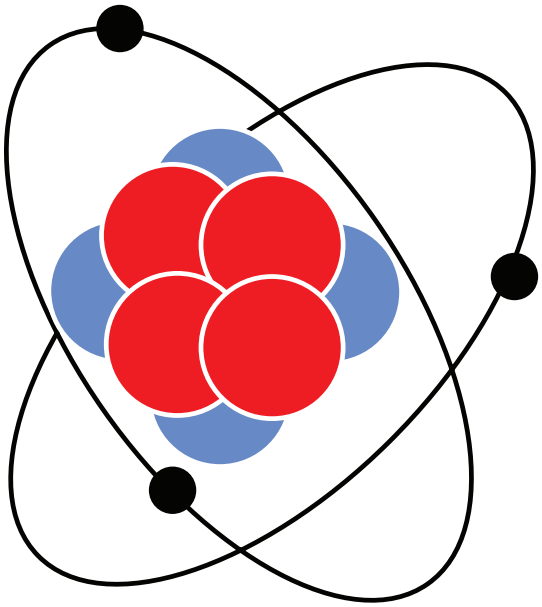
It's Elemental

5th Grade

1	→ Atomic Number
1.00794	→ Atomic Mass
H	→ Symbol
Hydrogen	→ Name



1 1.00794 H Hydrogen											
3 6.941 Li Lithium	4 9.012182 Be Beryllium										
11 22.98977 Na Sodium	12 24.3050 Mg Magnesium										
19 39.0983 K Potassium	20 40.078 Ca Calcium	21 44.9559 Sc Scandium	22 47.867 Ti Titanium	23 50.9415 V Vanadium	24 51.9961 Cr Chromium	25 54.938 Mn Manganese	26 55.845 Fe Iron	27 58.9332 Co Cobalt	28 58.6934 Ni Nickel	29 63.546 Cu Copper	30 65.38 Zn Zinc
37 85.4678 Rb Rubidium	38 87.62 Sr Strontium	39 88.9059 Y Yttrium	40 91.224 Zr Zirconium	41 92.9064 Nb Niobium	42 95.96 Mo Molybdenum	43 (97.9072) Tc Technetium	44 101.07 Ru Ruthenium	45 102.9055 Rh Scandium	46 106.42 Pd Palladium	47 107.8682 Ag Silver	48 112.411 Cd Cadmium
55 132.9055 Cs Caesium	56 137.327 Ba Barium	71 174.9668 Lu Lutetium	72 178.49 Hf Hafnium	73 180.9479 Ta Tantalum	74 183.84 W Tungsten	75 186.207 Re Rhenium	76 190.23 Os Osmium	77 192.217 Ir Iridium	78 195.084 Pt Platinum	79 196.9666 Au Gold	80 200

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It's Elemental

** Has an Answer Sheet*

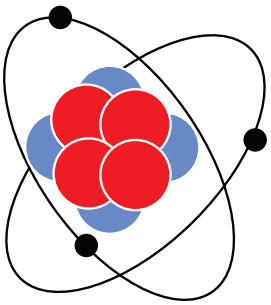
What is an Atom?

Painting of Democritus

People were thinking about atoms as early as 370 B.C.! A philosopher named Democritus believed that there must be an unbreakable particle that makes up all things. Not everyone agreed with him.

The word "atom" comes from the Greek word atomos, which means "indivisible." This was the name Democritus gave to his theoretical particle.

In the 1800s scientists knew that there were certain substances, which we now call elements, that cannot be broken down into anything simpler.

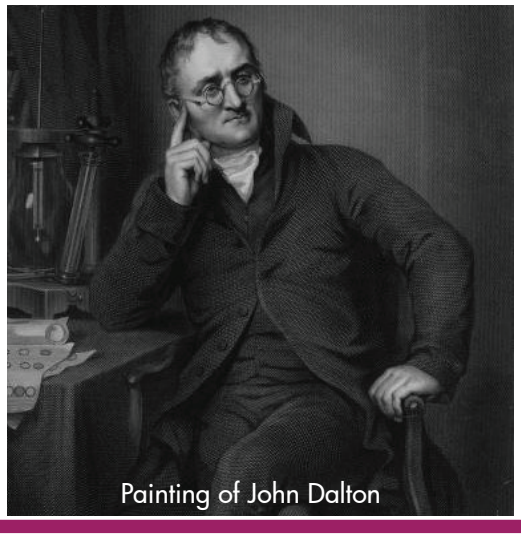


Then, a scientist named John Dalton discovered that all elements are made up of tiny particles called atoms.

As it turns out, atoms can also be broken down into smaller pieces. However, if you divide an atom of hydrogen, it won't be hydrogen any more.

This means that an atom is the smallest particle of a substance that has the same qualities of that substance.

Atoms are also made up of even smaller particles. These are known as *sub-atomic particles*, or protons, neutrons and electrons.

