It's Elemental



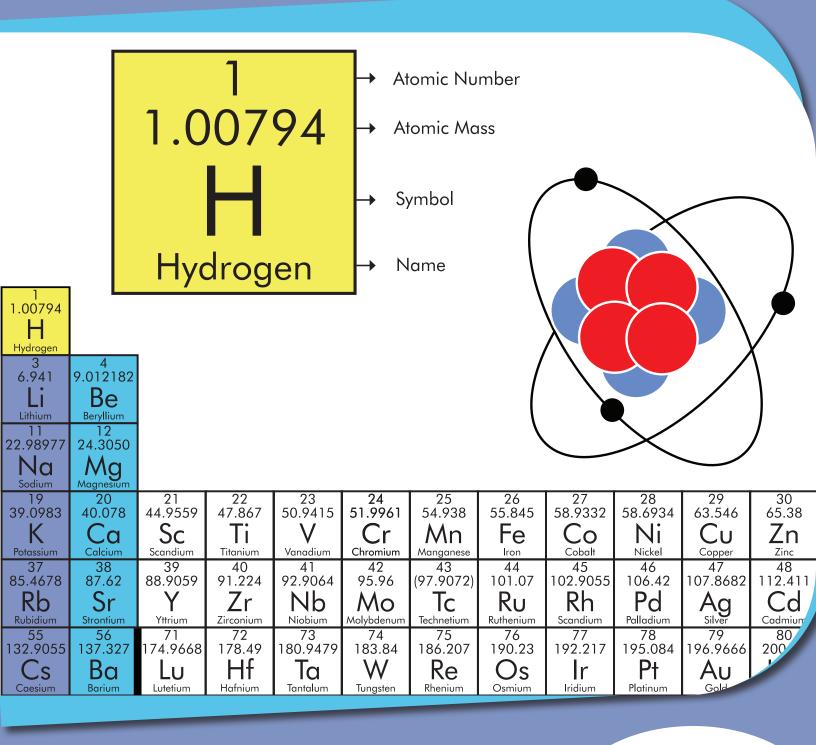




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What is an Atom?

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.

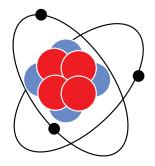
This means that an atom is the smallest particle of a substance that has the same qualities of that substance.

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



Painting of Democritus





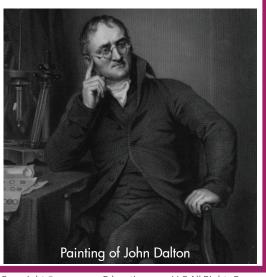




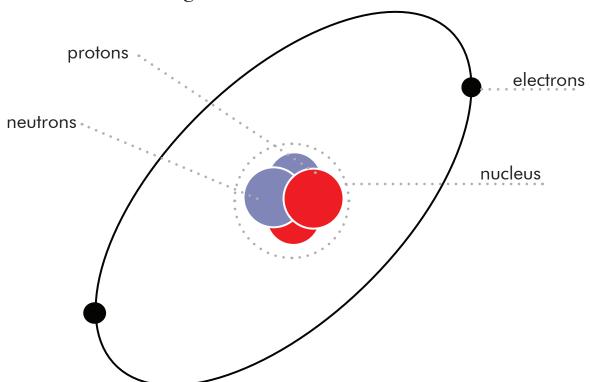
Diagram of an Atom

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.

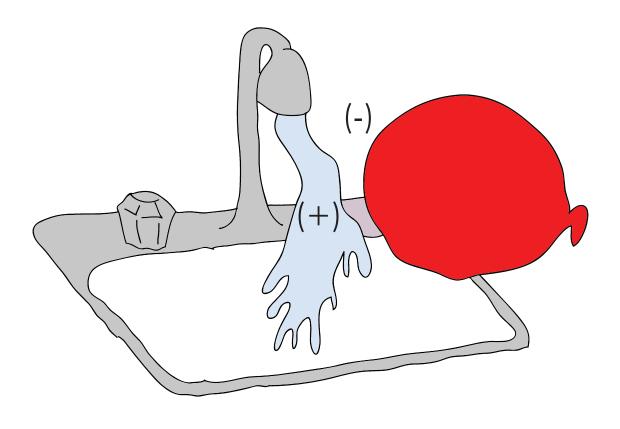
Diagram of a Helium Atom



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.



- 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!



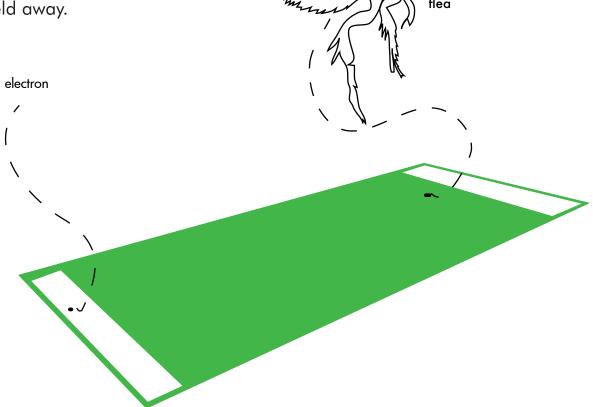


Sizing Up Atoms

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!

