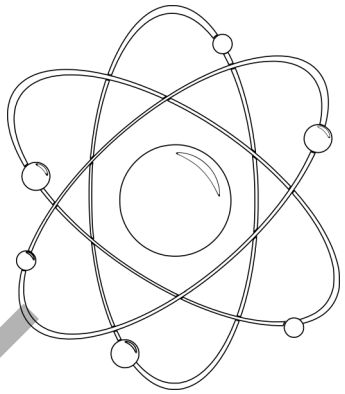
Elements, Compounds, and the Periodic Table

The world around us is made of matter, but why is there such a huge variety of substances around us? For example, you breathe oxygen and drink water. One is a gas, and one is a liquid. You may put table salt on food to give it flavor. Some things, like salt, dissolve in water, but other things do not. What makes all these things so different from each other?

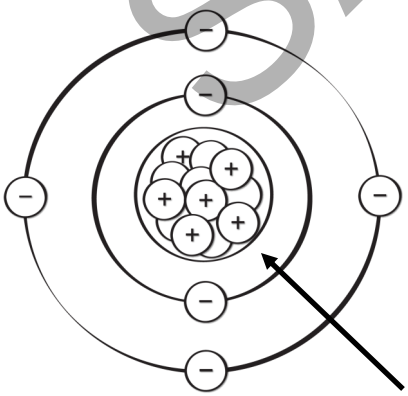


The answer lies within the matter itself. Deep within all matter are atoms. Atoms cannot be seen with just your eyes. If you look at the width of just a single human hair, it is more than one million times thicker than a single atom.

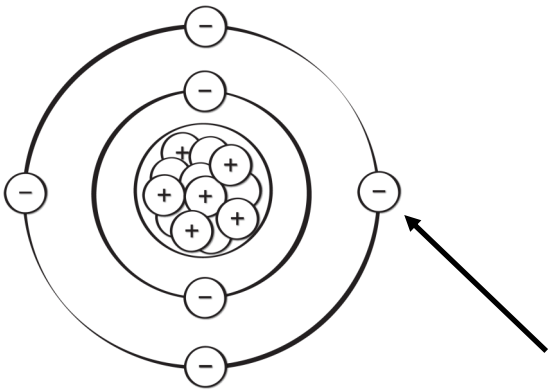
As hard as it is to imagine, atoms are made of even smaller parts called subatomic particles. The three main subatomic particles are protons, neutrons, and electrons. Protons and neutrons are made of quarks. Other types of subatomic particles include leptons (which include neutrinos and other smaller particles) and fundamental bosons (which include photons, gluons, and others).

The **nucleus of an atom** is made of protons and neutrons. **Protons** have a positive charge, but **neutrons** have no charge. They are neutral.

Electrons are smaller than the protons and neutrons. They revolve, or circle around, the nucleus. Electrons have a negative charge, so they are attracted to the positive charge of the protons. This attraction keeps them spinning around the nucleus.

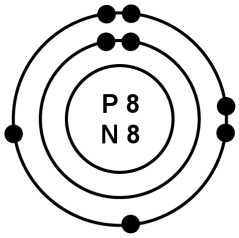


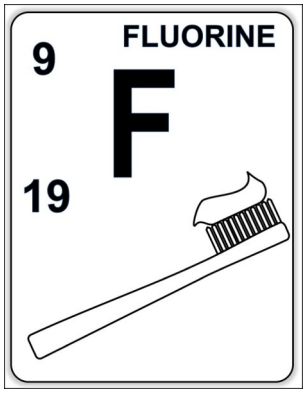
Nucleus (protons and neutrons)

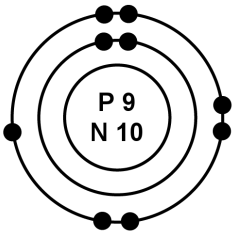


Electrons

The eighth element on the periodic table is oxygen, and I think we all know that oxygen is critical to almost every living thing. People need it to breathe. Plants need it to produce energy. Most fuels need oxygen to burn. Oxygen masks are used by medical professionals to help someone who is struggling to breathe. Oxygen has 8 protons, 8 neutrons, and a mass number of 16.

