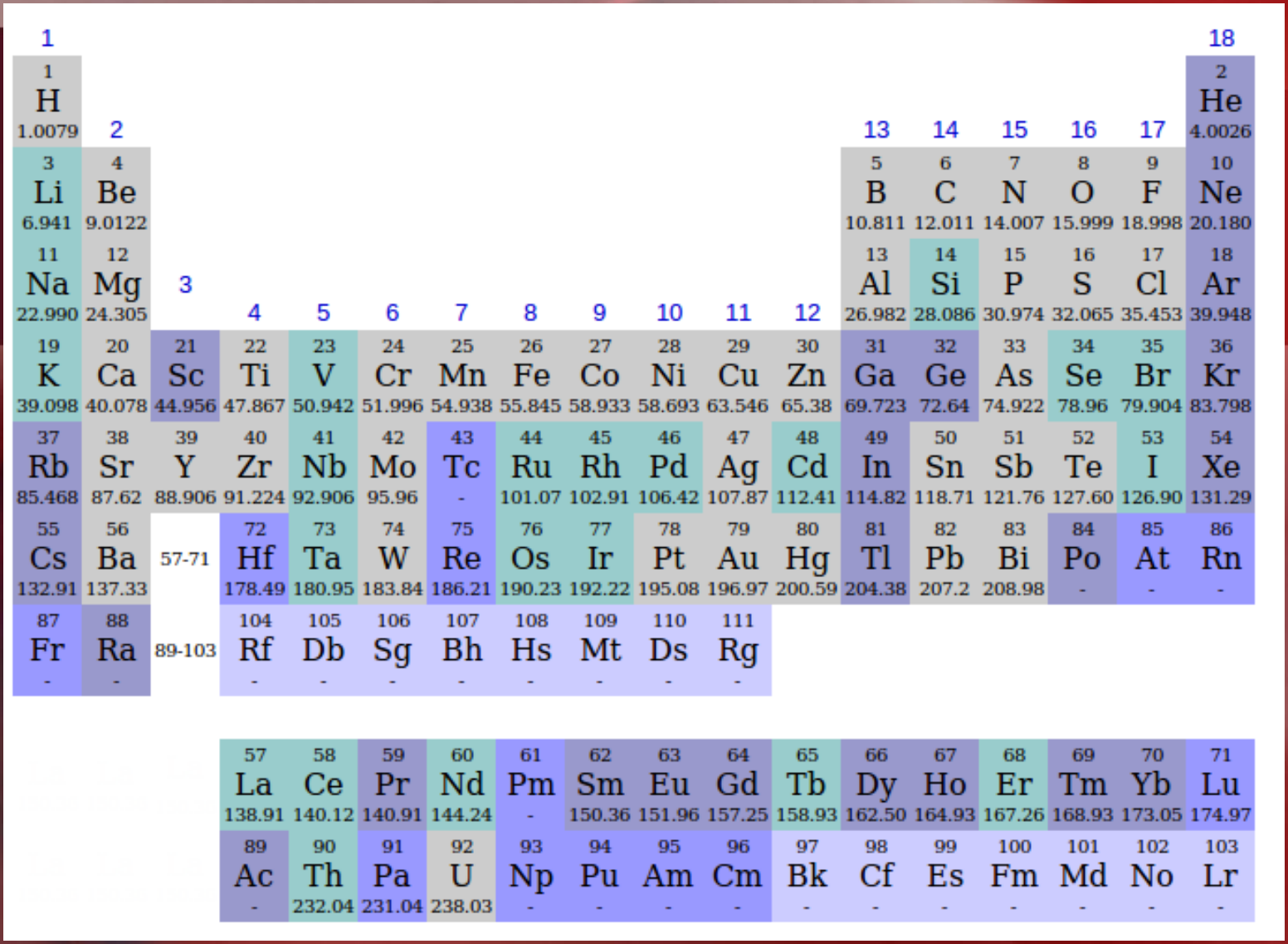
From 1850 to 1949 36 more elements were discovered.



From 1950 to 1999 15 more elements were discovered.