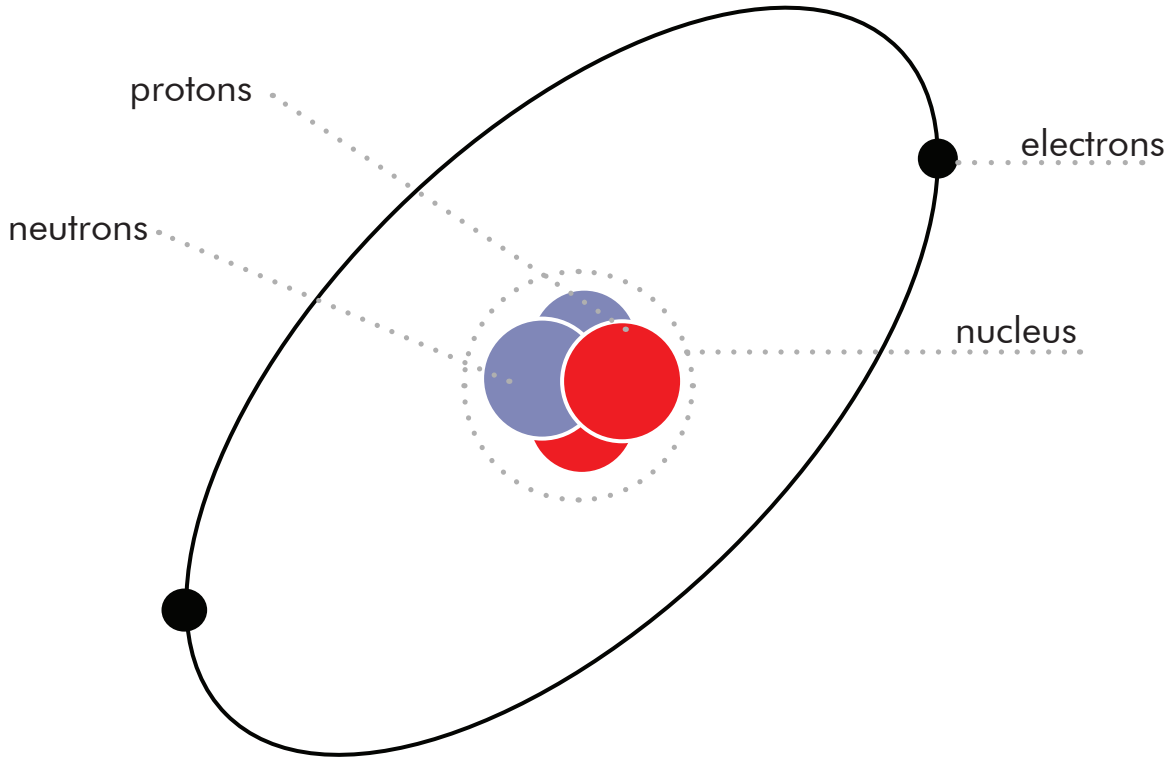


Painting of John Dalton

Diagram of an Atom

Protons : have a positive electrical charge.
Electrons : have a negative electrical charge.
Neutrons : are neutral.
Nucleus : is at the center of the atom. It is where the protons and neutrons are. The electrons swirl around the nucleus. Most of the atom's mass is in the nucleus.

Diagram of a Helium Atom



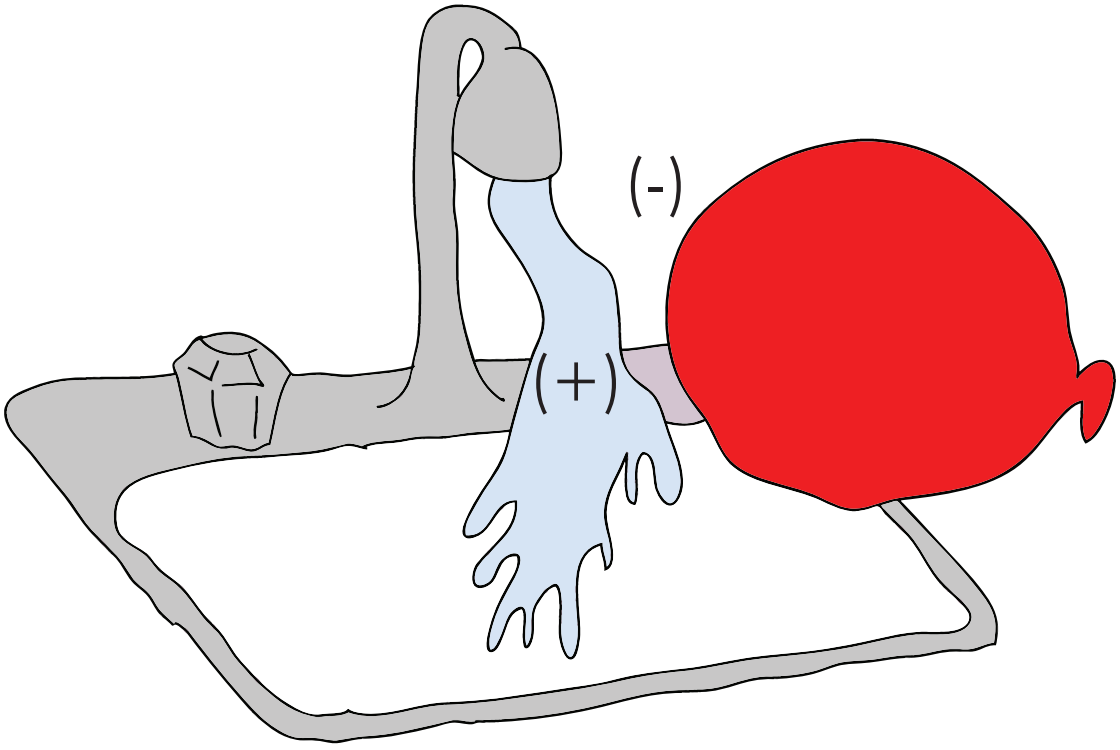
Protons and electrons are attracted to each other, but protons repel protons and electrons repel electrons. All atoms have an equal number of protons and electrons. If an atom loses or gains an electron, then it becomes an ion. An ion is an electrically charged atom.

