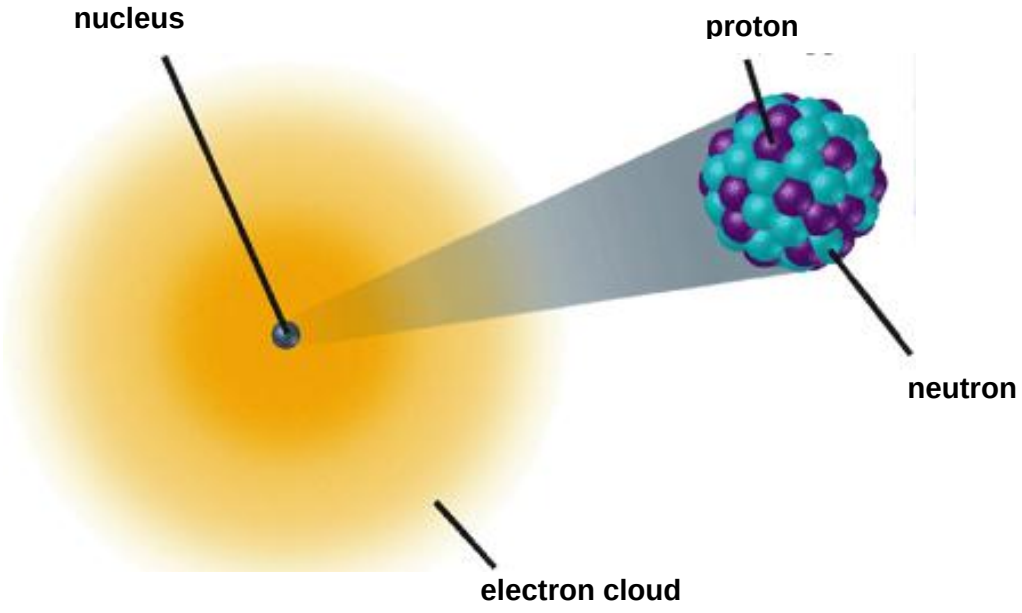
## SECTION 1 (PP. 137-144): ATOMS ARE THE SMALLEST FORM OF ELEMENTS.

**Georgia Standards: S8P1 - *Students will examine the scientific view of the nature of matter;* S8CS4b - - *Use appropriate tools and units for measuring objects and/or substances.***

1. **All matter is made of atoms.**
   All matter is made up of about 100 different elements, or basic substances. Hydrogen is the most abundant element in the universe. Oxygen is the most abundant element in the Earth's crust. Every element has a unique name and symbol. Names and symbols of the elements come from many sources.

2. **Each element is made of a different atom.**
   Atoms are made of three smaller particles: protons, neutrons, and electrons.
   - At the center of the atom is the ***nucleus***, which contains almost all of the atom's mass.
   - The nucleus contains ***protons*** and ***neutrons***. Protons have a positive charge ($^{+}1$) while neutrons have no charge. Protons and neutrons are approximately the same size and both have a mass of 1 atomic mass unit (amu).
   - In a cloud around the nucleus are ***electrons***. Electrons are 2,000 times smaller than protons and neutrons. Electrons have a negative charge ($^{-}1$) and for all practical purposes have no mass. The figure below shows the position of the electron cloud and the nucleus of an atom.



The ***atomic number*** is the number of protons in an atom and identifies the element. The ***atomic mass number*** is the number of protons plus the number of neutrons in the nucleus. ***Isotopes*** are atoms of the same element with different numbers of neutrons. Since isotopes occur in various amounts in nature, the ***average atomic mass*** represents the average mass of all of an element's isotopes.

