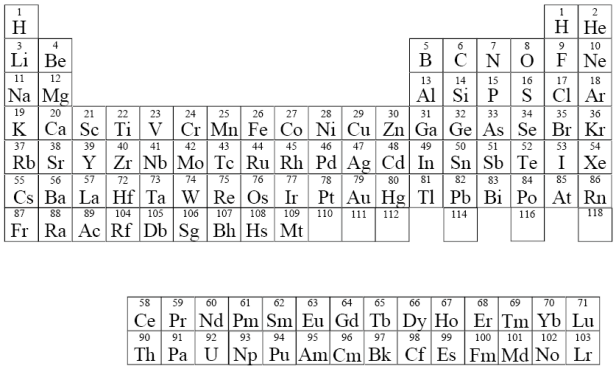
Chemistry A Periodic Table

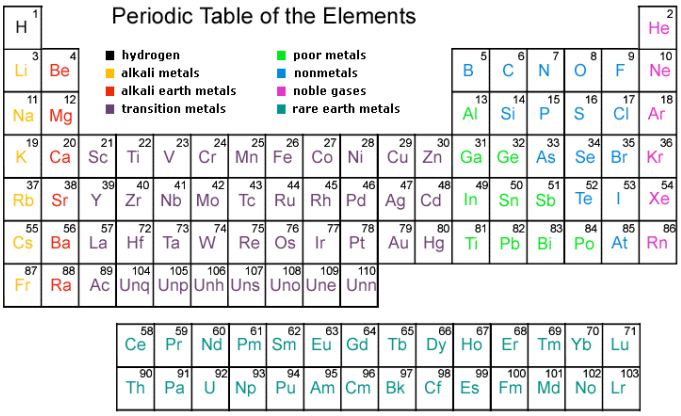


Worksheet #1: Periodic Table Inquiry Activity

Directions: I know that we have not talked about these ideas yet, but I want to see how much you can figure out on your own. **Sometimes you might feel like you are "guessing" at the answers, but if you read carefully and look at the pictures and diagrams all the information you need to answer the questions is on this sheet.**

A little background…

The periodic table is, in many ways, the world's greatest cheat sheet. It was created a long time ago by a guy named Dmitri Mendeleev who, probably like you, did not want to memorize tons of information. The periodic table lists all of the **elements** (simple substances that make up more complex materials) like gold, silver, tin, lead and mercury. It also provides lots of information about these elements. The good news is that you will be able to use the periodic table on all of your chemistry exams. The bad news is that first you have to learn all the symbols Mendeleev used for this information.



Questions:

1. Who created the first periodic table?

2. What is an element?

3. Each box represents a different element. How many elements are on this periodic table?

What makes up each element?

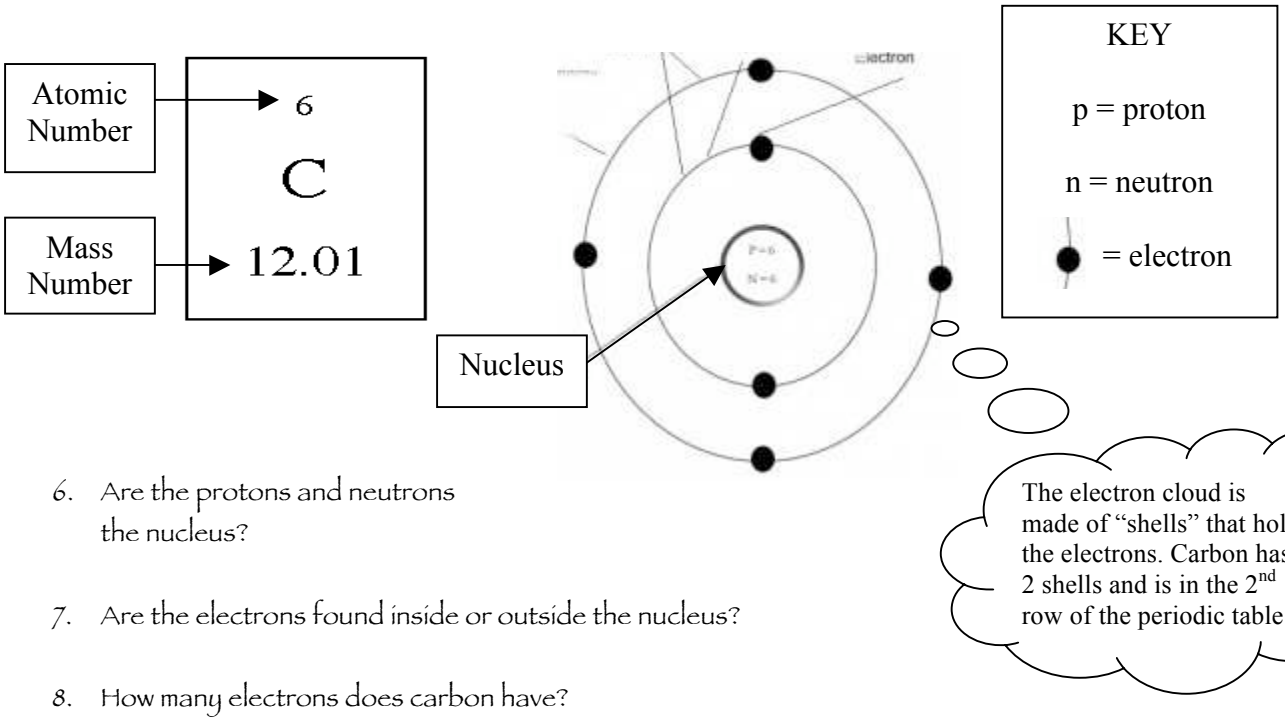
The parts that make up an element are called **sub-atomic particles**. There are three basic sub-atomic particles that we will talk about in chemistry, they are called protons, neutrons and electrons. Each proton has one positive charge of electricity (+1). Each electron has one negative charge of electricity (-1). Neutrons are neutral, which means they do not have a charge.