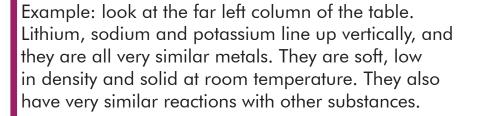
If an atom was magnified to the size of a flea, the orbit of its electrons would be a football field away.

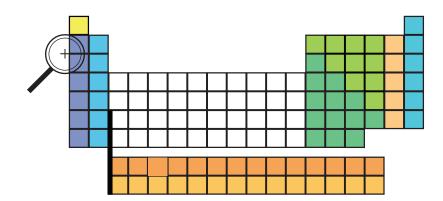


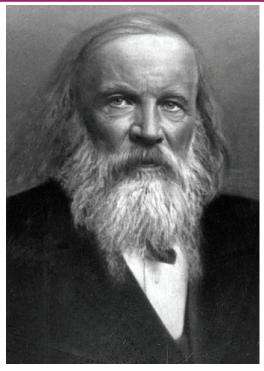


Discovering the Periodic Table

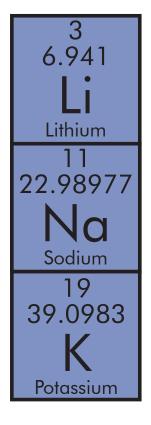
By the late 1800s scientists had discovered and named most of the elements, but they did not understand the elements or their behavior. An important discovery by Russian chemist Dmitri Mendeleev showed that when you arrange the elements in rows and columns you can see the similarities between them. His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





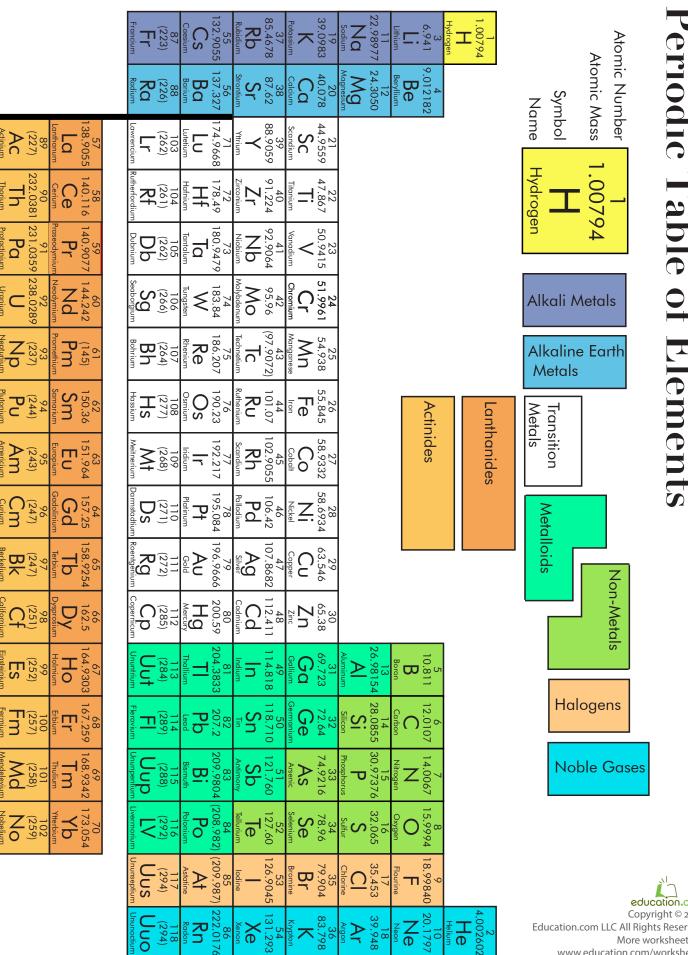


Photograph of Dmitri Mendeleev





Periodic Table of Elements



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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

1 1.00794 **H** Hydrogen

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.

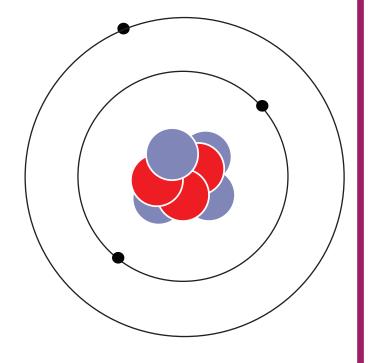
Bohr took that idea one step further. He said that the electrons arranged themselves in "shells," or energy levels around the nucleus. He also believed these shells had a pattern.