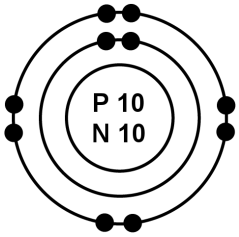


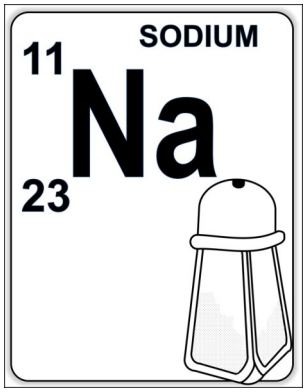


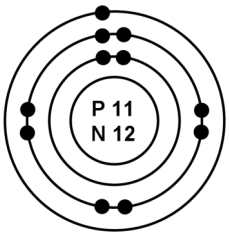


Fluorine is the ninth element on the periodic table. Fluoride, a fluorine ion, is used in toothpaste and even drinking water because it can help reduce the risk of tooth decay. It has 9 protons and 10 neutrons, and its mass number is 19.

The tenth element on the periodic table is neon. If you've ever seen a neon sign advertising a sale or an event, you've seen neon gas at work. When combined with electricity, the gas gives off a distinctive light. Neon light is also able to shine through fog much better than most other kinds of light, so it is commonly used in beacons for airplanes. Neon has 10 protons and 10 neutrons. Its mass number is 20.



