


Vocabulary: Chemical Bonding

- Chemical bond – an electrical force that holds atoms together.
 - Types of chemical bonds include *ionic bonds*, *covalent bonds*, and *metallic bonds*.
- Chemical reaction – a process in which one or more substances are transformed into others.
 - In a chemical reaction, bonds between atoms are broken and new bonds are formed, joining atoms into different combinations.
 - No atoms are created or destroyed in a chemical reaction.
- Conductivity – the ability of a substance to transmit heat or electricity.
- Covalent bond – a chemical bond in which atoms share a pair of valence electrons.
 - Covalent bonds form between nonmetal atoms.
- Ductility – the ability of a substance to be drawn out into a wire.
- Electron affinity – the tendency of an atom to attract electrons.
 - Electron affinity is a measure of the energy required to remove an electron from the atom. This value is also called *ionization energy*.
 - Nonmetals are characterized by a high electron affinity, while metals are characterized by a low electron affinity.
- Electron configuration – a description of the shells, subshells, and orbitals occupied by electrons.
- Electron dot diagram – a diagram that shows the element symbol surrounded by dots representing *valence electrons* and dashes that represent pairs of shared electrons.
 - The electron dot diagram at right shows two fluorine atoms in a fluorine molecule (F₂). 
 - Electron dot diagrams are also called *Lewis diagrams* or *Lewis dot diagrams*.
- Electrostatic forces – forces between charged objects.
 - Opposite charges (positive and negative) will attract one another.
 - Similar charges (positive-positive or negative-negative) will repel one another.
- Energy level – a particular region where electrons can orbit the nucleus of an atom.
 - Energy levels are also known as *shells*.
 - The potential energy of an electron increases as it moves farther from the nucleus.

- Ion – an electrically charged atom that has gained or lost one or more electrons.
 - An atom with more protons than electrons is a positively charged ion, or *cation*.
 - An atom with more electrons than protons is a negatively charged ion, or *anion*.
 - In an element symbol, the electric charge is shown at the upper right.
- Ionic bond – a bond formed by the attraction between two oppositely charged ions.
 - Positively charged ions attract negatively charged ions and vice versa.
 - Positively charged ions repel positively charged ions, and negatively charged ions repel negatively charged ions.
- Ionization energy – the amount of energy required to remove an electron from an atom.
- Luster – The way light reflects from the surface of a material.
- Malleability – the ability of a substance to be pounded into a flat sheet without breaking.
- Metal – an element that is malleable and usually conducts heat and electricity well.
 - Metal atoms tend to lose electrons when forming chemical bonds.
- Metallic bonds – chemical bonds formed by the attraction between positively-charged metal ions and a “sea” of free-floating electrons.
 - Unlike the electrons in ionic or covalent bonds, the electrons in metallic bonds are not constrained to any one atom or molecule.
 - Metallic bonding gives metals many of their unique qualities, including conductivity, malleability, and ductility.
- Metalloid – an element that has properties of both metals and nonmetals.
- Molecule – a stable particle made of two or more atoms joined by covalent bonds.
- Noble gases – a group of chemical elements that do not readily form chemical bonds.
 - The noble gases are helium, neon, argon, krypton, xenon, and radon.
 - Helium has two valence electrons. Other noble gases have eight valence electrons.
- Nonmetal – an element that is generally a poor conductor of heat and electricity.
 - Nonmetal atoms tend to gain or share electrons when forming chemical bonds.
 - Most nonmetals are gases at room temperature.

- Octet rule – a rule of thumb that states that atoms are most stable when surrounded by eight valence electrons.
 - Metals lose valence electrons to obtain a stable configuration.
 - Nonmetals gain or share electrons to obtain a stable configuration.
 - Elements with five or fewer electrons are exceptions to the octet rule because they become stable when they have two valence electrons.
- Orbital – a region in space occupied by an electron or pair of electrons.
 - Formally, an orbital is a mathematical function that describes the probability of an electron (or pair of electrons) being found in a particular space.
- Pauli exclusion principle – a rule that states that no two electrons can have exactly the same location and state.
 - If two electrons share the same shell, subshell, and orbital, they must have different spins.
- Periodic table – a chart that organizes the chemical elements based on their properties.
- Quantum number – a quantity that describes the state of an electron.
- Reactivity – the relative tendency of a substance to undergo chemical reactions.
- Reactivity series – a list of elements (usually metals) in order of reactivity.
- Spin – a property of electrons that causes them to have an angular momentum and magnetism.
 - Electrons don't actually spin, but these properties (angular momentum and magnetism) arise as if they did.
 - The magnetism of materials such as iron is explained by a coordination of electron spins.
- Strong nuclear force – the force responsible for binding protons and neutrons together within the nucleus of an atom.
 - The strong nuclear force is also known as the strong force or the strong interaction.
 - The strong force is the most powerful of the four fundamental forces but only acts at very small distances within the nucleus of the atom.
- Subshell – a subdivision of a shell.
 - The subshells are designated *s*, *p*, *d*, and *f*.
 - The *s* subshell has one orbital.
 - The *p* subshell has three orbitals.
 - The *d* subshell has five orbitals.
 - The *f* subshell has seven orbitals.

- Valence – the number of chemical bonds an element is capable of forming.
 - The valence of an element is equal to the number of electrons that an atom of that element gains, loses, or shares while forming chemical bonds.
- Valence electron – an electron in the outermost shell of an atom.