High School Chemistry - Core Concept Cheat Sheet

15: Chemical Bonding

Key Chemistry Terms

- **Ionic Bond:** Bond formed from electrostatic attraction between ions (charged atoms). Formed from metals with nonmetals.

- **Covalent Bond:** Bond formed between two nonmetals that involve 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 networks 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 atomic "pull" on electrons shared with another atom.

- **Polar molecule:** Molecule where the polar bonds do not cancel each other out in 3D orientation.

- **Valence Bond Theory:** Overlap of atomic orbitals form bond.

- **Sigma (σ) bond:** First bond between two atoms formed from head on overlap of orbitals (head-to-head overlap).

- **Pi (π) bond:** bond between two atoms from overlap of parallel p orbitals (side-to-side overlap).

Characteristics of Bond Types

Bond type	Happens between	Electrons are
Ionic	Metal & non-metal	Transferred
Covalent	Non-metals	Shared
Polar Covalent	Non-metals	Shared 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.

Electronegativity

There are 8 common elements that you should remember their electronegativity ordering.

Electronegativity Mnemonic: F(4.0) > O(3.5) > N(3.0) > Cl(3.0) > Br(2.8) > S(2.5) > C(2.5) > H(2.1) = _FON_ (fun) _C_lown _B_rings _S_uch _CH_aos.

Less common: I(2.5); P(2.1).

Using Bond Characteristics

Examples:
Identify the type of bond based on characteristics:

NaCl
     Ionic (metal & non-metal).

CH_3COOH
     Covalent (non-metal & non-metal).

Dissolves in water.
     Polar covalent or ionic.

Conducts electricity in solid state.
     Metallic.

Conducts electricity dissolved in water.
     Polar covalent.

Bond Polarity

When nonmetals bond covalently with a large difference in electronegativity

- **Absolute value of differences:**
  - 0 – 0.4 = covalent
  - 0.5 – 1.4 = polar covalent
  - 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

    Carbon electronegativity = 2.5

    Nitrogen electronegativity = 3.0

    Electronegativity difference of 0.5 = polar bond

    C – N

    ➤

Sigma and Pi Bonds

Each single bond is a sigma bond.

Each double or triple bond contains one sigma bond and then pi bonds to form the second or third bond.

Example:
    How many sigma and pi bonds are in the following?

```
    H    H
    |    |
H – C = C – C ≡ C
```
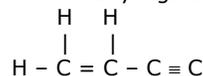
6 sigma bonds & 3 pi bonds

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