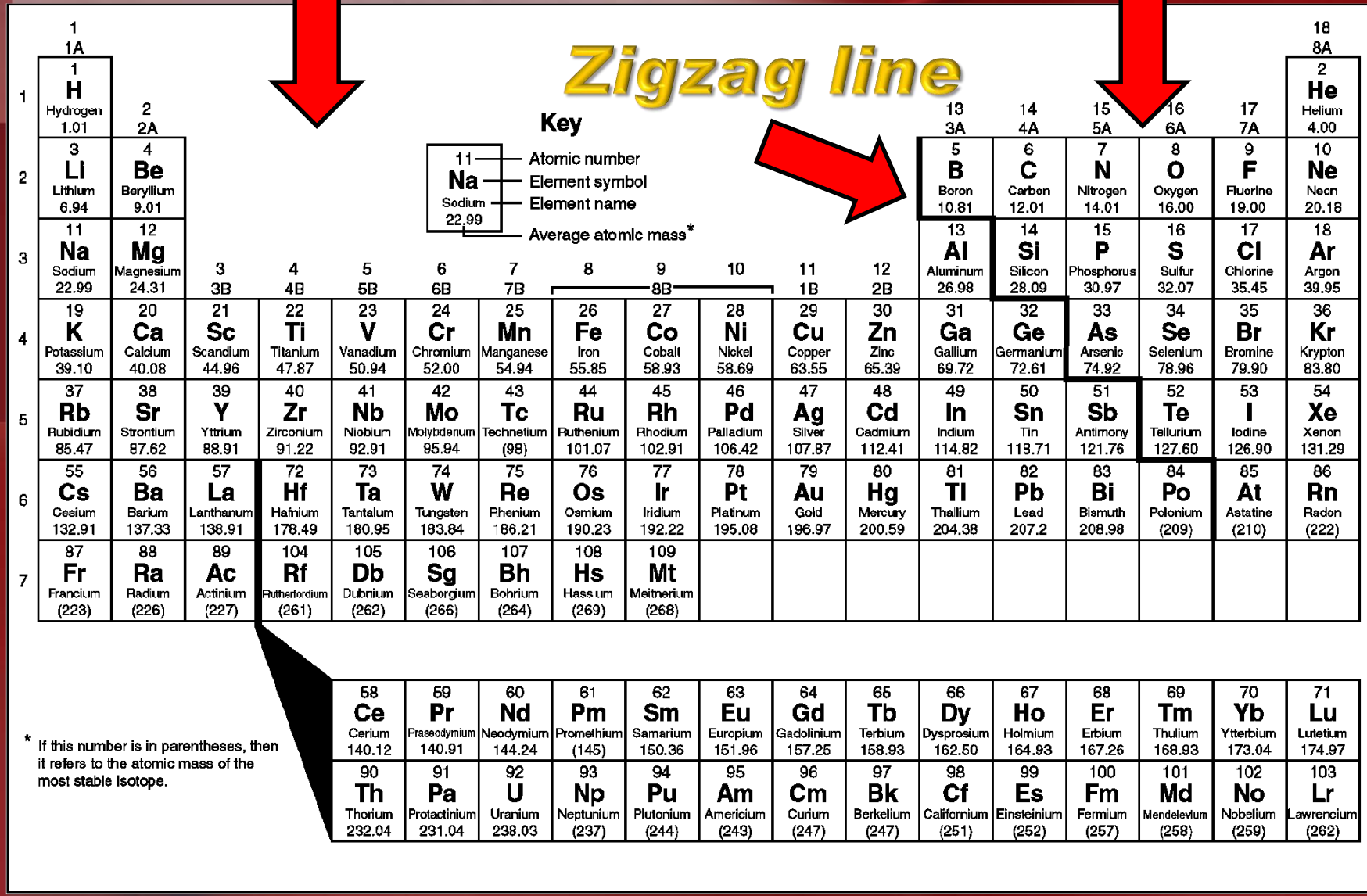
If a new element gets discovered, how many protons is it likely to have?.



Metals

Nonmetals

Zigzag line



* If this number is in parentheses, then it refers to the atomic mass of the most stable isotope.

