

14: Chemical Bonding Theories

Key Chemistry Terms

- **Ionic Bond:** Bond formed from electrostatic attraction between ions (charged atoms)—formed from metals with nonmetals.
- Covalent Bond: A bond formed between two nonmetals that involves shared electrons.
- Polar covalent bond: Bond formed between two nonmetals—uneven sharing of electrons.
- Metallic bond: Formed between metal atoms—electrons are pooled between the network of atoms.
- **Polar bond:** Bond between two atoms with a great difference in electronegativities—uneven sharing of electrons resulting in a slightly positive region and a slightly negative region of the bond.
- Electronegativity: An atom's "pull" on electrons shared with another atom.
- Polar molecule: Molecule where the polar bonds do not cancel each other out in 3D orientation.
- Isomers: Molecules with the same chemical formula, but different bonding structure.
- Resonance: Two compounds with multiple bonds in different locations.
- Valence Bond Theory: Overlap of atomic orbitals form bond.
- Sigma (o) bond: First bond between two atoms formed from head on overlap of orbitals.
- Pi (π) bond: 2nd or 3rd bond between two atoms formed from overlap of parallel p orbitals.
- **Hybridization:** Atomic orbitals hybridize into orbitals of the same energy for all sigma bonds of the atom.

Characteristics of bond types

Bond type	Happens	Electrons are
	between	
Ionic	Metal & non-metal	Transferred
Covalent	Non-metals	Shared
Polar	Non-metals	Shared
Covalent		unevenly
Metallic	Metals	pooled

Common characteristics:

- Ionic: High melting points, most dissolve in water, conduct electricity when dissolved in water, brittle.
- Covalent: Low melting points, most do not dissolve in water, do not conduct electricity when dissolved in water.
- Polar covalent: Medium melting points, some dissolve in water, do not conduct electricity when dissolved in water.
- Metallic: Soft, conduct heat and electricity, do not dissolve in water.

Bond Polarity

When nonmetals bond covalently with a large difference in electronegativity.

- Absolute value of differences:
 - 0 0.4 = covalent
 - \circ 0.5 1.4 = polar covalent
 - 0 1.5 4 = ionic

Symbolized with an arrow pointing towards the more electronegative element and a crossed tail by the less electronegative element.

Example:

C - N Electronegativity difference of 0.5 = polar bond



Isomers and Resonance

I somer examples:

Resonance examples:

Sigma and Pi bonds

How many sigma and pi bonds are in the following?

$$\begin{array}{ccc} & H & H \\ & | & | \\ H - C = C - C \equiv C \end{array}$$

6 sigma bonds & 3 pi bonds

Hybridization

# of sigma bonds	Hybridization	Formed from
2	sp	1 s and 1 p
3	sp ²	1 s and 2 p
4	sp ³	1 s and 3 p

How to Use This Cheat Sheet: These are the keys related this topic. Try to read through it carefully twice then rewrite it out on a blank sheet of paper. Review it again before the exams.