* **Atoms cannot be divided using chemicals. They do consist of parts, which include protons, neutrons, and electrons, but an atom is a basic chemical building block of matter.**
* **Each electron has a negative electrical charge.**
* **Each proton has a positive electrical charge. The charge of a proton and an electron are equal in magnitude, yet opposite in sign. Electrons and protons are electrically attracted to each other.**
* **Each neutron is electrically neutral. In other words, neutrons do not have a charge and are not electrically attracted to either electrons or protons.**
* **Protons and neutrons are about the same size as each other and are much larger than electrons. The mass of a proton is essentially the same as that of a neutron. The mass of a proton is 1840 times greater than the mass of an electron.**
* **The nucleus of an atom contains protons and neutrons. The nucleus carries a positive electrical charge.**
* **Electrons move around outside the nucleus.**
* **Almost all of the mass of an atom is in its nucleus; almost all of the volume of an atom is occupied by electrons.**
* **The number of protons (also known as its atomic number) determines the element.**
* **The particles within an atom are bound together by powerful forces. In general, electrons are easier to add or remove from an atom than a proton or neutron.**

**Periodic Table**

* Although elements such as gold, silver, tin, copper, lead and mercury have been known since ancient times, the first scientific discovery of an element occurred in 1649 when Hennig Brand discovered phosphorous.
* During the next 200 years, a vast body of knowledge concerning the properties of elements and their compounds was acquired by chemists. By 1869, a total of 63 elements had been discovered. As the number of known elements grew, scientists began to recognize patterns in properties and began to develop classification schemes.
* Russian Dmitri Mendeleev organized his material in terms of the families of the known elements which displayed similar properties. The first part of the text was devoted to the well known chemistry of the halogens. Next, he chose to cover the chemistry of the metallic elements in order of combining power. Mendeleev noticed patterns in the properties and atomic weights of halogens, alkali metals and alkaline metals. He created a card for each of the 63 known elements. Each card contained the element's symbol, atomic weight and its characteristic chemical and physical properties.
* 1911, A. van den Broek in a series of two papers proposed that the atomic weight of an element was approximately equal to the charge on an atom. This charge, later termed the atomic number, could be used to number the elements within the periodic table

Groups are the eighteen series of elements in columns across the table. For instance, the elements in group one (the alkali metals) are hydrogen, lithium, sodium, potassium, rubidium, caesium and francium. Each of these groups are special for the common characteristics their constituent elements share.

**Alkali Metals (Group 1)**

The most reactive metal family, these must be stored under oil because they react violently with water!

- do not occur elementally in nature
- have one valence electron
- are good conductors of electricity and heat
- are ductile, malleable, and soft enough to be cut with a knife
- have a silvery luster, low density, and a low melting point

**Alkaline Earth Metals (2)**

- do not occur elementally in nature
- occur most commonly as carbonates, phosphates, silicates, and sulfates
- occur naturally as compounds
- contain two valence electrons
- are less reactive than alkali metals
- are good conductors of heat and electricity
- are ductile and malleable
- have a silvery luster

**Transition Metals (3-12)**

- consist of metals in groups 3 through 12
- contain one or two valence electrons
- are good conductors of heat and electricity
- are malleable and ductile
- have a silvery luster, except copper and gold
- include radioactive elements 89 through 109
- include mercury, the only metal that is liquid at room temperature

**Boron Family (13)**

- do not occur elementally in nature
- are scarce in nature (except aluminum)
- have three valence electrons
- are metallic (except boron, which is a solid metalloid)
- are soft and have low melting points (except boron)

**Carbon Family (14)**

- includes a nonmetal (carbon), two metalloids (silicon and germanium) and two metals (tin and lead)
- vary greatly in both physical and chemical properties
- occur in nature in both combined and elemental forms
- have four valence electrons
- are relatively unreactive

**Nitrogen Family (15)**

- consists of two nonmetals (nitrogen and phosphorus), two metalloids (arsenic and antimony), and one metal (bismuth)
- nitrogen is most commonly found as atmospheric N2,
- range from very abundant elements (nitrogen and phosphorus) to relatively rare elements (arsenic, antimony, and bismuth)
- have five valence electrons
- are solids at room temperature, except nitrogen

**Oxygen Family (16)**

- occur elementally in nature and in combined states
- consists of three nonmetals (oxygen, sulfur, and selenium), one metalloid (tellurium), and one metal (polonium)
- have six valence electrons
- tend to form covalent compounds with other elements

**Halogen Family (17)**

- are nonmetals and occur in combined form in nature, mainly as metal halides
- are found in the rocks of Earth's crust and dissolved in sea water
- have seven valence electrons
- tend to gain one electron to form a halide, X- ion, but also share electrons and have positive oxidation states
- are reactive, with fluorine being the most reactive of all nonmetals

**Noble Gases (18)**

- not reactive
- have a full outer energy level
- are all gases
- are all nonmetals