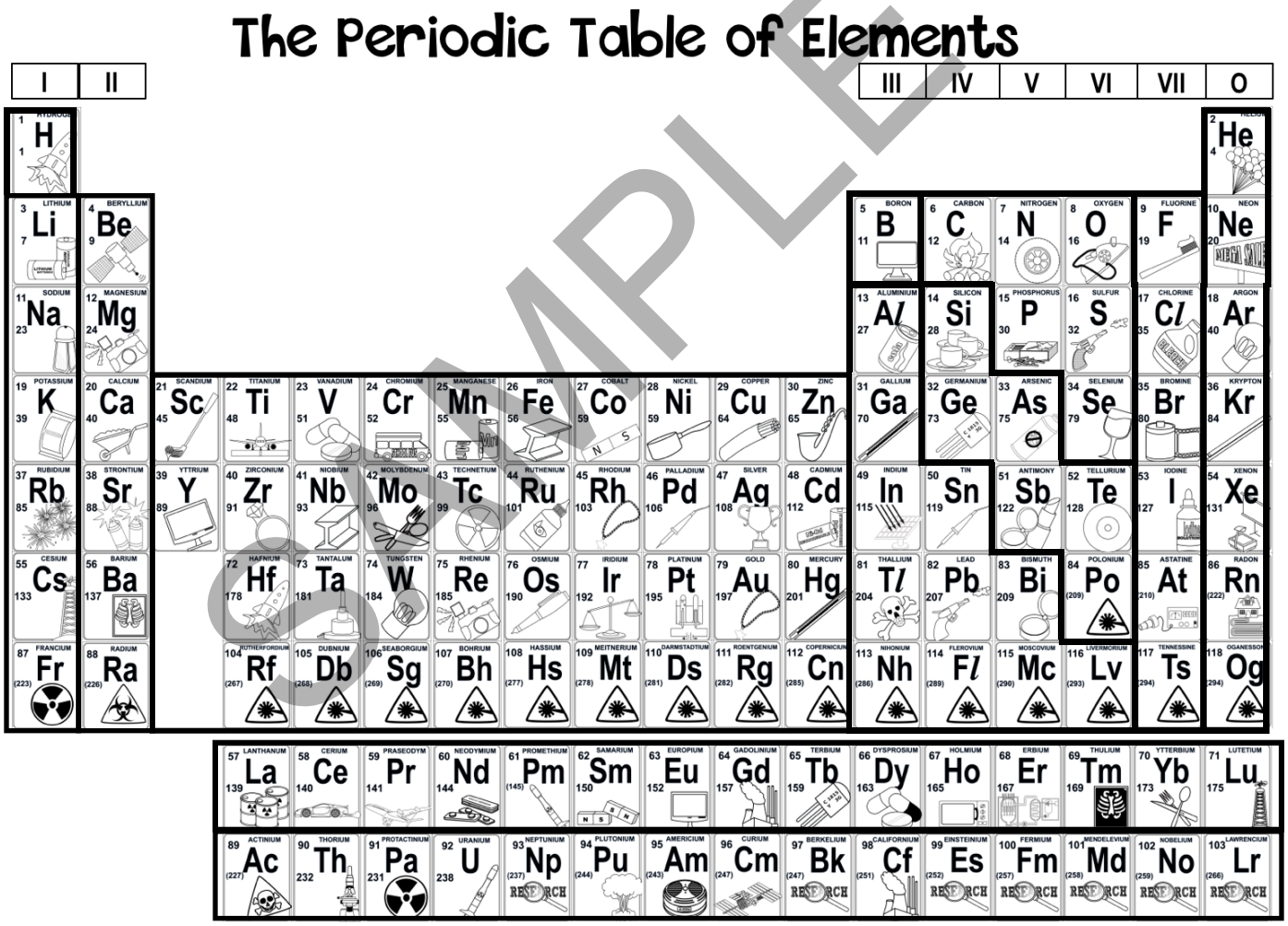




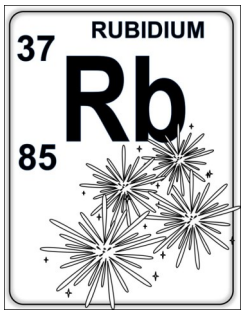
Sodium is the eleventh element on the periodic table. It's probably most famous for being part of table salt. Sodium is actually the sixth most common chemical element in the Earth's crust, but it is never found as a separate element. It's always combined with other elements. It has 11 protons and 12 neutrons, and its mass number is 23.

Sodium through argon have three shells; potassium through krypton have four shells. Rubidium through xenon have five shells; cesium through radon and lanthanum through lutetium, which are two separate rows, have six shells. Francium through oganesson and actinium through lawrencium, which are also two separate rows, have seven shells.

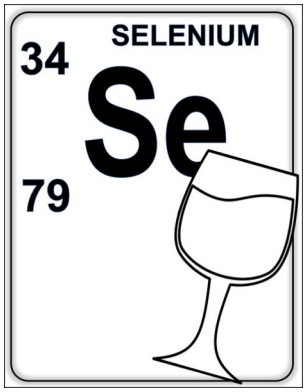
Chemists also break the periodic table down into classes. Each class has certain things in common. We won't look at every element or everything they have in common, but we'll take a look at what makes each class different. For example, most of the metals we will look at are **ductile**, which means they can be drawn into wires, and **malleable**, which means they can be pounded down into thin sheets. It's important to remember that not all scientists agree on what class some of the elements belong in.

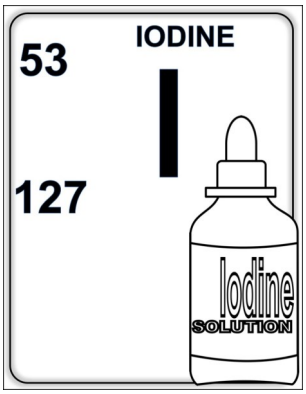


The first class you come to on the left is the **alkali metal** class. It includes lithium (Li), sodium (Na), potassium (K), rubidium (Rb), cesium (Cs), and francium (Fr). They are soft, light metals that react strongly with water. We've already seen some of the uses of lithium, sodium, and potassium. Rubidium is used in fireworks, cesium is being studied as a possible fuel for space vehicles, and francium is radioactive.



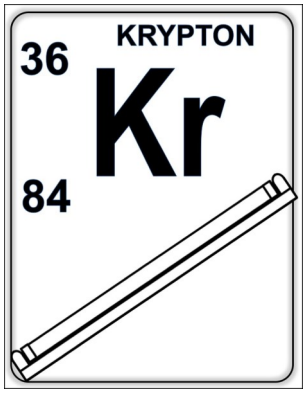
We've already mentioned the next class of elements, **nonmetals**. We know they don't conduct heat or electric current well. They vary in color. Some of them are solids, others are liquids, and others are gasses. They are a little scattered on the periodic table, with hydrogen (H) being the first element in the top left corner and the rest in a block on the right—carbon (C), nitrogen (N), oxygen (O), phosphorus (P), sulfur (S), and selenium (Se). We've already looked at all of these elements except selenium, which is used in manufacturing and in making glass.





Our next class is halogens, which are also nonmentals. They get their name "halogen" from the Greek roots "hal-" and "-gen" which means "to produce salt" or "salt producer." They are in the second column from the right. They include fluorine (F), chlorine (Cl), bromine (Br), iodine (I), and astatine (At). When the element chlorine is combined with sodium, we get sodium chloride, or table salt. Humans use iodine in their bodies to produce thyroxine, which is an important hormone.

The last class of elements is the **noble gases**. They form the first column of the periodic table on the right. They are all gases and do not react easily with other elements. They include helium (He), neon (Ne), argon (Ar), krypton (Kr), xenon (Xe), and radon (Rn). They are very useful in many ways. Argon is used in light bulbs because it won't eat away or corrode the metal parts of the bulb. Helium doesn't burn, so it is safe to use in blimps. The element krypton is used in many kinds of fluorescent lights.