Try This

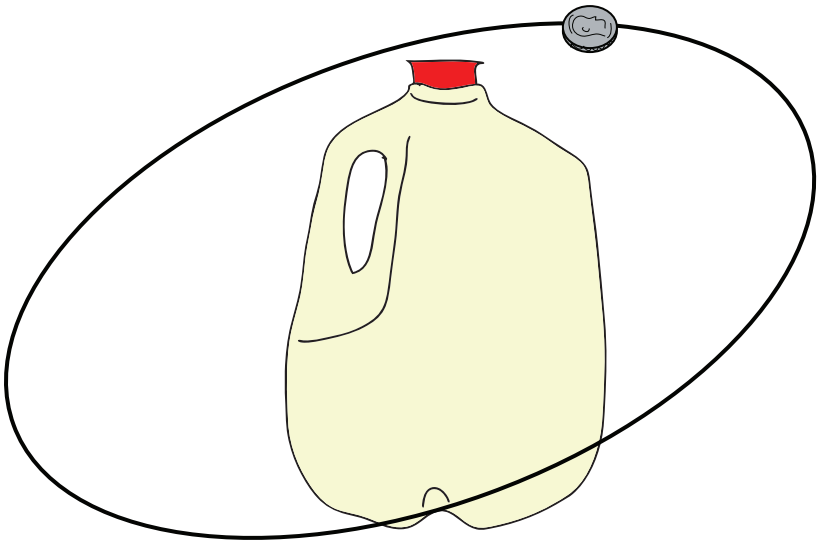
1. Get a balloon and rub it on your hair or clothes. The electrons from your hair or clothes will attach to the balloon and give it a negative (-) charge.

2. When the balloon is near the water the electrons on the negatively charged balloon move away from it. What is left is a positive(+) area of water near the balloon.

3. The positively-charged area of water and the negatively-charged balloon attract!



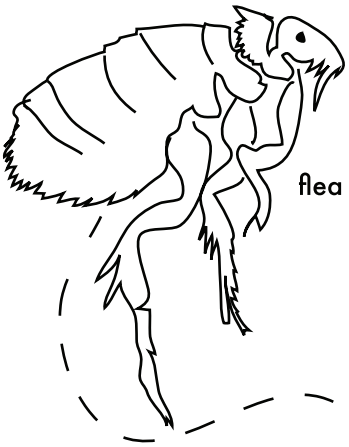
Sizing Up Atoms

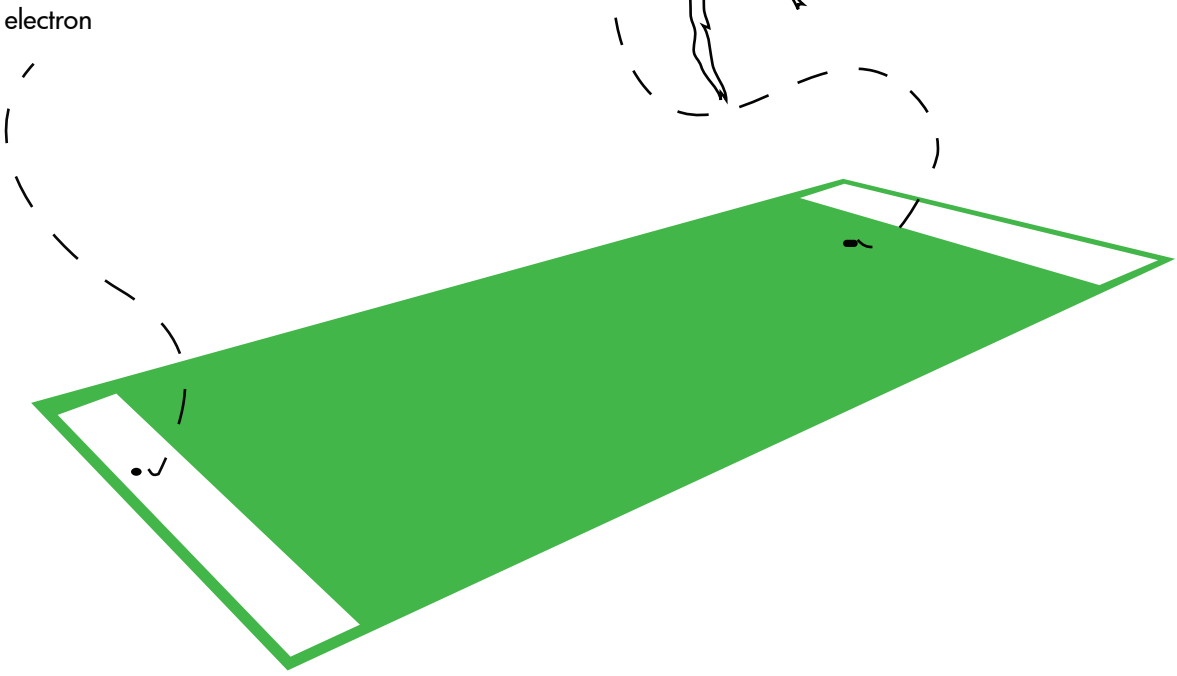


An atom is so small that about one million can fit along the width of your hair.