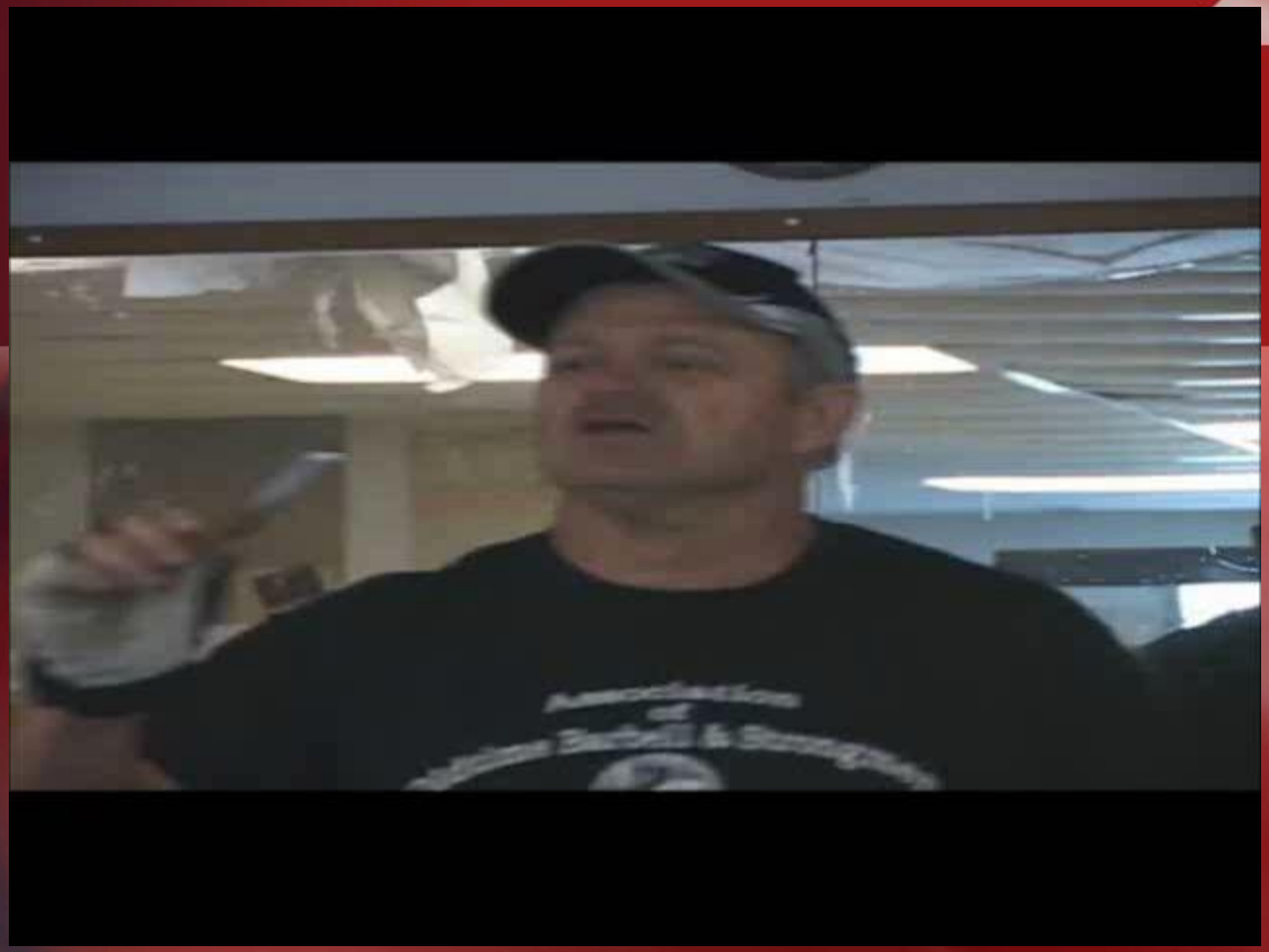
Properties of metals -

1. Most are solid at room temperature.

Properties of metals -

2. Malleable (bendable).

Bending iron.