That is a lot of elements, and there is still much for scientists to learn! Thankfully, we don't have to memorize all 118 elements right now, but let's review the chemical symbols for the first twenty because many of them are going to be good to know as we keep studying chemistry.

Hydrogen	H
Helium	He
Lithium	Li
Beryllium	Be
Boron	B

Carbon	C
Nitrogen	N
Oxygen	O
Fluorine	F
Neon	Ne

Sodium	Na
Magnesium	Mg
Aluminum	Al
Silicon	Si
Phosphorus	P

Sulphur	S
Chlorine	Cl
Argon	Ar
Potassium	K
Calcium	Ca

Terminology

Using what you learned, define these words in the best way you can. Use the back of the page if you need more room.

Nucleus of an atom: _____

Proton: _____

Neutron: _____

Electron: _____

_____

Atomic number: _____

Mass number: _____

Element: _____

Periodic table: _____

Isotope: _____

Ductile: _____

Malleable: _____

Alkali metals: _____

Transition metals: _____

_____

Metalloids: _____

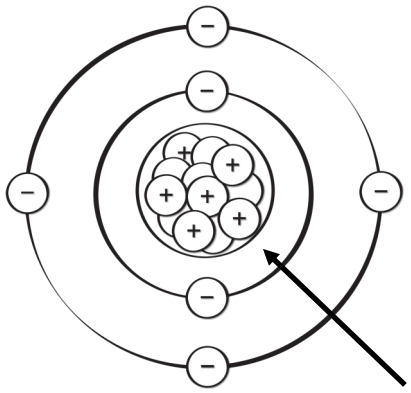
_____

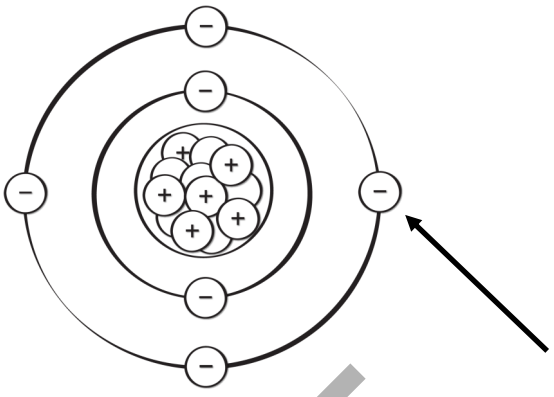
Nonmetals: _____

_____

Review Answer Key

Label the following diagram.

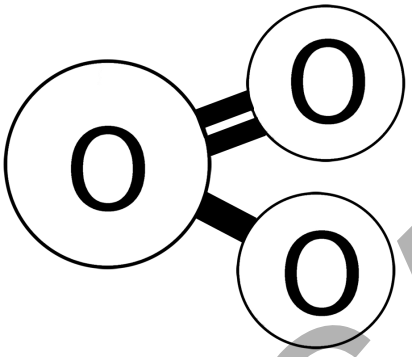




Nucleus (protons and neutrons) _____

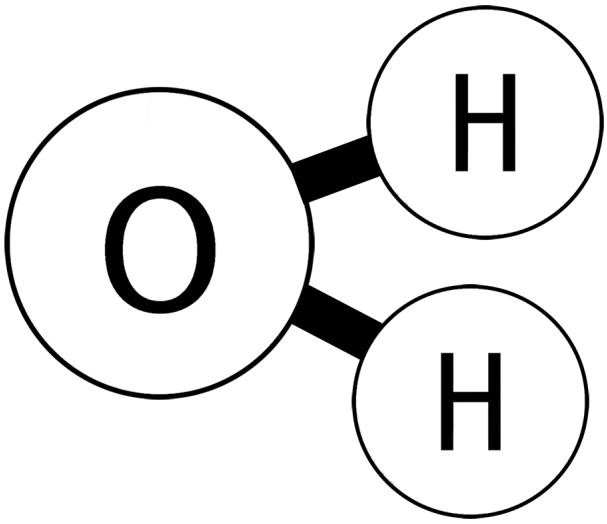
Electrons _____

Write the name of the molecule and the chemical formula.



Ozone _____ O_3 _____

Label the atoms of the following molecule and write the chemical formula in the blank on the right.



Water H_2O _____