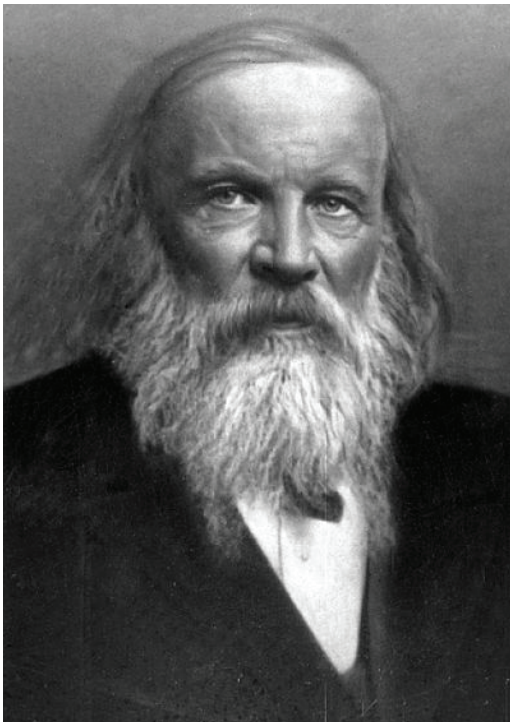
If an electron weighed the same as a dime, a proton would weigh the same as a gallon of milk!

If an atom was magnified to the size of a flea, the orbit of its electrons would be a football field away.





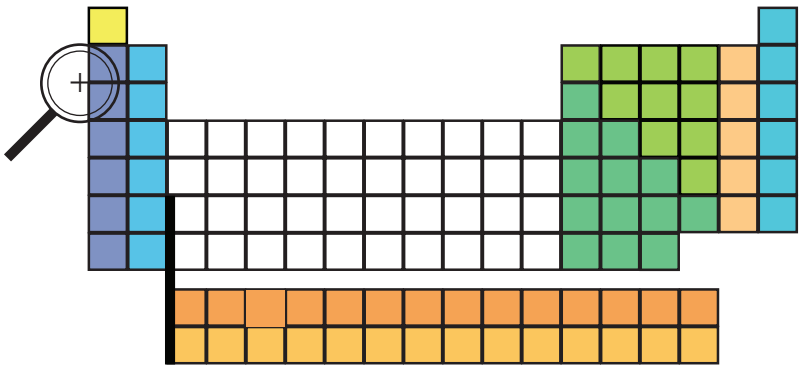
Discovering the Periodic Table



Photograph of Dmitri Mendeleev

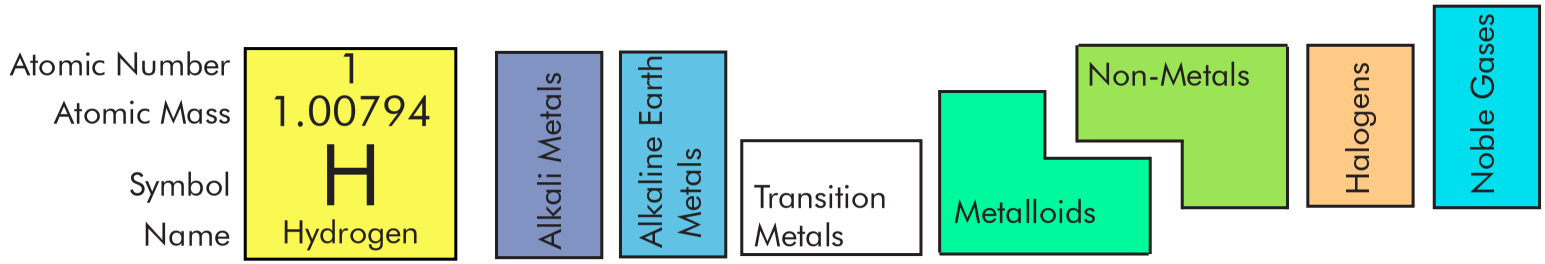
By the late 1800s scientists had discovered and named most of the elements, but they did not understand the elements or their behavior. An important discovery by Russian chemist Dmitri Mendeleev showed that when you arrange the elements in rows and columns you can see the similarities between them. His discovery proved that the elements repeat certain characteristics at regular intervals, or periodically.

Example: look at the far left column of the table. Lithium, sodium and potassium line up vertically, and they are all very similar metals. They are soft, low in density and solid at room temperature. They also have very similar reactions with other substances.