4. What is a sub-atomic particle?

5. What is the difference between a proton, a neutron and an electron?

Here is a close-up of the periodic table symbol for carbon, an element that is very common and we will study about this

Here is a close-up of the element carbon if we could see it under a very powerful microscope:



6. Are the protons and neutrons the nucleus?

7. Are the electrons found inside or outside the nucleus?

8. How many electrons does carbon have?

9. How many protons does carbon have?

10. How many neutrons does carbon have?

11. What is the total **positive** charge of carbon?

12. What is the total **negative** charge of carbon?

These + and – charges "cancel out" making a neutral carbon atom.

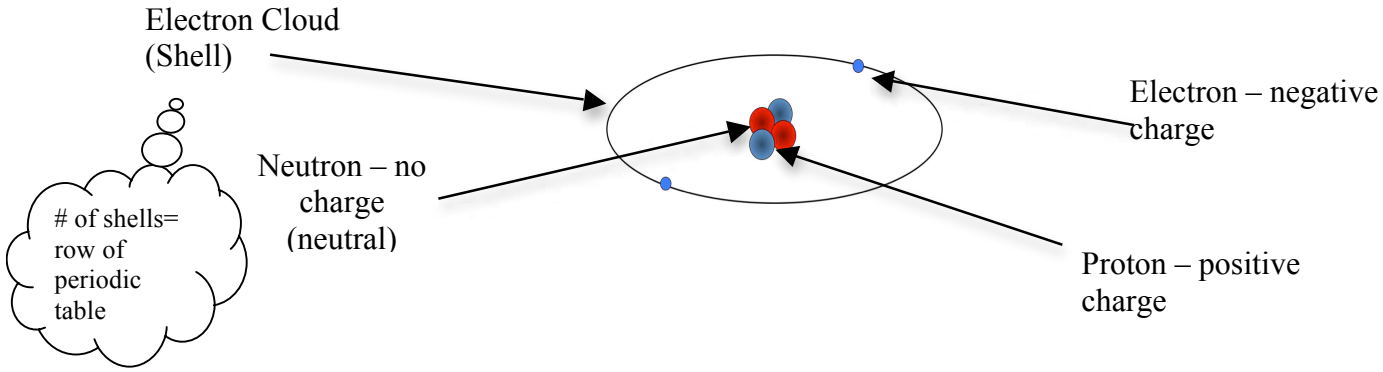
13. Match the following

a. Atomic Number — i. the number of protons in the nucleus of an atom

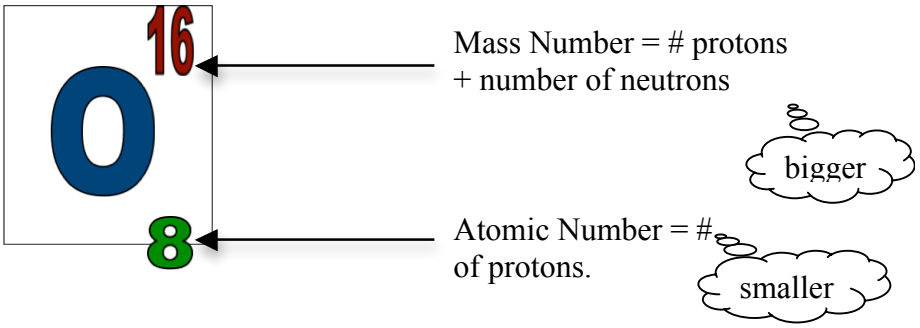
b. Atomic Mass — ii. the number of protons + number of neutrons (approximately)

Worksheet #2: Atoms

All matter (air, water, soil, people) is made the elements on the Periodic Table. The smallest unit of one element that can exist on its own is called an **atom**. Atoms are made of a central **nucleus**, which contains **protons** and **neutrons**. Protons are positively charged and neutrons have no charge. Surrounding these nuclei are little negatively charged particles called **electrons**. The space around the nucleus that contains the electrons is called the **electron cloud or shell**.



