Electronegativity and Bonding

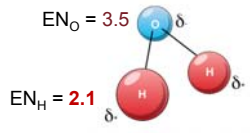
Section 2.3

Electronegativity (EN)

- a number that describes the relative ability of an atom to attract electrons, while bonded to another atom
  - How well is an atom able to "hog" the shared electrons in a covalent bond?
- fluorine = highest value = 4.0

$EN_O = 3.5$

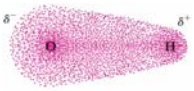
$EN_H = 2.1$



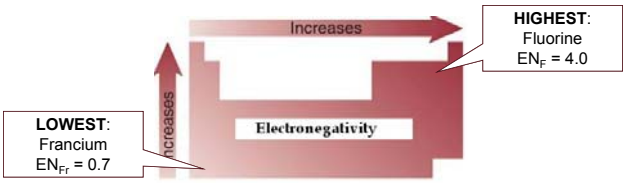
Example:
Water, H_2O

$EN_O > EN_H$

∴oxygen attracts the shared electrons in the bond more than hydrogen does



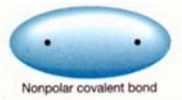
Electronegativity is highest when electrons feel a strong effective charge from the positive nucleus.



Across a period: Electronegativity increases
- strong force of attraction between nucleus and electrons

Down a group: Electronegativity decreases
- screening effect due to additional energy levels

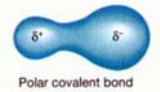
Non-polar covalent bonds



- bonded atoms have **no or little difference** in electronegativity
- electrons are distributed equally between bonded atoms

blobs represent electron clouds surrounding nuclei

Polar covalent bonds

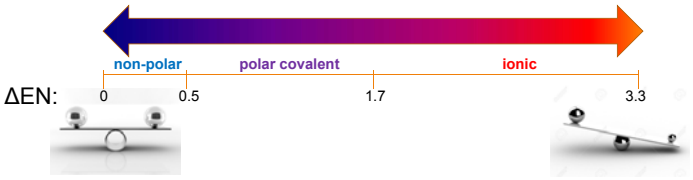


- atoms have **significant differences** (ΔEN > 0.5)
- slightly ionic in character
  - one atom is partially positive ("positive dipole")
  - other atom is partially negative ("negative dipole")

The Bonding Continuum

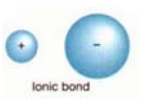
The electronegativity difference (Δ EN) between atoms in a bond determines the type of bond that exists between them.

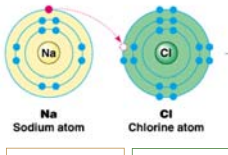
Greater difference = More unequal distribution of electrons



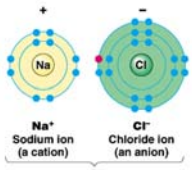
Ionic Bonds

ΔEN is so great (1.7+) that one atom TAKES electrons from the other
- more electronegative atom becomes the anion (-)





$EN_{Na} = 0.93$ $EN_{Cl} = 3.16$



$\Delta EN = | EN_{Na} - EN_{Cl} |$
$= |0.93 - 3.16|$
$= 2.23$

Practice:
Find **ΔEN** for each pair of atoms and **classify** the bond as non-polar, polar, or ionic:

a. Cl – Cl

c. C – Cl

b. Mg – O

d. Be - H

Example: carbon monoxide, CO

EN_C
EN_O
ΔEN

Representing the dipoles in a bond
- ∂ symbol to indicate slight positive and negative atoms (∂+ or ∂-)

Intramolecular Force
aka "Bond"
- within a molecule
- holds atoms together

Ionic Bonds
- cation + anion
- transfer of electrons

Covalent Bonds
- usually non-metals
- sharing electrons

Non-polar covalent
Electrons are **equally** shared

Polar covalent
Electrons are **unequally** shared

Homework

- Pg. 73 #1-4, 8
- Worksheet