3
6.941
Li
Lithium
11
22.98977
Na
Sodium
19
39.0983
K
Potassium

Periodic Table of Elements



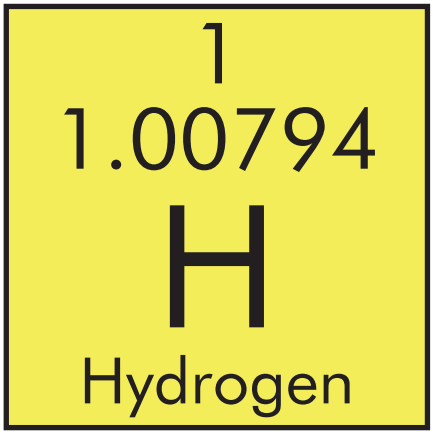
1 1.00794 H Hydrogen																	2 4.002602 He Helium
3 6.941 Li Lithium	4 9.012182 Be Beryllium											5 10.811 B Boron	6 12.0107 C Carbon	7 14.0067 N Nitrogen	8 15.9994 O Oxygen	9 18.99840 F Flourine	10 20.1797 Ne Neon
11 22.98977 Na Sodium	12 24.3050 Mg Magnesium											13 26.98154 Al Aluminum	14 28.0855 Si Silicon	15 30.97376 P Phosphorus	16 32.065 S Sulfur	17 35.453 Cl Chlorine	18 39.948 Ar Argon
19 39.0983 K Potassium	20 40.078 Ca Calcium	21 44.9559 Sc Scandium	22 47.867 Ti Titanium	23 50.9415 V Vanadium	24 51.9961 Cr Chromium	25 54.938 Mn Manganese	26 55.845 Fe Iron	27 58.9332 Co Cobalt	28 58.6934 Ni Nickel	29 63.546 Cu Copper	30 65.38 Zn Zinc	31 69.723 Ga Gallium	32 72.64 Ge Germanium	33 74.9216 As Arsenic	34 78.96 Se Selenium	35 79.904 Br Bromine	36 83.798 K Krypton
37 85.4678 Rb Rubidium	38 87.62 Sr Strontium	39 88.9059 Y Yttrium	40 91.224 Zr Zirconium	41 92.9064 Nb Niobium	42 95.96 Mo Molybdenum	43 (97.9072) Tc Technetium	44 101.07 Ru Ruthenium	45 102.9055 Rh Scandium	46 106.42 Pd Palladium	47 107.8682 Ag Silver	48 112.411 Cd Cadmium	49 114.818 In Indium	50 118.710 Sn Tin	51 121.760 Sb Antimony	52 127.60 Te Tellurium	53 126.9045 I Iodine	54 131.293 Xe Xenon
55 132.9055 Cs Caesium	56 137.327 Ba Barium	71 174.9668 Lu Lutetium	72 178.49 Hf Hafnium	73 180.9479 Ta Tantalum	74 183.84 W Tungsten	75 186.207 Re Rhenium	76 190.23 Os Osmium	77 192.217 Ir Iridium	78 195.084 Pt Platinum	79 196.9666 Au Gold	80 200.59 Hg Mercury	81 204.3833 Tl Thallium	82 207.2 Pb Lead	83 209.9804 Bi Bismuth	84 (208.982) Po Polonium	85 (209.987) At Astatine	86 222.0176 Rn Radon
87 (223) Fr Francium	88 (226) Ra Radium	103 (262) Lr Lawrencium	104 (261) Rf Rutherfordium	105 (262) Db Dubnium	106 (266) Sg Seaborgium	107 (264) Bh Bohrium	108 (277) Hs Hassium	109 (268) Mt Meitnerium	110 (271) Ds Darmstadtium	111 (272) Rg Roentgenium	112 (285) Cp Copernicum	113 (284) Uut Ununtrium	114 (289) Fl Flerovium	115 (288) Uup Ununpentium	116 (292) LV Livermorium	117 (294) Uus Ununseptium	118 (294) Uuo Ununoctium

57 138.9055 La Lanthanum	58 140.116 Ce Cerium	59 140.9077 Pr Praseodymium	60 144.242 Nd Neodymium	61 (145) Pm Promethium	62 150.36 Sm Samarium	63 151.964 Eu Europium	64 157.25 Gd Gadolinium	65 158.9254 Tb Terbium	66 162.5 Dy Dysprosium	67 164.9303 Ho Holmium	68 167.259 Er Erbium	69 168.9342 Tm Thulium	70 173.054 Yb Ytterbium
89 (227) Ac Actinium	90 232.0381 Th Thorium	91 231.0359 Pa Protactinium	92 238.0289 U Uranium	93 (237) Np Neptunium	94 (244) Pu Plutonium	95 (243) Am Americium	96 (247) Cm Curium	97 (247) Bk Berkelium	98 (251) Cf Californium	99 (252) Es Einsteinium	100 (257) Fm Fermium	101 (258) Md Mendelevium	102 (259) No Nobelium

How to Read the Periodic Table

The periodic table is a graphic representation of all the known elements. It is designed to give as much important information as possible in as little space as possible and to show the relationships between the elements.

How to Read the Hydrogen Atom



Atomic Mass
The average mass of the atoms in the element

Name
Usually derived from a Greek or Latin root

Atomic Number
The number of protons in the nucleus

Symbol
The one or two letter abbreviation for the element

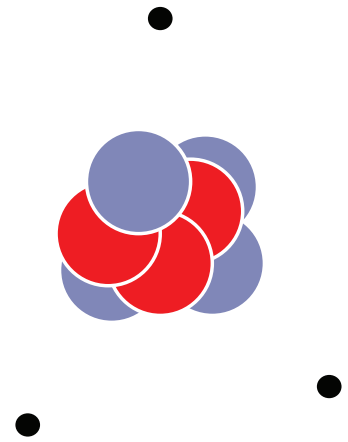
Discovering the Atom

In the 1920s a Danish scientist named Niels Bohr expanded our understanding of Mendeleev's Periodic Table. He believed that there was one reason why elements had distinctive properties and could combine with other elements in distinct ways – the number of electrons in an atom of the element.

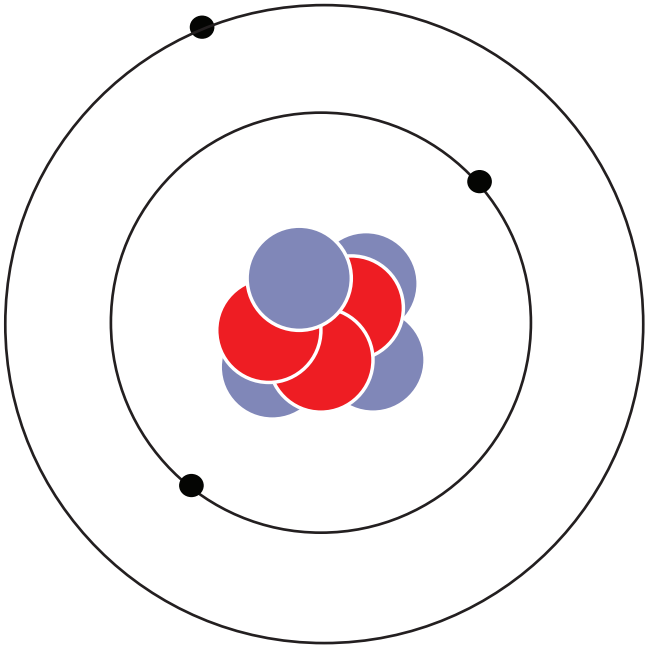
Scientists already knew that the atoms of each element have a certain number of electrons. They assigned each element a number, which reflected the number of electrons and protons in that element's atom.