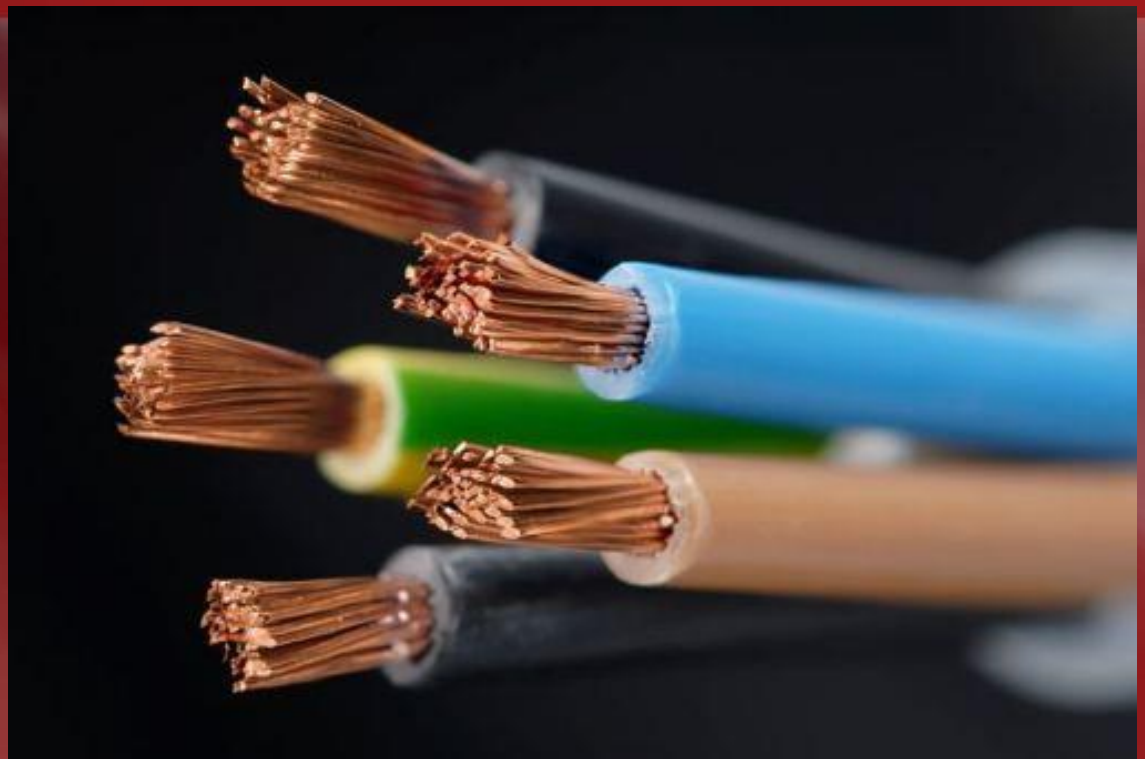


Properties of metals -

3. High melting points.

Properties of metals -

4. Good conductors of heat and electricity.



Electric fence fail.

Properties of nonmetals -

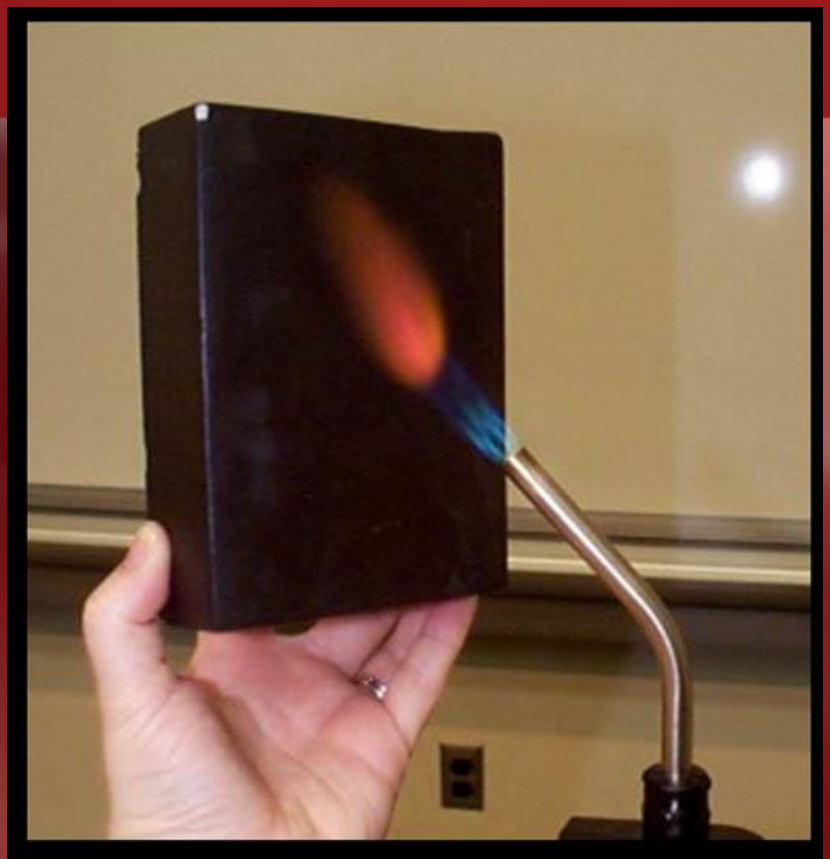
1. Most are gasses at room temperature.

