

Bonding, EN & Bond Polarity, Lewis Structures

Bonding

Metals vs Nonmetals

The periodic table lets us distinguish between metals and nonmetals based on where something is located on the table. There are some important properties of metals and nonmetals that differ within a period

Property	Metal	Nonmetal
Atomic Size		
Z_{eff}		
IE		
EA		

Three Types of Bonding

1. Ionic bonding (electron _____)

Involves a _____ with a _____

Observed between:

Mechanism:

Definition:

2. Covalent bonding (electron _____)

Involves a _____ with a _____

Observed between:

Mechanism:

Definition:

3. Metallic bonding (electron _____)

Involves a _____ with a _____

Observed between:

Mechanism:

Definition:

Note:

Starting Small – Lewis Dot Symbols

Define –

lewis electron dot symbol:

octet rule:

Writing symbols for main group elements:

1.

2.

3.

Example: nitrogen

1. group _____, therefore _____ valence e^-

2.

3.

Note: e^- placement is not critical. All four of the following are the same:

Write the Lewis electron dot symbols for the following: O, C, Ar, Si, Al, P. Which elements have similar looking symbols? Why?

So, why do we care about Lewis electron dot symbols? What do they tell us?

Specifically for metals:

Specifically for nonmetals:

A Brief Look at Ionic Bonding

The central idea of ionic bonding is:

Using orbital diagrams & Lewis electron dot symbols to represent ion formation – Combining Li and F involves a transfer of 1 e⁻ from Li to F. Show the formation of the Li⁺ and F⁻ ions pictorially using orbital diagrams and Lewis electron dot symbols then write the compound that forms between them.

Do the same for the formation of Na⁺ and O²⁻ ions from sodium and oxygen atoms.

Forming Covalent Bonds

Define –

shared (bonding) pair:

lone (unshared) pair:

bond order:

single bond:

double bond:

triple bond:

What is the principle way that atoms interact chemically?

Formation of a bond always results in _____ e^- density between the two nuclei.

Bonding Pairs and Lone Pairs

Like ionic bonds, covalent bonds result in a _____ outer (valence) level of e^- . How does this occur?

Examples:



General conventions
bonding pairs:

lone pairs:

Representing Multiple Bonds

Multiple bonds most frequently involve these four atoms: _____, _____, _____, and/or _____.

Double bond – C_2H_2

Triple bond – N_3

Electronegativity & Bond Polarity

Define –
electronegativity:

polar covalent bond:

nonpolar covalent bond:

partial ionic character:

electronegativity difference:

What is the consequence of this concept?

Trends:

1.

2.

3.

What is the most electronegative element? The close second?

The least?

Bond Polarity

Representing polarity – polar arrows and partial charges as shown on HF

Knowing the electronegativity of atoms in a bond lets us find the direction of bond polarity.

Example: Using polar arrows, indicate the polarity of

1. NH

2. FN

3. ICl

Also, knowing the trends of electronegativity let us rank things in order of polarity.
Example: Rank the following bonds in order of increasing polarity
HN, HO, HC

Lewis Structures

Define –

Lewis structure:

resonance structures:

resonance hybrid:

electron-pair delocalization:

formal charge:

Writing Lewis Structures Using the Octet Rule

NF₃ – Lewis structure in four steps

1.

2.

3.

4.

What happens with more than one central atom? CH₄O

Lewis Structures with Multiple Bonds – adding step 5
5.

Write Lewis structures for the following:

CCl₂F₂, HCN, NH₃O, OF₂, C₂H₆O, CO₂, CO, H₂S, SOCl₂

Next week we'll address the issue of formal charges, resonance structures, Lewis structures when the octet rule is not obeyed, and VSEPR