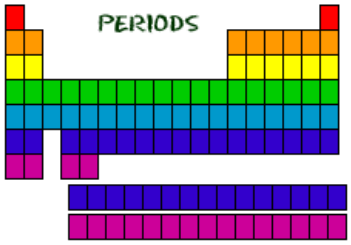
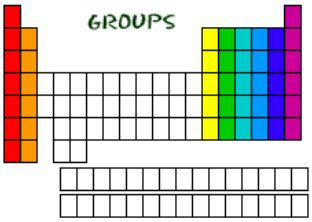
The Periodic Table
Groups & Periods

The **periodic table** is organized like a big grid. Each **element** is placed in a specific location because of its atomic structure. As with any grid, the periodic table has rows (left to right) and columns (up and down)…but that isn't quite what they are called in this case. Each row and column has specific characteristics. For example, beryllium (Be) and magnesium (Mg) are found in ***column*** two and share certain similarities while potassium (K) and calcium (Ca) from ***row*** four share different characteristics.



ROWS = PERIODS

Even though they skip some squares in between, all of the rows read left to right. When you look at the periodic table, each row is called a **period**. All of the elements in a period have the same number of energy levels or electron shells. For example, every element in the top row (the first period) has one energy level/shell for its electrons. All of the elements in the second row (the second period) have two energy levels/shells for their electrons. As you move down the table, every row adds an energy level/shell. At this time, there is a maximum of seven electron energy levels/shells.



COLUMNS = GROUPS OR FAMILIES

Now you know about periods going left to right. The periodic table also has a special name for its vertical columns. Each column is called a **group**. The elements in each group have the same number of valence electrons in their valence shell. Remember, valence is just another word for "outer." The valence electrons are important because they are the electrons involved in bonding with other elements. Every element in the first column (group one) has one electron in its valence shell. Every element in the second column (group two) has two electrons in the outer shell. As you might notice, the middle of the periodic table is not included in this pattern, but the pattern continues as you reach the other side of the table. The group in yellow continues the trend with 3 valence electrons; the next group has 4 and so on until you reach the last group, which has 8 valence electrons for a complete and stable valence shell.

Scientists have also grouped these "families" of elements together because they have similar physical and chemical properties. Some of the families are very reactive, while others don't react.

1. Compare and contrast periods and families. Reference text in your response.

2. Using evidence from the text, explain why the term "family" is appropriate to describe groups in the periodic table.

3. Hydrogen (H) is a nonmetal, yet it is located on the metal side of the periodic table. Explain its location using evidence from the texts.

Classification of Elements

Just as elements are arranged in groups (columns) and periods (rows) based on their reactivity and physical structure, the periodic table also organizes elements based on some of their basic physical properties. These three basic classifications are Metals, Metalloids and Nonmetals.

Metals:
Metals make up the largest group on the table, almost 75%. Some metals are familiar to everyone, especially Fe (iron), Au (gold) and Ag (silver). Metals have a certain look to them. They are solid at room temperature except for Hg (mercury), which is a liquid. They have a shiny luster or appearance. Metals can also be bent or change shape without breaking. Also, metals can be beaten into flat sheets without breaking. This is called malleability. Another characteristic of all metals is the ability to conduct heat or electricity. All metals have free electrons. That means the electrons float freely between the atoms and are not stuck. Since energy is transferred by moving electrons, it is easy to see that free electrons would be able to transfer energy more easily. This property is called conductivity. Not all metals have the same ability to conduct. It depends on how far their electrons can move before bumping into something else. Copper (Cu) has a weak bond with its electrons. The electrons move easily around copper atoms, so copper is a great conductor of both heat and electricity.

Metalloids:
The metalloids are located along the "staircase" between the metal and nonmetal sections of the periodic table. There are always things that don't quite fit in. Metalloids are the elements that don't belong in either the metals or nonmetals groups. There are seven known metalloids, B (boron), Si (silicon), Ge (germanium), As (arsenic), Sb (antimony), Te (tellurium), and Po (polonium). These elements share some characteristics of both metals and non-metals. Silicon has a shiny luster, but it is brittle and conducts electricity poorly. Some metalloids change their characteristics when they react with different elements. Boron acts like a metal when it reacts with fluorine and yet, behaves as a non-metal when reacting with sodium. These elements can be very useful when we need to use something that has properties of a metal but not as strong. The computer industry makes great use of the element silicon. Silicon conducts some electric current, but does not get hot. It is very useful in computer chips and transistors.

Nonmetals:
Nonmetals are the opposite of metals. They are grouped in the upper right corner of the Periodic Table. Elements like O (oxygen) and H (hydrogen) are members of nonmetals. They can be a solid or a gas at room temperature. They have an appearance that is dull or without luster. Nonmetals are very poor conductors of heat or electric energy.

But what about water? Water is made from two nonmetal elements (two hydrogen atoms and an oxygen atom), and yet it is a good conductor of electricity, right? It is not the water molecules that conduct the electricity, but the metals that are dissolved in the water, like Na (sodium). Nonmetal solids are also brittle, like S (sulfur) or C (carbon). If they are pounded, they break easily. They can't they be flattened into a sheet or pulled into thin strips like metals.

1. Compare and contrast metals and nonmetals, use evidence from the text in your response.

2. Relate the location of metalloids on the periodic table to their physical properties. Use evidence from the text to support your answer.

3. Explain why it is important for copper wires to be coated in plastic (PVC plastic contains hydrogen, carbon and chlorine atoms). Use evidence from the text to support your answer.