Electronegativity

An atoms ability to attract electrons towards itself in a chemical bond

Rep and Trans Metals

1 – 4 Valence Electrons (e^-)

- Wants to Lose Electrons
- Forms Ions vs Sharing e^-
- Low Electronegativity (*0.7-1.9*)

Metalloids and Non-Metals

4-7 Valence Electrons (e^-)

- Wants to Gain Electrons
- Shares Electrons (*Covalent*)
- High Electronegativity (*2.0 – 4.0*)

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Electronegativity Difference

The difference in electronegativity values between atoms in a bond

Ionic Bonds

Transfer of Electrons (*Metal to Non-Metal*)

Metal – Low Electroneg.
Non-Metal – High Electroneg.

Electroneg Difference Range
1.91 – 3.50 with a Metal

Polar Covalent Bonds

Unequal Sharing of Electrons (*Non-Metal to Non-Metal*)

Non-Metal – Mid Electroneg.
Non-Metal – High Electroneg.

Electroneg Difference Range
0.51 – 1.90 (No Metals)

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Electronegativity Difference

The difference in electronegativity values between atoms in a bond

Non-Polar Covalent Bonds
Equal Sharing of electrons
(*Non-Metal to Non-Metal*)

Non-Metal – High Electroneg.
Non-Metal – High Electroneg.

Electroneg Difference Range
0.00 – 0.50 (No Metals)

Diatomic Element
Equal Sharing of electrons
(*Same Elements*)

Element A – Electroneg. A
Element A – Electroneg. A

Electroneg Difference Range
0.00 (Same Element)

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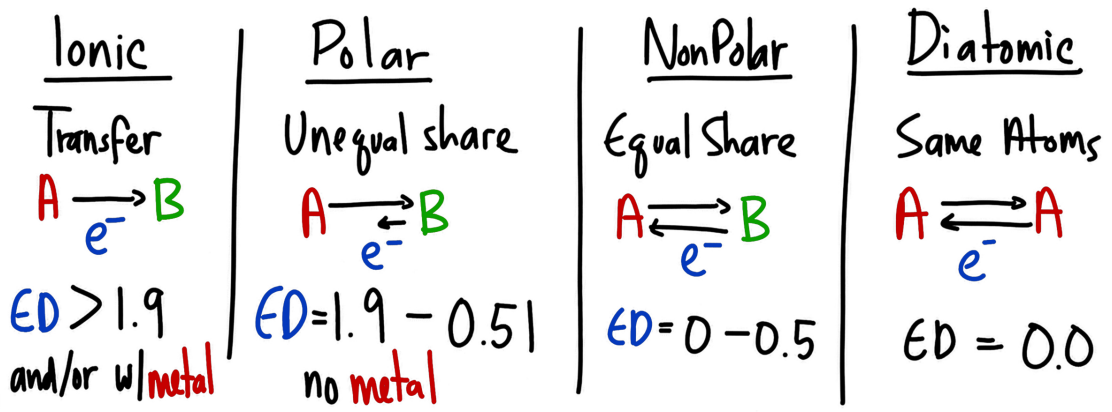
Bonding Comparison



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Calculating Electronegativity Difference

Electroneg. Difference (ED) = High Electro. Value – Low Electro. Value

Ionic Bond
Na (*E = 0.9*) and Cl (*E = 3.0*)

ED = Electro. Cl – Electro. Na
ED = 3.0 – 0.9 = 2.1 (*Ionic*)

Polar Covalent Bond
H (*E = 2.1*) and Cl (*E = 3.0*)

ED = Electro. Cl – Electro. H
ED = 3.0 – 1.9 = 0.9 (*Polar*)

Non-Polar Covalent Bond
Cl (*E = 3.0*) and S (*E = 2.5*)

ED = Electro. Cl – Electro. S
ED = 3.0 – 2.5 = 0.5 (*Non-Polar*)

Diatomic Element Bond
Cl (*E = 3.0*) and Cl (*E = 3.0*)

ED = Electro. Cl – Electro. Cl
ED = 3.0 – 3.0 = 0.0 (*Non-Polar*)

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Electronegativity Examples

Al and F
Al: 1.5 F: 4.0
ED = 4.0 − 1.5 = 2.5
Ionic (>1.9 w/metal)
Al is a metal: Ionic Bond

H and Cl
H: 2.1 Cl: 3.0
ED = 3.0 − 2.1 = 0.9
Polar Covalent (0.51-1.9) no metal
Polar Covalent

Ionic
> 1.9 w/metal
Polar
0.51 – 1.9 no metal
Non-Polar
0.1 – 0.5
Diatomic
0.0

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Electronegativity Examples

Pb and P

Pb: 1.8 P: 2.2

$\epsilon D = 2.2 - 1.8 = 0.4$

Ionic: metal (>1.9)

Covalent: no metal (1.9 - 0.51)

Pb is a metal = Ionic

Steps

1. metal? Ionic
   (1A-2A, Al, 1B-8B, In, Sn, Tl, Pb, Bi)
2. Calculate ϵD
3. Use chart to determ. bond type

Ionic
> 1.9 w/metal
Polar
0.51 - 1.9 no metal
Non-Polar
0.1 - 0.5
Diatomic
0.0

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