# Lecture 4 — Covalent Bonding

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- Electron Sharing in Covalent Bonds
  - Covalent bonds form when atoms share electrons to achieve a stable electron configuration (octet rule)
  - Key Characteristics
    - Localized Electrons:
      - Shared electrons are concentrated in the bond region between two nuclei
    - Directionality:
      - Covalent bonds are directional, determining the geometry of molecules and latices
- Octet Rule
  - Atoms tend to share, gain, or lose electrons to achieve a stable configuration with eight valence electron configuration
  - Covalent bonding enables atoms to fulfill this rule by sharing electrons
  - Exceptions to the Octet Rule
    - Expanded Octets: Elements like phosphorus (P) or sulfur (S) can have more than eight valence electrons
    - Electron Deficiency: Atoms have fewer than 8 electrons in their valence shell
    - Deviations occur due to varying atomic size, electron configurations, or bonding needs
    - Odd-Electron Molecules (Radicals): Molecules with unpaired electrons, resulting in an incomplete octet
- Bond Types
  - Single: Longest bond length and lowest bond energy
  - Double: Shorter and stronger than single bonds
  - Triple: Shortest bond length and highest bond energy