Properties of nonmetals -

2. Solids are dull and brittle.

Properties of nonmetals -

3. Poor conductors of heat and electricity.

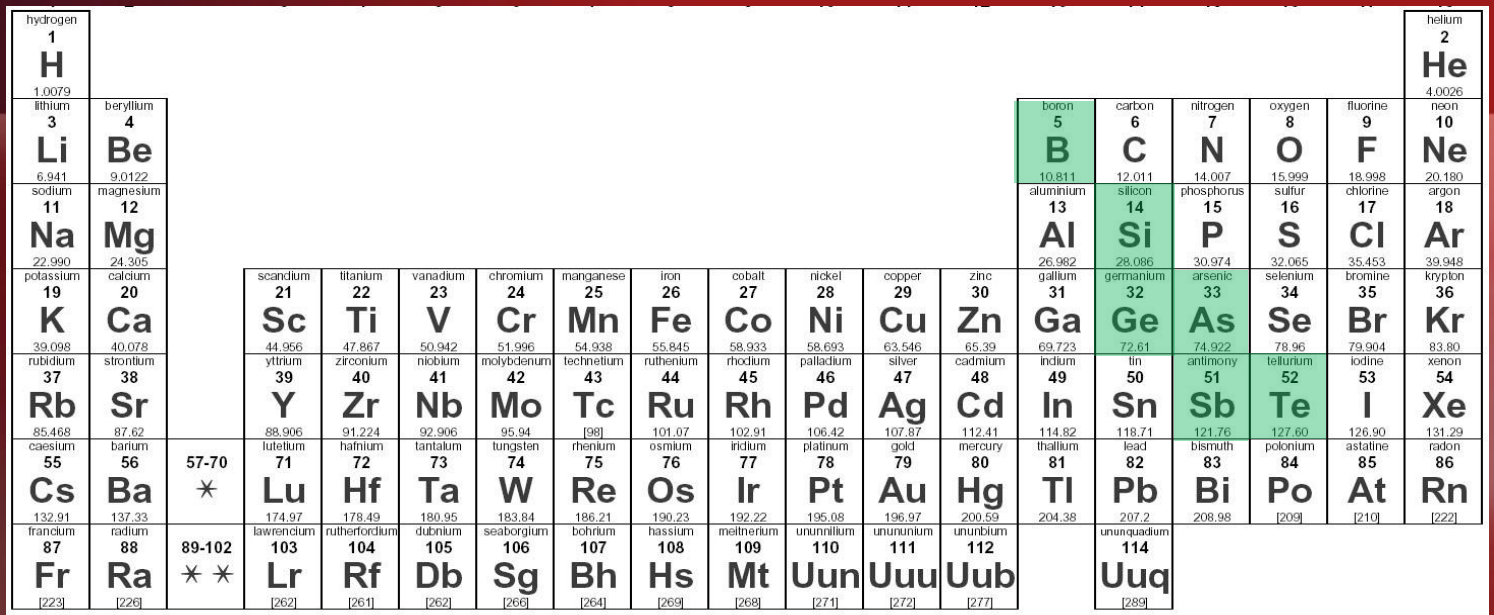


Nonmetals are used to make the heat shield of the space shuttles because even though the atmosphere rubbing against the shuttle makes tremendous heat, the shuttle is protected because of the poor conductivity of the nonmetal.


KEITH

Metalloids -

Elements with some of the properties of metals and nonmetals.



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Let's look at some of the families or groups of elements on the Periodic Table.

What determines the family or group of elements on the Periodic Table? -

By their properties.

