

# GENERAL CHEMISTRY

## STANDARD 5.1

**5.1: Define a chemical bond and calculate the electronegativity difference to determine bond type and polarity**

# TYPES OF CHEMICAL BONDS

- **Ionic Bond:** Bond between a metal ion (cation) and a nonmetal ion (anion)
  - Metal ions are positive ions (cations) – have a positive oxidation number
  - Nonmetal ions are negative ions (anions) – have a negative oxidation number
  - The cation gives its valence electrons to the anion – this is an ionic bond
  - Characterized by a HIGH electronegativity difference ( $> 2.0$ ) across the bond
- **Covalent Bond:** Bond between two nonmetal ions (anions)
  - Valence electrons are shared between two anions
  - Two types of Covalent Bonds:
    - Polar Covalent Bond: Unequal sharing of electrons, moderately-high electronegativity difference ( $1.0 - 1.9$ ) across the bond)
    - Nonpolar Covalent Bond: Approximately equal sharing of electrons, low electronegativity difference ( $0.0 - 0.9$ ) across the bond

# EXAMPLES OF CHEMICAL BONDS

- Classify the following molecules as having ionic bonds, polar covalent bonds, or nonpolar covalent bonds:
  - LiOH
    - Lithium is a metal (+1 oxidation number), hydroxide is an anion (-1)
    - Molecule has ionic bonds
  - NH<sub>3</sub>
    - Nitrogen is an anion (-3), hydrogen is an anion (-1), only 0.9 electronegativity difference
    - Molecules has nonpolar covalent bonds
  - CO<sub>2</sub>
    - Carbon is an anion (-4), oxygen is an anion (-2), electronegativity difference of 1.0
    - Molecule has polar covalent bonds