Each atom is different from every other atom by the number of protons it has in its nucleus. Hydrogen has one proton; helium has two. Calcium has 20 and gold has 79. **The number of protons in an atom is equal to the atomic number** of the element.



The proton has a positive charge and a mass of approximately one amu (atomic mass unit). A neutron is a neutral particle with a mass of approximately one amu. **To determine the number of neutrons in an atom you subtract the atomic number from the mass number of the atom**. The electrons are negatively charged particles located in energy levels outside the nucleus. The mass of an electron is extremely small—we describe it as negligible since it would take nearly two thousand electrons to have the mass of a single proton. **The number of electrons in an atom is equal to the atomic number** and, since the charge on an electron is equal in size but opposite in sign to that of the proton, **an atom is neutral**.

(+) charge + (-) charge = 0

Complete the following table:

Particle Name	Charge	Mass	Location in Atom	What tells you how many are in an atom?
PROTON				
ELECTRON				
NEUTRON				

 Name: _____Hr:___

Worksheet #3: Atomic and Mass Number Practice

Draw a picture of the symbol of carbon from the periodic table. Label its atomic number and mass number:

1. Carbon has 6 protons. How many electrons does it have?

2. Lead has an atomic number of 82. How many protons? Electrons?

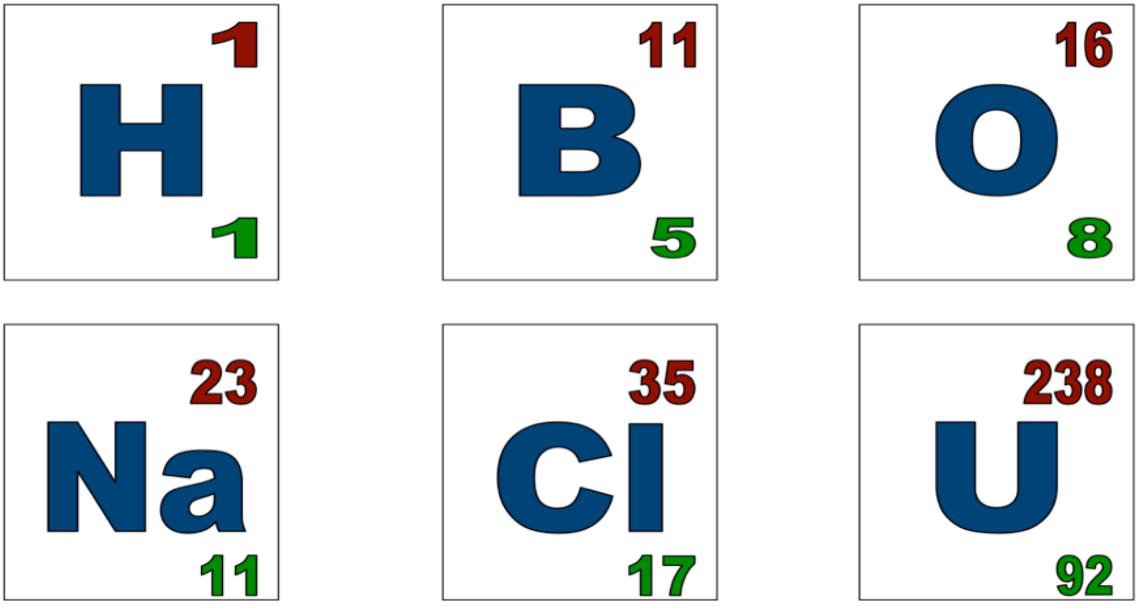
3. How many protons does Silicon have? Electrons?