Where are families or groups found on the Periodic Table? -

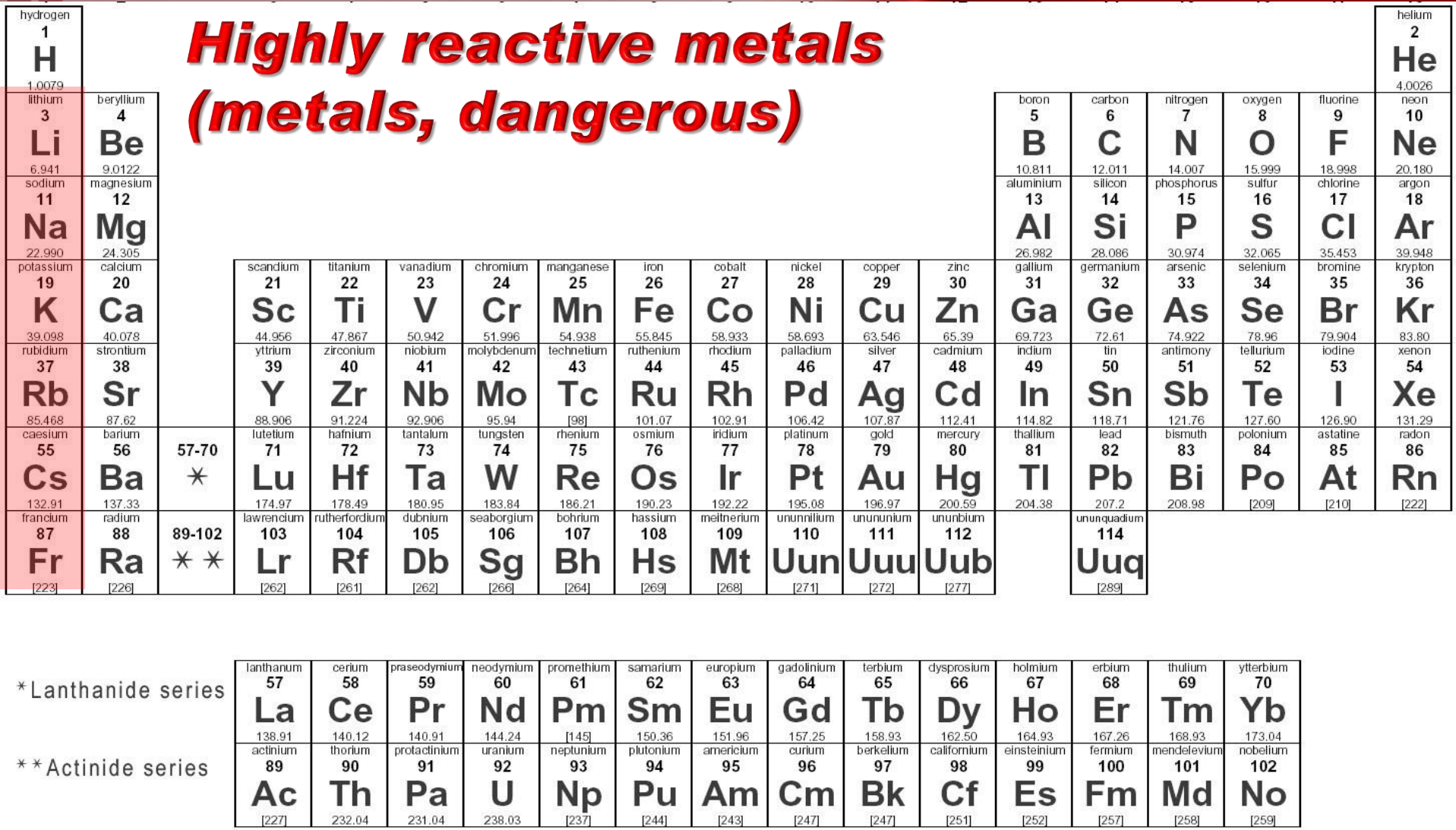
In rows or columns (up and down).

Highly Reactive Metals Family or Group -

1. Also called “alkali metals”.
2. These silvery metals react quickly, so they are dangerous.
3. Examples are sodium (Na) and potassium (K).

Sodium reacting to water.

Highly reactive metals (metals, dangerous)



Less Reactive Metals Family or Group -

1. Also called “transition metals”.
2. Tend to be very hard and do not react, so they are safe.
3. Examples are iron (Fe) and copper (Cu).

The strength of steel, which is made from iron.

Less reactive metals (metals, safe)

hydrogen 1 H 1.0079												boron 5 B 10.811	carbon 6 C 12.011	nitrogen 7 N 14.007	oxygen 8 O 15.999	fluorine 9 F 18.998	helium 2 He 4.0026
lithium 3 Li 6.941	beryllium 4 Be 9.0122											aluminium 13 Al 26.982	silicon 14 Si 28.086	phosphorus 15 P 30.974	sulfur 16 S 32.065	chlorine 17 Cl 35.453	neon 10 Ne 20.180
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potassium 19 K 39.098	calcium 20 Ca 40.078	scandium 21 Sc 44.956	titanium 22 Ti 47.867	vanadium 23 V 50.942	chromium 24 Cr 51.996	manganese 25 Mn 54.938	iron 26 Fe 55.845	cobalt 27 Co 58.933	nickel 28 Ni 58.693	copper 29 Cu 63.546	zinc 30 Zn 65.39	gallium 31 Ga 69.723	germanium 32 Ge 72.61	arsenic 33 As 74.922	selenium 34 Se 78.96	bromine 35 Br 79.904	krypton 36 Kr 83.80
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Nonreactive Gasses Family or Group -

1. Also called "noble".
2. Tend not to react so are safe
3. These are a gas at room temperature.
4. Examples are helium (He) and neon (Ne).