Bohr took that idea one step further. He said that the electrons arranged themselves in "shells," or energy levels around the nucleus. He also believed these shells had a pattern.

Mendeleev's idea of what Lithium looked like



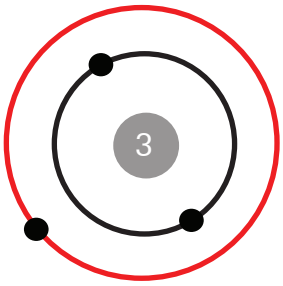
Bohr's idea of what Lithium looked like



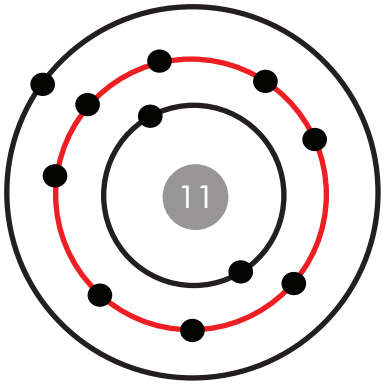
Discovering the Atom

We can see an example of Bohr's pattern by looking at atoms of lithium, sodium and potassium, which line up vertically on the periodic table.

Element 3 Lithium
shell 1: 2 electrons
shell 2: 1 electron



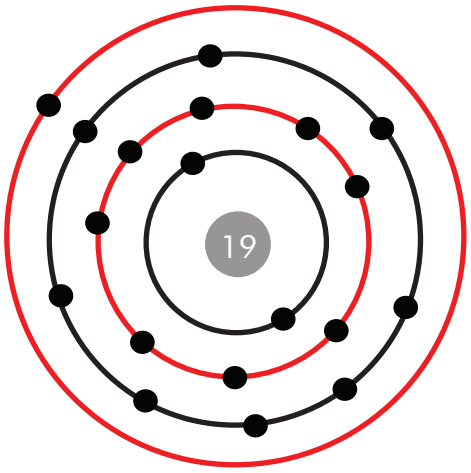
Element 11 Sodium
shell 1: 2 electrons
shell 2: 8 electrons
shell 3: 1 electron



Element 19 Potassium
shell 1: 2 electrons
shell 2: 8 electrons
shell 3: 8 electrons
shell 4: 1 electron

What do you notice about this pattern?

All the elements have just one electron in their outermost shell. All the elements have two electrons in their inner most shells.



Bohr thought that the electrons in the outermost shell were the ones that determined the properties of the atom.

Metals & Non-Metals

The periodic table of the elements is separated into two basic categories: metals and non-metals. The majority of the elements are metals, and they all share many common characteristics.

Take a look at the non-metal elements in the periodic table. Do they have anything in common? Some are gasses, and some are not. Think about how metals differ from non-metals. Write out as many unique properties of metal as you can.

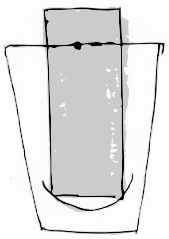
Some metals, such as aluminum (Al), iron (Fe), nickel (Ni), copper (Cu), silver (Ag), and gold (Au), are pure elements; others, such as steel and brass, are composed of a combination of elemental metals. These are called alloys.

Metals &Non-Metals

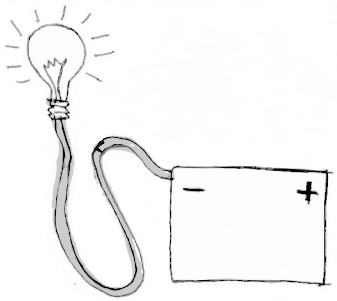
Answers:

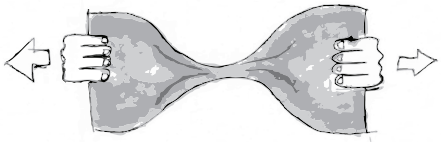
The Properties of Metals

Most metals are solid at room temperature.



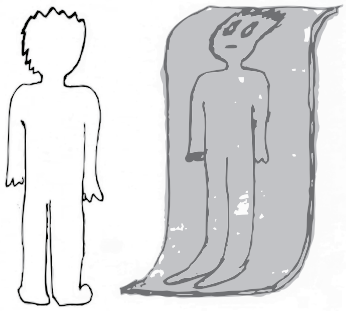
Metals are conductive. This means that electric ity and heat can travel through them very easily Some metals are better conductors than others.

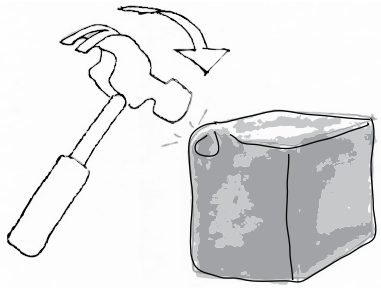




Metals are ductile. This means that they can be stretched—that's how we can make wires!

Metals are shiny and often reflective.





Metals are malleable. This means that they can be bent and molded into different shapes.

Quiz:
Name That Element

Use the periodic table of the elements to name each element below.

#23: _____

#14: _____

#83: _____

Mn: _____

H: _____

Ne: _____

How many protons does aluminum have? _____

Which element has 47 protons? _____

Some of the element abbreviations are based on the Latin names of the element. For example, Fe is short for ferrum, Cu is short for cuprum, Ag is short for argentum and Au is short for aurum. Use the table to find out the English names of these elements.