4. An atom has a mass number of 42 and an atomic number of 39. How many neutrons does it have?

5. What is the mass number of calcium?

6. How many neutrons does calcium have?

More Practice: How many protons, neutrons and electrons are in each?



Worksheet #4: Organization of the Periodic Table

In addition to being different from each other because of the number of protons they have, atoms also differ in their behavior. Potassium and sodium are extremely explosive in the presence of water, while a chunk of copper or silver would just sink effortlessly to the bottom of a swimming pool.

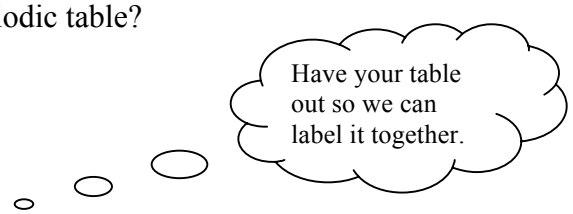
Dmitry Mendeleev (1834-1907) was a Russian chemist who proposed a method of arranging atoms according to their mass as well as their behavior. He noticed that certain elements behaved similarly to others, and he arranged these on his table so that they were in the same vertical row.

For example, i**f you look at a periodic table of elements, you will notice that H, Li, Na, K, Rb, Cs, and Fr are all in the same vertical column. These elements all share common behaviors and also share a similar electron arrangement.**

Mendeleev's work is important to us today because he was able to successfully classify the chemical elements in order to give scientists a better understanding of how atoms interact with each other and of the properties they hold. **The periodic table organizes the elements into a grid of horizontal rows called periods and vertical columns called groups or families.** By setting up this periodic table, he was even successful in predicting the existence of at least three more elements that had yet to be discovered (gallium, scandium, and germanium).

Arranging elements by mass resulted in several elements being placed in groups of elements with different properties. Henry Mosely (1913) discovered that atoms of each element contain a unique number of protons in their nuclei (plural of nucleus), the number of protons being equal to the atomic number. Arranging the periodic table by atomic number, instead of mass, eliminated the problems with the Mendeleev's periodic table.

1) What are the vertical (up and down) columns of the periodic table called? _____
2) What are the horizontal (back and forth) rows of the periodic table called? _____
3) Which elements have similar properties, those in the same period or in the same family? _____
4) How did Mosley improve the organization of the periodic table?



The Modern Periodic Table:

There are three main classifications for the elements- metals, nonmetals, and metalloids. **Metals** are elements that are **generally shiny when smooth and clean, solid at room temperature, and good conductors of heat and electricity**. Most metals are **ductile and malleable**, meaning that they can be pounded into thin sheets and drawn into wires.

Most group A elements and all group B elements are metals. If you look at boron (B), you see a heavy stair-step line that zigzags down to astatine (At) at the bottom of group 7A. This stair step line serves as a visual divider between the metals and the nonmetals on the table. **Except for hydrogen, all of the elements on the left side of the table are metals.** The group 1A elements (except for hydrogen) are known as the **alkali metals**. The group 2A elements are known as the **alkaline earth metals**. **Both the alkali metals and the alkaline earth metals are chemically reactive, with the alkali metals being more reactive of the two groups.**

The elements in the center of the periodic table are called **transition metals**. As with all metals, the transition elements are both ductile and malleable, and conduct electricity and heat. We will learn later in the trimester what makes transition metals unique in their behavior. The 2 sets of inner transition metals, known as the lanthanide and actinide series, are located along the bottom of the periodic table.

Nonmetals are elements that **are generally gases or brittle dull-looking solids found in the upper right side of the periodic table. They are poor conductors of heat and electricity. The highly reactive group 7A elements are known as halogens, and the extremely unreactive group 8A elements are commonly called the noble gases.**

Worksheet #4 Continued: Organization of the Periodic Table

The elements bordering the stair-step line are called metalloids. Metalloids are elements with physical and chemical properties of both metals and nonmetals. Silicon and germanium are 2 of the most important metalloids, as they are extensively used in computer chips and solar cells.

Directions: Fill in the blanks on the right with the information in the chart below.