Mendeleev's idea of what Lithium looked like

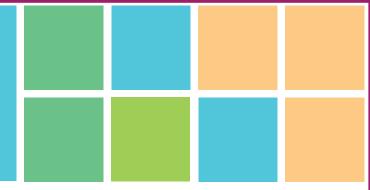


Bohr's idea of what Lithium looked like





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

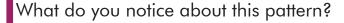
Element 19 Potassium

shell 1: 2 electrons

shell 2: 8 electrons

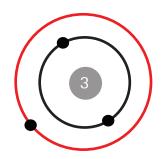
shell 3: 8 electrons

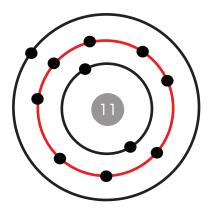
shell 4: 1 electron

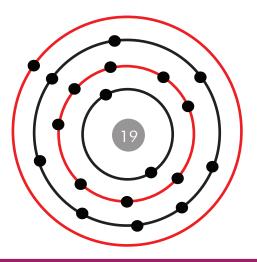


All the elements have just one electron in their outermost shell. All the elements have two electrons in their inner most shells.

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 canon-metals. The majority of the elements are metals, and they a mon characteristics.	•	
Take a look at the non-metal elements in the periodic table. Do in common? Some are gasses, and some are not. Think about he from non-metals. Write out as many unique properties of metal	now metals	differ
Some metals, such as aluminum (Al), iron (Fe), nickel (Ni), coppe and gold (Au), are pure elements; others, such as steel and bras a combination of elemental metals. These are called alloys.	, ,	, <i>–</i> ,

Metals & Non-Metals

Answers: The Properties of Metals

solid at room

temperature.

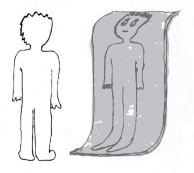


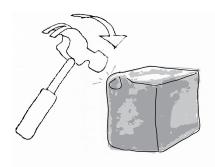




Metals are ductile. This means that they can be stretched—that's how we can make wires!

Metals are shiny and often reflective.

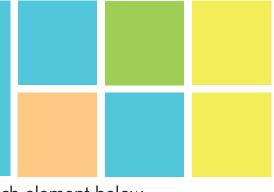




Metals are malleable. This means that they can be bent and molded into different shapes.



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

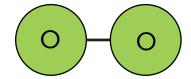
Atoms are the tiny building blocks that make up all matter. Individually, they aren't much good. When atoms join together, they are called *molecules*.

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

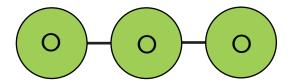
Add one more oxygen atom to the O^2 molecule, and you have ozone, or O^3 .

When molecules of different elements join together, they are called *compounds*. One compound that you may already know is H²O, the chemical compound for water.

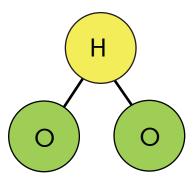
Breathable Oxygen Molecule



Ozone Molecule



Water Molecule

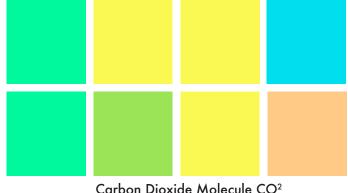




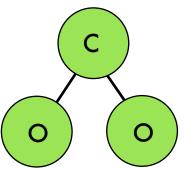
Molecules & Compounds

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 CO²







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

saw a piece of wood in half

burning a piece of wood

metal rusting



Atom Structures

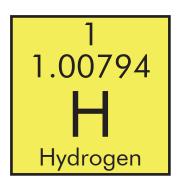
The number of neutrons in an element is not listed anywhere on the periodic table. However, it is not hard to figure out.

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.

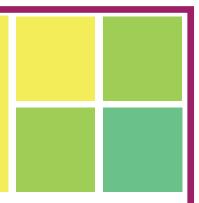


1 (rounded atomic mass) -1 (atomic number) = 0 neutrons



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?

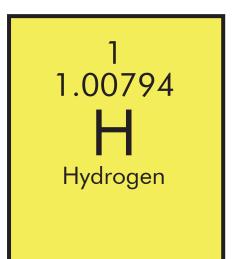
How many neutrons does radon have?

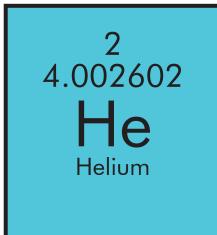
Name three elements that have the same amount of neutrons and protons.



Flash Cards

Here are some elements to practice.





3 6.941 **Li** Lithium 9.012182 **Be**Beryllium

5 10.811 **B** Boron

6 12.0107 Carbon 7 14.0067 **N** Nitrogen

8 15.9994 Oxygen



9 18.99840 **F** Flourine 10 20.1797 **Ne** Neon 11 22.98977 **Na** Sodium

12 24.3050 **Magnesium** 13 26.98154 **A** Aluminum 14 28.0855 **Si** Silicon

15 30.97376 **P** Phosphorus 16 32.065 **S** Sulfur 17 35.453 **C**I 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 **C**U 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 **F** Flerovium 115 288 **Uup** Ununpentium

116 292 LV Livermorium 117 294 **UUS** Ununseptium 118 294 **Uuo** Ununoctium



Periodic Table of Elements

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



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Answer Sheets

It's Elemental

Quiz: Name That Element

Quiz: Name That Element



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

#23: <u>vanadium</u>

#14: ____silicon

#83: bismuth

Mn: manganese

H: <u>hydrogen</u>

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: <u>copper</u>

Argentum: <u>silver</u>

Aurum: gold