Noble gasses (gasses, safe)

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sodium 11 Na 22.990	magnesium 12 Mg 24.305											aluminium 13 Al 26.982	silicon 14 Si 28.086	phosphorus 15 P 30.974	sulfur 16 S 32.065	chlorine 17 Cl 35.453	argon 18 Ar 39.948
potassium 19 K 39.098	calcium 20 Ca 40.078	scandium 21 Sc 44.956	titanium 22 Ti 47.867	vanadium 23 V 50.942	chromium 24 Cr 51.996	manganese 25 Mn 54.938	iron 26 Fe 55.845	cobalt 27 Co 58.933	nickel 28 Ni 58.693	copper 29 Cu 63.546	zinc 30 Zn 65.39	gallium 31 Ga 69.723	germanium 32 Ge 72.61	arsenic 33 As 74.922	selenium 34 Se 78.96	bromine 35 Br 79.904	krypton 36 Kr 83.80
rubidium 37 Rb 85.468	strontium 38 Sr 87.62	yttrium 39 Y 88.906	zirconium 40 Zr 91.224	niobium 41 Nb 92.906	molybdenum 42 Mo 95.94	technetium 43 Tc [98]	ruthenium 44 Ru 101.07	rhodium 45 Rh 102.91	palladium 46 Pd 106.42	silver 47 Ag 107.87	cadmium 48 Cd 112.41	indium 49 In 114.82	tin 50 Sn 118.71	antimony 51 Sb 121.76	tellurium 52 Te 127.60	iodine 53 I 126.90	xenon 54 Xe 131.29
caesium 55 Cs 132.91	barium 56 Ba 137.33	57-70 *	lutetium 71 Lu 174.97	hafnium 72 Hf 178.49	tantalum 73 Ta 180.95	tungsten 74 W 183.84	rhenium 75 Re 186.21	osmium 76 Os 190.23	iridium 77 Ir 192.22	platinum 78 Pt 195.08	gold 79 Au 196.97	mercury 80 Hg 200.59	thallium 81 Tl 204.38	lead 82 Pb 207.2	bismuth 83 Bi 208.98	polonium 84 [209]	astatine 85 [210]	radon 86 [222]
francium 87 Fr [223]	radium 88 Ra [226]	89-102 **	lawrencium 103 Lr [262]	rutherfordium 104 Rf [261]	dubnium 105 Db [262]	seaborgium 106 Sg [266]	bohrium 107 Bh [264]	hassium 108 Hs [269]	meitnerium 109 Mt [268]	ununnilium 110 Uun [271]	ununnunium 111 Uuu [272]	ununbium 112 Uub [277]		ununquadium 114 Uuq [289]			

*Lanthanide series	lanthanum 57 La 138.91	cerium 58 Ce 140.12	praseodymium 59 Pr 140.91	neodymium 60 Nd 144.24	promethium 61 Pm [145]	samarium 62 Sm 150.36	europium 63 Eu 151.96	gadolinium 64 Gd 157.25	terbium 65 Tb 158.93	dysprosium 66 Dy 162.50	holmium 67 Ho 164.93	erbium 68 Er 167.26	thulium 69 Tm 168.93	ytterbium 70 Yb 173.04
**Actinide series	actinium 89 Ac [227]	thorium 90 Th 232.04	protactinium 91 Pa 231.04	uranium 92 U 238.03	neptunium 93 Np [237]	plutonium 94 Pu [244]	americium 95 Am [243]	curium 96 Cm [247]	berkelium 97 Bk [247]	californium 98 Cf [251]	einsteinium 99 Es [252]	fermium 100 Fm [257]	mendelevium 101 Md [258]	nobelium 102 No [259]

The Hindenburg caught fire because instead of using a nonreactive gas like helium, they used hydrogen.