Word List

actinide series	metal
alkali metal	metalloid
alkaline earth metal	Moseley
atomic mass	noble gas
atomic number	nonmetal
family	period
group	periodic law
halogen	periodic table
lanthanide series	transition element

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____

Dmitri Mendeleev developed a chart-like arrangement of the elements called the __(1)__. He stated that if the elements were listed in order of increasing __(2)__, their properties repeated in a regular manner. He called this the __(3)__ of the elements. The arrangement used today, devised by __(4)__, differs from that of Mendeleev in that the elements are arranged in order of increasing __(5)__. Each horizontal row of elements is called a(n) __(6)__. Each vertical column is called a(n) __(7)__, or, because of the resemblance between elements in the same column, a(n) __(8)__.

In rows 4 through 7, there is a wide central section containing elements, each of which is called a(n) __(9)__. Rows 6 and 7 also contain two other sets of elements that are listed below the main chart. These are called the __(10)__ and the __(11)__, respectively. Each of these elements, as well as those in the first two columns at the left end of the chart, is classified as a(n) __(12)__. Each of the elements at the right side of the chart is classified as a(n) __(13)__. Each of the elements between these two main types of elements, having some properties in common with each, is called a(n) __(14)__.

Each of the elements in Group 1A is called a(n) __(15)__. Each of the elements in the Group 2A is called a(n) __(16)__. Each of the elements in Group 7A is called a(n) __(17)__. Each of the elements in Group 8A is called a(n) __(18)__.

Worksheet #5: Color Coding the Periodic Table

REVIEW: *The Periodic Table is a list of all the known elements. It is organized by increasing atomic number. There are two main groups on the periodic table: metals and nonmetals. The left side of the table contains elements with the greatest metallic properties. As you move from the left to the right, the elements become less metallic with the far right side of the table consisting of nonmetals. The elements in the middle of the table are called "transition" elements because they are changed from metallic properties to nonmetallic properties. A small group whose members touch the zigzag line are called metalloids because they have both metallic and nonmetallic properties.*

NEW: The table is also arranged in vertical columns called "groups" or "families" and horizontal rows called "periods." Each arrangement is significant.

Groups (vertical, "up and down") – **same number of valence electrons (electrons in outermost shell of atom) which gives elements of the same group similar properties.**

Example: All group 1 elements have one electron in the outer shells and all group 2 elements have two electrons in their outer shells.

Periods (horizontal, "back and forth") – **same number of electron shells around nucleus**

Example: The elements in the first period all have one shell, the elements in the second period all have two shells etc.

There are a number of major groups with similar properties. They are as follows:

Hydrogen: This element does not match the properties of any other group so it stands alone. It is placed above group 1 but it is not part of that group. It is a very reactive, colorless, odorless gas at room temperature. (1 valence electron)

Group 1: Alkali Metals – These metals are extremely reactive and are never found in nature in their pure form. They are silver colored and shiny. They are soft enough to be cut with a knife. (1 valence electron)

Group 2: Alkaline-earth Metals – Slightly less reactive than alkali metals. They are silver colored and more dense than alkali metals. (2 valence electrons)

Groups 3 – 12: Transition Metals – These metals have a wide range of properties. In general, they are shiny and good conductors of heat and electricity. They also have higher densities and melting points than groups 1 & 2. (1 or 2 valence electrons)

Lanthanides and Actinides: These are also transition metals that were taken out and placed at the bottom of the table so the table wouldn't be so wide. The elements in each of these two periods share many properties. The lanthanides are shiny and reactive. Elements 95 through 103 do not exist in nature but have been manufactured in the lab-thus are man-made.

Group 13: Boron Group – Contains one metalloid (B) and 4 metals. Reactive. Aluminum is in this group. It is also the most common metal in the earth's crust. (3 valence electrons)

Group 14: Carbon Group – Contains one nonmetal, two metalloids (Si & Ge), and two metals. (4 valence electrons)

Group 15: Nitrogen Group – Contains two nonmetals, two metalloids (As & Sb), and one metal.(5 valence electrons)

Group 16: Oxygen Group – Contains three nonmetals and two metalloids (Te & Po).(6 valence electrons)

Groups 17: Halogens – All nonmetals. Very reactive. (7 valence electrons)

Groups 18: Noble Gases – Unreactive nonmetals. All are colorless, odorless gases at room temperature. All found in earth's atmosphere in small amounts. (8 valence electrons)