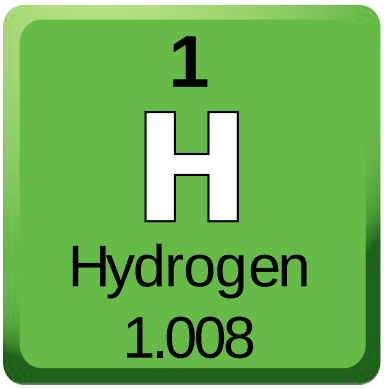
3. **Atoms form ions.**
   Atoms form ions when they gain or lose electrons. Gaining electrons results in the formation of ***negative ions***. Losing electrons results in ***positive ions*** being formed. Atoms normally lose or gain electrons in pairs.

## SECTION 2 (PP. 145-153): ELEMENTS MAKE UP THE PERIODIC TABLE.

**Georgia Standards: S8P1f – *Recognize that there are more than 100 elements and some have similar properties as shown on the Periodic Table of Elements;* S8CS6c – *Organize scientific information in appropriate tables, charts, and graphs, and identify the relationships they reveal.***

1. **Elements can be organized by similarities.**
   Many scientists thought the elements could be organized by their properties. A Russian scientist, *Dmitri Mendeleev*, made the first periodic table. Mendeleev used atomic mass to order the elements and place elements with similar properties in the same rows.

2. **The periodic table organizes the atoms of elements by properties and atomic number.**
   The modern periodic table is organized by ***atomic number***. The periodic table gives the following information about each element: *atomic number*, *chemical symbol*, *name*, and *average atomic mass*. It also indicates state at room temperature.



- A ***group***, or ***family***, is a column of elements. The elements in a group have similar properties. There are 18 groups.
- A ***period*** is a row of elements. These elements have chemical properties that tend to change the same way across the table. Properties such as atomic size, density, and likelihood to form ions vary in regular ways up, down, and across the periodic table. There are 7 periods.

## SECTION 3 (PP. 154-161): THE PERIODIC TABLE IS A MAP OF THE ELEMENTS.

**Georgia Standards: S8P1f –** ***Recognize that there are more than 100 elements and some have similar properties as shown on the Periodic Table of Elements;*** **S8CS6c –** ***Organize scientific information in appropriate tables, charts, and graphs, and identify the relationships they reveal.***

1. **The periodic table has distinct regions.**
   Position in the periodic table reveals something about how ***reactive*** an element is.
   Elements in Group 1 (Alkali metals) and Group 17 (Halogens) are especially reactive.
   Elements in Group 18 (Noble gases) are the least reactive.

2. **Most elements are metals.**
   ***Metals*** are usually shiny (luster), often conduct heat and electricity, can be easily shaped (malleable), and can be drawn into a thin wire (ductile).
   - ***Alkali metals*** (Group 1) and *alkaline earth metals* (Group 2) are at the left of the periodic table and are very reactive.
   - ***Transition metals*** are near the center of the periodic table and include copper (Cu), gold (Au), silver (Ag) and iron (Fe).
   - ***Rare earth metals*** are located in the two bottom rows which are separated from the rest of the table.
   - The two bottom rows are separated from the table to save space.

3. **Nonmetals and metalloids have a wide range of properties.**
   ***Nonmetals*** appear at the right side of the periodic table.
   They include elements with a wide range of properties.
   Carbon (C), nitrogen (N), oxygen (O), and sulfur (S), are nonmetals; as are the extremely reactive ***Halogens***, such as chlorine (Cl); and the ***Noble* or *Inert gases***, such as neon (Ne).
   ***Metalloids*** are located between the metals and the nonmetals in the periodic table. They have characteristics of both. An important use of metalloids is in the making of *semiconductors* for electronic devices.

4. **Some metals can change their identity.**
The nucleus of an atom is held together by forces. Sometimes there can be too many or too few neutrons in a nucleus, and so the forces holding it together cannot hold it together properly. To regain its stability, the nucleus will produce particles and eject them. This process is called ***radioactive decay***. Radioactive decay occurs at a steady rate that is characteristic of the particular isotope. The amount of time that it takes for one-half of the atoms in a particular sample to decay is called the ***half-life*** of the isotope. The chart shown below illustrates the progress of radioactive decay.