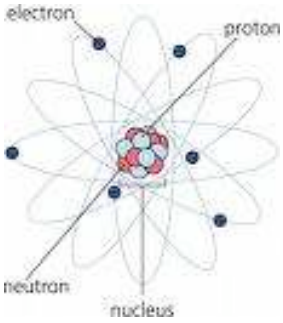


Atomic Structure Unit Review

Main Ideas:

- Everything that has mass and volume is matter.
- A chemical is anything that has a definite composition—that means that a chemical is always made of the same substances.
- All chemicals are either naturally-occurring or manmade.
- The most basic unit of matter is an element, which cannot be broken down any further. There are only 109 elements, but they combine to form every substance in the world.
- Elements can be put together in different ways to make mixtures or compounds.

Structure of an Atom

Everything in the universe that has mass and takes up space is called **matter**. All matter is made up a tiny parts called **atoms**. Every atom is made up of three parts: the **proton**, the **neutron**, and the **electron**. Protons and neutrons are held tightly together in the nucleus, while electrons float around in outer **electron clouds**. Check the chart below for more information about the parts of the atom.

Particle	Location	Charge	Mass
Proton	Nucleus	+ 1	1
Neutron	Nucleus	Neutral	1
Electron	Electron Cloud	- 1	None

Each electron cloud of an atom can hold a specific number of electrons. The 1st cloud can only hold **2 electrons**. The 2nd cloud can hold a maximum of **8 electrons**. The 3rd cloud can hold a maximum of **18 electrons**, while the 4th can hold a maximum of **36 electrons**. The electrons in the outermost cloud of an element are called **valence electrons**.

See the diagram to the right for a picture of these electron clouds.

Different types of atoms are called **elements**. We can name elements by counting the number of protons an atom has. For example, if an atom has 12 protons, we know it is carbon.

All elements in the universe are organized in something called **the periodic table**.

Elements are either naturally-occurring or synthetic. If an element is **natural**, it can be found in nature. If an element is **synthetic**, it is man-made. Synthetic elements tend to have very high atomic numbers, as they were created in labs.

Periodic Table: One Square at a Time

The periodic table has a LOT of information in it, so to prevent being overwhelmed, you must look at one square at a time.

8
C
Carbon
15.998

The 8 (above) represents the **atomic number**, which is the number of protons in one atom of carbon. The C represents its **chemical symbol**, used in chemical formulas.

Finally, the 15.998 represents the **atomic mass**, or the total number of protons and neutrons in one atom of carbon. Remember that protons and neutrons each have a mass of 1.

To find the number of neutrons, subtract the atomic number from the atomic mass.

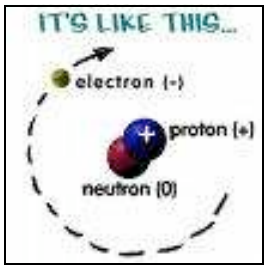
To find the number of electrons, look at the atomic number. In order for elements to have a neutral charge (zero charge), there must be an equal number of protons and electrons.

To find # of Protons: Look at atomic number.

To find # of electrons: Look at atomic number.

To find # of neutrons:

Atomic mass – atomic number



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Periodic Table: The Whole Thing

The periodic table organizes every element in the universe into **periods** (rows) and **groups** (columns). These help us locate elements more easily, but also tell us **properties**, or characteristics, of different elements. We name the groups from left to right, #1-#18. We name the periods from top to bottom, #1-7.

To find the number of <u>valence electrons</u>:

Atoms of elements in GROUPS 1 & 2 have the same number of valence electrons as their group number.

Groups 3-12 have no rules about their valence electrons.

Groups 13-18 have 10 fewer valence electrons than their group number.

To tell whether an atom is a <u>metal, nonmetal, or metalloid</u>:

Locate the zig-zag (stair-step) line. It starts between B and Al and continues until between Sb and Te.

All elements touching this line (except for aluminum) are considered metalloids. **Metalloids** share properties of metals and nonmetals.

All elements to the left of the line are metals. **Metals** are solid (except mercury), shiny, and conduct electricity and heat (think pots and pans.

All elements to the right of the line are nonmetals. **Nonmetals** are gases and solids (except bromine--liquid), brittle when they are solid, dull rather than shiny, and not good conductors of heat and electricity.

To tell what family an element is in:

Families (groups) share similar properties. The main families we studied were:

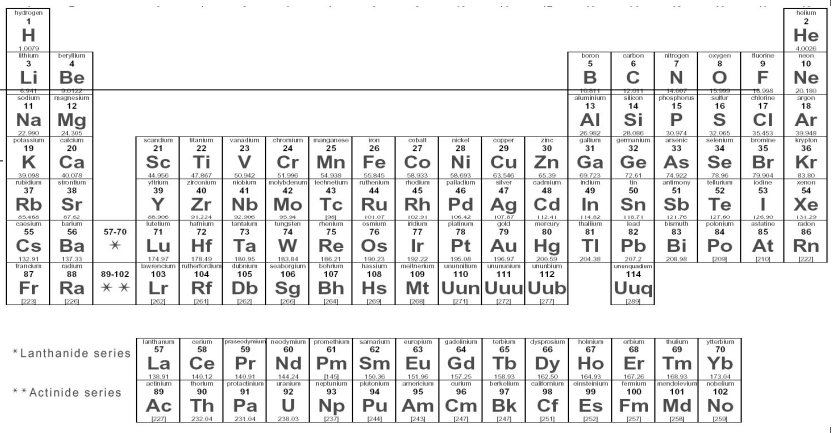
GROUP 1: ALKALI METALS

GROUP 2: ALKALINE EARTH METALS

GROUPS 3-12: TRANSITION METALS

GROUP 17: HALOGENS

GROUP 18: NOBLE GASES



Properties of Matter

Properties of matter can be helpful to identify different substances. We have two main types:

-**Physical properties**: A characteristic of a substance that can be observed without changing the identity of the substance. Ex: Crumpling paper, melting ice to water.

-**Chemical properties**: A characteristic that describes how matter will change. Ex: Burning, rusting, reacting to light, reacting to acids.

Some examples of physical properties include: **density**, which is mass divided by volume; **melting point**, which is the temperature at which a solid changes to a liquid. Water's melting point is 0 degrees C because at that temperature it melts from solid to liquid. **Melting Point = Freezing Point. Boiling point** is the temperature at which a liquid changes to a gas. The boiling point of water is 100 degrees C. **Specific Heat** is the amount of heat needed to raise 1 gram of a substance by 1 degree Celsius. **Solubility** is the measure of hose much a substance dissolves. **Reactivity** is how likely an element is to bond with other elements.

Properties of Metals

Metallic elements, those elements to the left of the zig-zag line on the periodic table, have many special properties.

Most metals are **malleable**, meaning they are able to be hammered and shaped, or flattened into thin sheets. (Ex: Aluminum foil)

Many metals are also **ductile**, meaning they can be stretched or drawn into wires without breaking. (Ex: Copper wires)

Some metals have strong **magnetic properties**, causing them to stick or push away between like or unlike poles.

Most metals are also good **conductors**, meaning they allow electricity to travel through them. Materials that do not allow electricity to flow are called **insulators.**

Many metalloids act as **semiconductors**, which allow some electricity to flow under certain conditions.

Thermal conductors allow the transfer of heat. This allows for metal pots and pans in the kitchen, especially since metals have a low specific heat.