**Chapter 6 Outline**

**Section 1: Introduction to Chemical Bonding**

1. **Types of Chemical Bonding** (Pg. 175-177)
   1. A chemical bond is the mutual attraction b/w the nuclei and the valence electrons of different atoms that binds the atoms together. Atoms bond together to minimize their potential energy which in turn makes them more stable.
      1. Ionic bonding- chemical bonding that results from the electrical attraction between cations and anions
      2. Covalent bonding- results from sharing of electron pairs between two atoms.
         1. Figure 1 (Pg. 176) shows the role of the electrons in the different types of bonds.
   2. To tell the difference between ionic and covalent bonds, we calculate the difference in the electronegativities between the elements. For ionic it is 50% or less (1.7-3.3). For polar covalent it is 5-50% (0.3-1.7) and nonpolar 0-5% (0-0.3).
      1. Nonpolar-covalent bonds- covalent bond in which the bonding electrons are shared equally by the bonded atoms
      2. Polar-covalent bonds- covalent bond in which the bonded atoms have an unequal attraction for the shared electrons.
         1. Figure 2 (Pg. 176) shows the difference in electronegativities between the elements in the bond and how it affects the bond type.
         2. Figure 3 (Pg. 177) shows the difference in the electron sharing in nonpolar and polar bonds.
2. What is the main distinction between ionic and covalent bonding?
   1. In ionic bonding the electrons are transferred instead of shared like the covalent bonds.

**Section 2: Covalent bonding and Molecular Compounds**

1. **Formation of a Covalent Compound** (Pg. 179)
   1. Molecule is a neutral group of atoms that are held together by covalent bonds. A molecular compound is a chemical compound composed of molecules. Covalent bonds indicate the relative numbers of atoms of each kind in a chemical compound by using atomic symbols and numerical subscripts. A molecular formula is used to show covalent bonds.
   2. Chemical bonds are formed because atoms want to be stable as a result of the high potential energy they posses as lone atoms. As atoms become closer together, they start to interact and become attracted with each other, which cause the decrease in potential energy. When the nuclei repel each other, an increase in potential energy occurs.
      * 1. Figure 5 (Pg.179) shows how the potential energy changes when atoms are attracted or repelled from each other.
        2. Figure 6 (Pg.179) shows the forces between the nuclei of two atoms.
2. **Characteristics of the Covalent Bond** (Pg. 181-182)
   1. In order to form a covalent bond, the energy needed to bond and separate the atoms must be the same.
      1. Bond energy- energy required to break a chemical bond and form neutral isolated atoms
3. **The Octet Rule** (Pg.182-183)
   1. Atoms want to possess the same stability as the noble gases.
   2. There are some exceptions to the octet rule. Some elements can be surrounded by more than 8 valence electrons because of expanded valence that involves electrons in the d, p, and s orbitals.
4. **Electron-Dot Notation** (Pg. 184-185)
   * 1. Electron-dot notation- electron-configuration notation in which only the valence electrons of an atom of a particular element are shown, indicated by symbol and dots placed around the symbol
5. **Lewis Dot Structures** (Pg.184)
   1. It is a way to represent molecules.
      1. Lewis Structures- formulas in which atomic symbols represent nuclei and inner shell electrons, dot-pairs or dashes represent electron pairs in covalent bonds
      2. Structural formula- indicates the kind, number, arrangement, and bonds, but not the unshared pairs of the atoms in the molecule.
      3. Single bond- covalent bond in which one pair of electrons is shared between two atoms.
6. **Multiple Covalent Bonds** (Pg.186-188)
   1. Atoms can share more than one electron pair.
      1. Multiple bonds- double or triple bonds
7. **Resonance Structures** (Pg.189)
   1. Some molecules cannot be correctly represented by the Lewis structures.
      1. Resonance- bonding in molecules or ions that cannot be correctly represented by a single Lewis structure.
8. **Covalent-Network Bonding** (Pg.189)
   1. Atoms can bond in a 3D structure because of covalent bonding.
9. Define bond energy.
   1. Bond energy is the energy required to break a chemical bond and form neutral isolated atoms.
10. State the octet rule.
    1. The octet rule states that many chemical compounds tend to form bonds so that each atom stares or has eight electrons in its highest occupied energy level.
11. How many pairs of electrons are shared in the following types of covalent bonds? (a) single bond (b) double bond (c) triple bond
    1. one pair
    2. two pairs
    3. three pairs
12. What are structural formulas and how are they helpful?
    1. Structural formulas are useful because they indicate the number, arrangement, and bonds, but not the unshared pairs of electrons.

**Section 3: Ionic Bonding and Ionic compounds**

1. **Formation of Ionic Compounds** (Pg. 190-192)
   1. Ionic compounds are the second main type of bond.
      1. An ionic compound is composed of positive and negative ions that are combined so that the numbers of positive and negative charges are equal.
      2. A formula unit is the simplest collection of atoms from which an ionic compound’s formula can be established.
         1. Figure 12 (pp 190) shows how sodium chloride is a crystalline solid like most ionic compounds.
   2. Ionic bonds are organized in a way that minimizes their potential energy. Because of the crystal lattice structure, one small change in the structure can cause the atoms in the compound to repel each other, which makes them brittle.
      1. Lattice energy is the energy released when one mole of an ionic crystalline compound is formed from gaseous ions.
         1. Figure 13 (pp 191) shows the ions in an ionic compound lower their potential energy by forming an orderly, 3D array in which the positive and negative charges are balanced.
         2. Figure 14 (pp 191) shows the crystalline structure of sodium chloride
         3. Figure 15 (pp 192) shows the crystal structure of sodium chloride in greater.
         4. Figure 16 (pp 192) shows that each calcium cation is surrounded by eight fluorine anions and each fluorine ion is surrounded by four calcium cations.
2. **A Comparison of Ionic and Molecular Compounds** (Pg. 193)
   1. Ionic and molecular compounds differ in many ways.
      1. Figure 17 (pp 193) shows a crystalline structure of an ionic compound, even a slight shift of one row of ions relative to another causes a large buildup of repulsive forces.
3. **Polyatomic Ions** (Pg. 194)
   1. Polyatomic ions are a special type of ions that are used in ionic bonding.
      1. Polyatomic ion - charged group of covalently bonded atoms.
4. What are structural formulas and how are they helpful?
   1. Structural formulas are useful because they indicate the number, arrangement, and bonds, but not the unshared pairs of electrons.