Ferrum : _____

Cuprum: _____

Argentum: _____

Aurum: _____

Molecules & Compounds

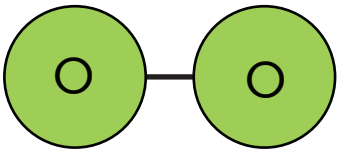
Atoms are the tiny building blocks that make up all matter. Individually, they aren't much good. When atoms join together, they are called *molecules*.

For example, the oxygen we breathe is not single atoms of oxygen; they're actually combined molecules of two oxygen atoms.

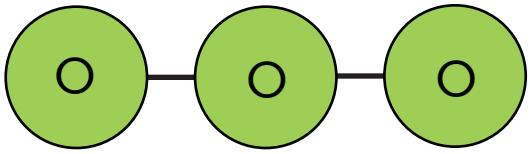
Add one more oxygen atom to the O^2 molecule, and you have ozone, or O^3 .

When molecules of different elements join together, they are called *compounds*. One compound that you may already know is H^2O, the chemical compound for water.

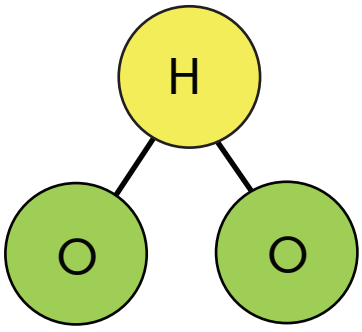
Breathable Oxygen Molecule



Ozone Molecule



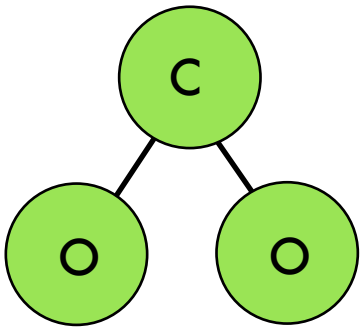
Water Molecule



Molecules & Compounds

Name any other chemical compounds that you know, and draw their diagrams below.
To draw a diagram use circles with the elements symbols in them and use lines to show where the elements attach to become a molecule.

Carbon Dioxide Molecule CO^2



Physical Changes

Chemical Changes

All matter changes. All substances can undergo a *physical change*, meaning that the appearance changes, but the chemical makeup of the substance remains the same. All substances can also undergo a *chemical change*, meaning that the atoms and molecules of the substance is being changed. Though all the original atoms are still there, the molecules will have changed into something different. Think of different examples of each and write them in their column.

ice melting	*burning a piece of wood*
saw a piece of wood in half	*metal rusting*

Atom Structures

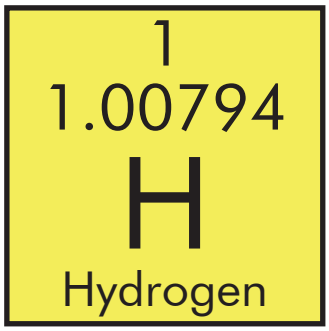
The number of neutrons in an element is not listed anywhere on the periodic table. However, it is not hard to figure out.

The atomic mass of an element is the average of all naturally occurring isotopes. Since electrons weigh almost nothing compared to protons and neutrons (which weigh the same) the atomic mass can be assumed to be the weight of all the protons and neutrons in an atom. The weight of a proton and neutron in all elements is one.

From this all we have to do is round the atomic mass of each element to the nearest whole number and subtract the atomic number (the number of protons in the element) and we find the number of neutrons.

For example: Hydrogen's atomic number is 1, its atomic weight is 1.00794, which we round down to 1. 1-1=0. Hydrogen has no neutrons.

Use your math skills to answer the questions on the following page.



1 (rounded atomic mass) -1(atomic number) = 0 neutrons

Atom Structures Problems Sheet

How many neutrons are in carbon?

Name the element that has 8 neutrons.

How many neutrons does gold have?

If an elements atomic mass is 70 and it has 39 neutrons, how many protons does it have? What element is this?

How many neutrons does radon have?

Name three elements that have the same amount of neutrons and protons.

Flash Cards

Here are some elements to practice.

1
1.00794
H
Hydrogen

2
4.002602
He
Helium

3
6.941
Li
Lithium

4
9.012182
Be
Beryllium

5
10.811
B
Boron

6
12.0107
C
Carbon

7
14.0067
N
Nitrogen

8
15.9994
O
Oxygen

9 18.99840 F Flourine	10 20.1797 Ne Neon	11 22.98977 Na Sodium
12 24.3050 Mg Magnesium	13 26.98154 Al Aluminum	14 28.0855 Si Silicon
15 30.97376 P Phosphorus	16 32.065 S Sulfur	17 35.453 Cl Chlorine

18 39.948 Ar Argon	19 39.0983 K Potassium	20 40.078 Ca Calcium
22 47.867 Ti Titanium	26 55.845 Fe Iron	27 58.9332 Co Cobalt
28 58.6934 Ni Nickel	29 63.546 Cu Copper	30 65.38 Zn Zinc