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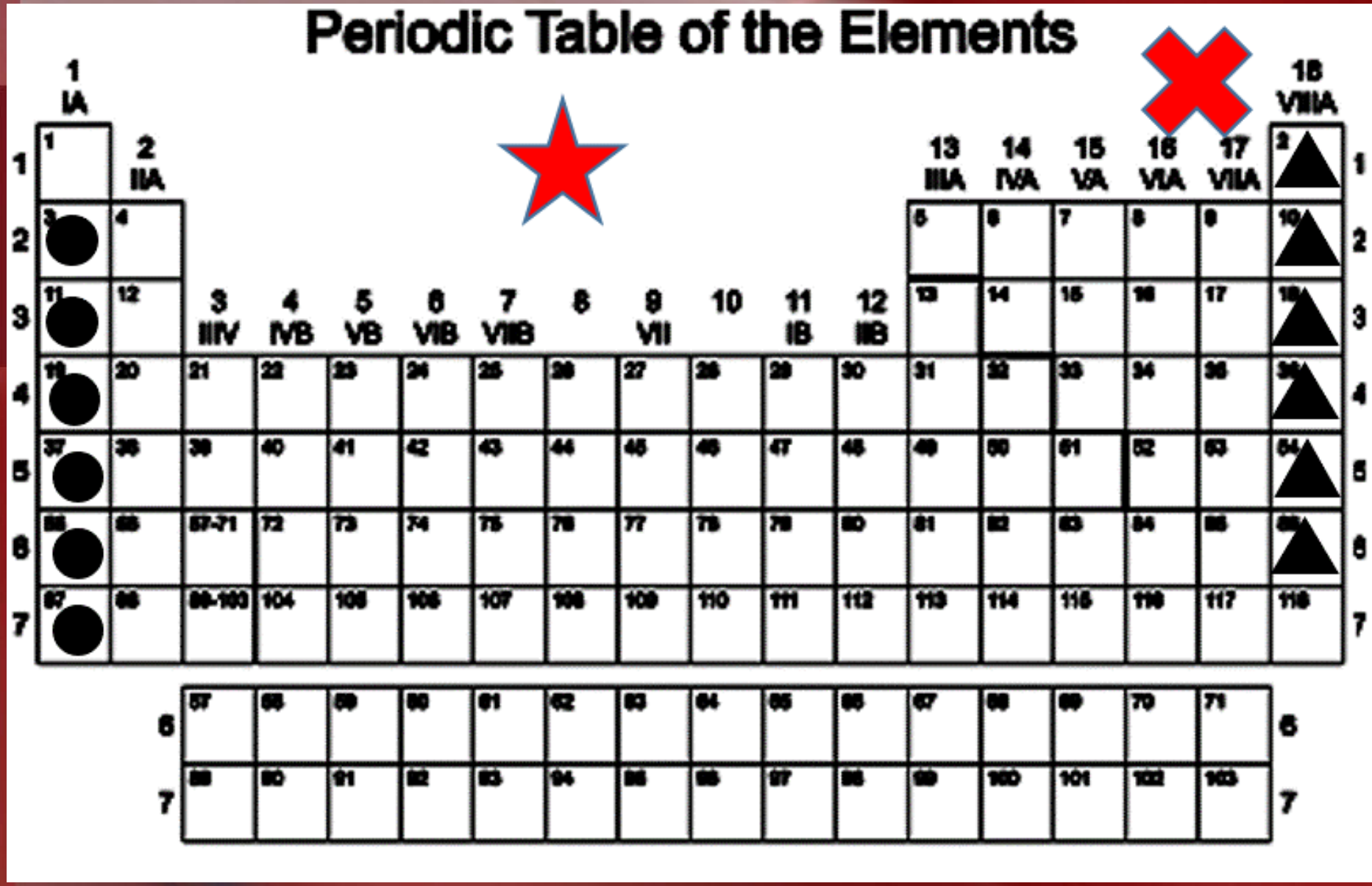
Periodic Table of the Elements
1 IA
2 IIA
3 IIIV
4 IVB
5 VB
6 VIB
7 VIIB
8
9 VII
10
11 IB
12 IIB
13 IIIA
14 IVA
15 VA
16 VIA
17 VIIA
18 VIIIA

Acids and Bases

pH scale -

A measure of how acidic or basic something is. The scale ranges from 0 to 14.

Acidic -

Something with a pH below 7. The lower the number, the stronger the acid.

Ex. of an acid -

Vinegar, lemon juice, pop.

Basic -

Something with a pH above 7. The higher the number, the stronger the base.

Ex. of a base -

Ammonia, bleach, tums, Alka Seltzer

Neutral -

Anything with a pH of exactly 7.

Ex. of a neutral substance -

Pure water.

Indicator -

A compound that changes color in either an acid or base.

What happens when an acid and base mix?

They neutralize each other.

0 (battery acid)

1 (sulfuric acid)

2 (vinegar)

3 (pop)

4 (acid rain)

5 (black coffee)

6 (urine, milk)

7 (pure water)

8 (seawater)

9 (baking soda)

10 (milk of magnesia)

11 (ammonia)

12 (bleach)

13 (oven cleaner)

14 (Drano)