Name _____ Class _____ Date _____

Chapter 5 The Periodic Table

Summary

5.1 Organizing the Elements

Mendeleev arranged the elements into rows in order of increasing mass so that elements with similar properties were in the same column.

- A **periodic table** is an arrangement of elements in columns, based on a set of properties that repeat from row to row.
- Within a column, the masses of elements increase from top to bottom.
- You can use the gaps in a periodic table to predict what undiscovered elements would be like.

The close match between Mendeleev's predictions and the actual properties of new elements showed how useful his periodic table could be.

5.2 The Modern Periodic Table

In the modern periodic table, elements are arranged by increasing atomic number (number of protons).

Properties of elements repeat in a predictable way when atomic numbers are used to arrange elements into groups.

- Each row in the periodic table is called a **period.**
- Each column in the periodic table is called a **group.** The elements within a group have similar properties.
- The pattern of repeating properties is the **periodic law.**
- There are four pieces of information for each element on the periodic table: name, symbol, atomic number, and atomic mass.

Atomic mass is a value that depends on the distribution of an element's isotopes in nature and the masses of those isotopes.

- An **atomic mass unit** (amu) is defined as one twelfth the mass of a carbon-12 atom.

Elements are classified as metals, nonmetals, and metalloids.

- **Metals** are elements that are good conductors of electric current and heat. Almost all metals are solids at room temperature. Most are malleable and many are ductile.
- **Transition metals** are elements that form a bridge between the elements on the left and right sides of the periodic table. Many transition metals can form compounds with distinctive colors.

- **Nonmetals** are elements that are poor conductors of heat and electric current. They have low boiling points, so many are gases at room temperature.
- **Metalloids** are elements with properties that fall between those of metals and nonmetals.

Across a period from left to right, the elements become less metallic and more nonmetallic in their properties.

5.3 Representative Groups

Elements in a group have similar properties because they have the same number of valence electrons.

- A **valence electron** is an electron that is in the highest occupied energy level of an atom.
- The number of valence electrons increases from left to right in the periodic table.

The reactivity of alkali metals increases from the top of Group 1A to the bottom.

- **Alkali metals** are elements in Group 1A.
- The alkali metals include lithium, sodium, potassium, rubidium, cesium, and francium.
- Alkali metals are extremely reactive. They have one valence electron.

Differences in reactivity among the alkaline earth metals are shown by the ways they react with water.

- **Alkaline earth metals** are elements in Group 2A.
- All alkaline earth metals have two valence electrons.
- The alkaline earth metals include beryllium, magnesium, calcium, strontium, barium, and radium.

Aluminum is the most abundant metal in Earth's crust.

- Aluminum often combines with oxygen. It is found in a mineral called bauxite.
- Aluminum, boron, gallium, indium, and thallium are in the boron family, Group 3A.

Except for water, most of the compounds in your body contain carbon.

- Carbon is in Group 4A. It is a nonmetal.
- Other members of the group are metalloids (silicon and germanium) and metals (tin and lead). All have four valence electrons.

Besides nitrogen, fertilizers often contain phosphorus.

- Nitrogen and phosphorus are both in Group 5A. They are nonmetals.
- Other members of the group include two metalloids (arsenic and antimony) and one metal (bismuth). All have five valence electrons.

Oxygen is the most abundant element in Earth's crust.

- Oxygen is in Group 6A. Other nonmetals in the group are sulfur and selenium.
- Other members of the group are metalloids (tellurium and polonium). All have six valence electrons.

Despite their physical differences, the halogens have similar chemical properties.

- **Halogens** are elements in Group 7A.
- The halogens include four nonmetals (fluorine, chlorine, bromine, and iodine) and one metalloid (astatine).
- Each halogen has seven valence electrons.

The noble gases are colorless and odorless and extremely unreactive.

- **Noble gases** are elements in Group 8A. They include helium, neon, argon, krypton, xenon, and radon.
- Helium has two valence electrons. All the other noble gases have eight valence electrons.