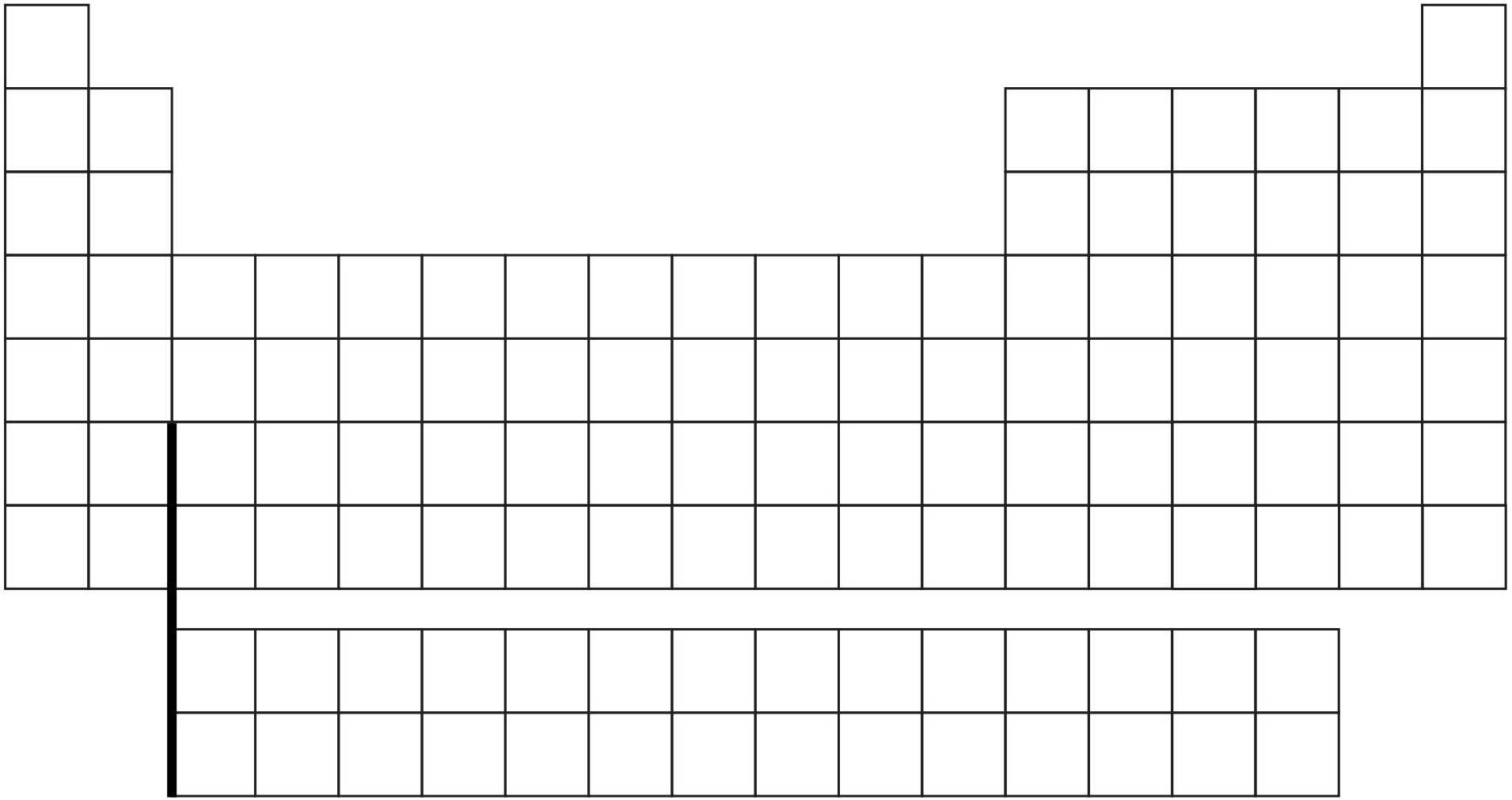
New Elements

These elements have all been officially added to the Periodic Table of Elements since 2012. Ununtrium, Ununpentium, Ununseptium, and Ununoctium are the newest of these six and do not yet have official names. Their current names stand for their number – un (from Latin for one), pent (from Greek for five). Un-un-pent-ium has an atomic number of one-one-five (115). All of these elements are considered "artificial", since they have only occurred in laboratory experiments, and have not been found in nature.

113 284 **Uut** Ununtrium	114 289 **Fl** Flerovium	115 288 **Uup** Ununpentium
116 292 **Lv** Livermorium	117 294 **Uus** Ununseptium	118 294 **Uuo** Ununoctium

Periodic Table of Elements

Use light-colored markers to color in the different sections of the periodic table and then write in the element symbols.



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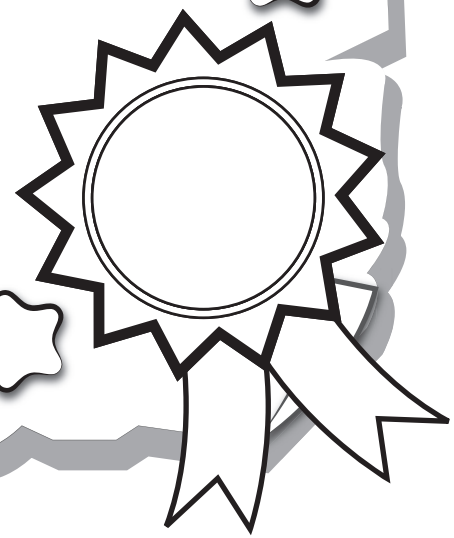

Answer Sheets

It's Elemental

Quiz: Name That Element

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Name That Element

Use the periodic table of the elements to name each element below.

#23: vanadium

#14: silicon

#83: bismuth

Mn: manganese

H: hydrogen

Ne: neon

How many protons does aluminum have? Aluminum has 13 protons.

Which element has 47 protons? Silver has 47 protons.

Some of the element abbreviations are based on the Latin names of the element. For example, Fe is short for ferrum, Cu is short for cuprum, Ag is short for argentum and Au is short for aurum. Use the table to find out the English names of these elements.

Ferrum : iron

Cuprum: copper

Argentum: silver

Aurum: gold