

Chemical Bonds



Objectives

- ☐ Explain how valence electrons are related to the formation of a chemical bond.
 - ☐ Predict whether a bond is ionic or covalent.
 - ☐ Describe the formation of an ionic bond between a metal atom and a nonmetal atom.
 - ☐ Describe the formation of a covalent bond between two nonmetal atoms.
 - ☐ Draw the electron dot formula for a molecule.
 - ☐ Draw the structural formula for a molecule.
-

Objectives

- ☐ Draw the electron dot formula for a polyatomic ion.
 - ☐ Draw the structural formula for a polyatomic ion.
 - ☐ Classify a bond as being either polar or non-polar based on the electronegativities of the atoms that form the bond.
-

Kinds of Chemical Bonds

- ☐ Ionic Bonds
 - ☐ Polar Covalent Bonds
 - ☐ Non-Polar Covalent Bonds
-

The Octet Rule

- ❑ Atoms bond in such a way that each atom acquires eight electrons in its outer shell.
-

Ionic Bond Terminology

- ❑ Ionic Bond – A Bond in which one or more valence electrons are transferred from one atom to another.
 - ❑ Formula Unit – The fundamental particle held together by ionic bonds.
 - ❑ Cation – A ion formed when a metal loses one or more electrons resulting in a stable configuration of 8 electrons in the outermost energy level.
 - ❑ Anion – An ion formed when a non-metal gains one or more electrons resulting in a stable configuration of 8 electrons in the outermost energy level.
-

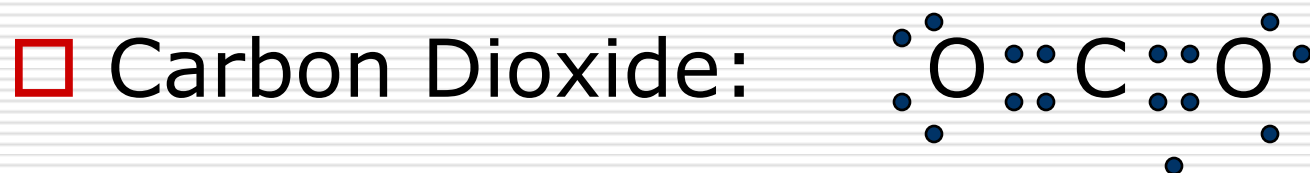
Covalent Bond Terminology

- ❑ Covalent Bond – A bond in which valence electrons are shared between two atoms.
 - ❑ Molecule – The fundamental particle held together by covalent bonds.
-

Electron Dot Formulas (Molecules)

- ❑ Calculate the total number of valence electrons by adding together all of the valence electrons for each atom in the molecule. The total should be an even number.
 - ❑ Divide the total number of valence electrons by 2 to find the number of electron pairs in the molecule.
 - ❑ Surround the central atom with four electron pairs. Use the remaining electron pairs to complete an octet around each of the other atoms (2 around hydrogen).
 - ❑ If there are not enough electron pairs to provide an octet for each atom, move a nonbonding electron pair between two atoms that already share a pair of electrons.
-

Electron Dot Formula Examples



Electron Configurations (Polyatomic Ions)

- ❑ Calculate the total number of valence electrons by adding together all of the valence electrons for each atom in the molecule. If the ion is negatively charged, add the number of electrons equal to the charge. If the ion is positively charged, subtract the number of electrons equal to the charge. The total should be an even number.
 - ❑ Divide the total number of valence electrons by 2 to find the number of electron pairs in the molecule.
 - ❑ Surround the central atom with four electron pairs. Use the remaining electron pairs to complete an octet around each of the other atoms (2 around hydrogen).
 - ❑ If there are not enough electron pairs to provide an octet for each atom, move a nonbonding electron pair between two atoms that already share a pair of electrons.
-

Electron Dot Examples

☐ Ammonium ion

☐ Sulfate ion

☐ Carbonate ion

Types of Covalent Bonds

□ Polar Covalent Bonds

- Electrons are shared unequally.
 - One end of the bond is more positive and the other end is more negative.
 - Electronegativity trends can be used to determine which atom will be more positive and which end will be more negative.
 - Delta notation is used to show the polar nature of the bond. $\delta^+ \text{H}-\text{Cl} \delta^-$
-

Types of Covalent Bonds

☐ Non-polar Covalent Bonds

- Electrons are shared equally.
- Atoms have the same electronegativity.
- Diatomic molecules are non-polar.

☐ Coordinate Covalent Bonds

- One atom does not contribute any of the shared electrons.
-