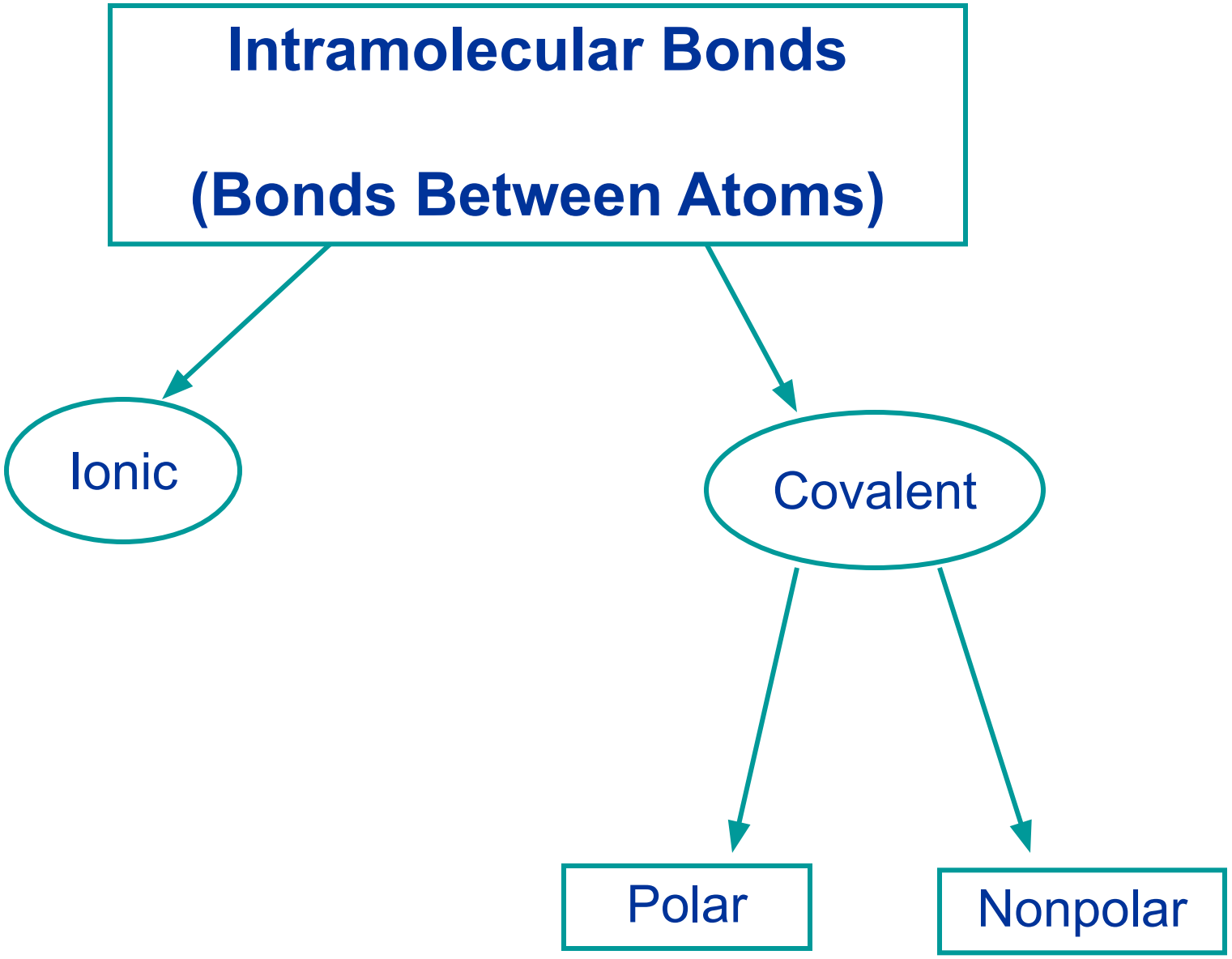
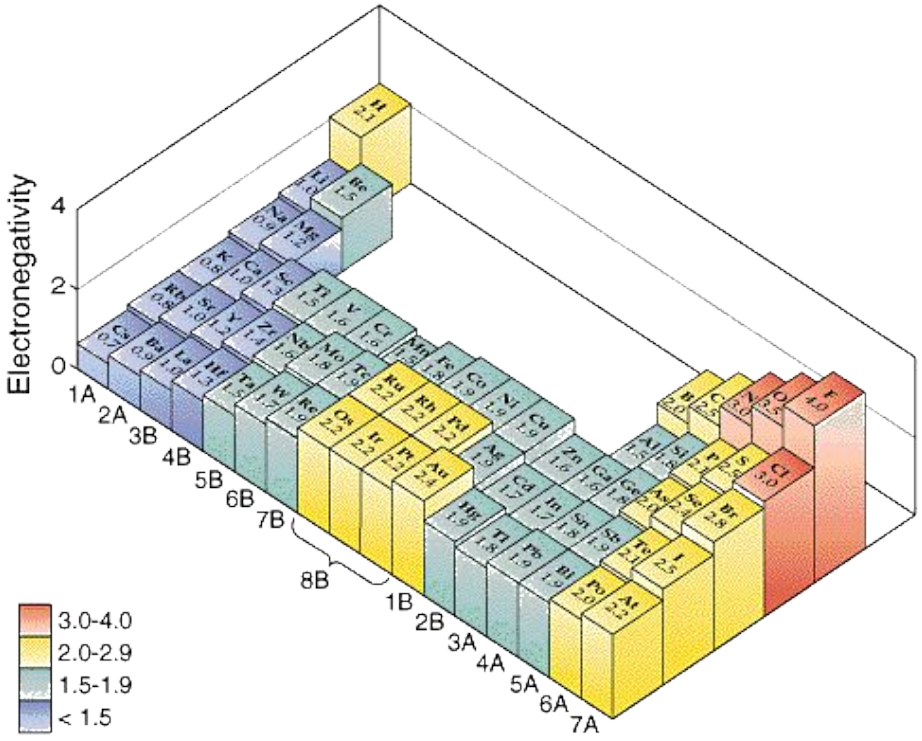

Intramolecular Bonds
(Bonds Between Atoms)
Ionic
Covalent
Polar
Nonpolar

Bond Polarity and Electronegativity

- **Electronegativity:** The ability of one atoms *in a molecule* to attract electrons to itself.
- Pauling set electronegativities on a scale from 0.7 (**Cs**) to **4.0** (**F**).
- Electronegativity increases
  - across a period and
  - up a group.



The type of bond can usually be calculated by finding the difference in electronegativity of the two atoms that are going together.

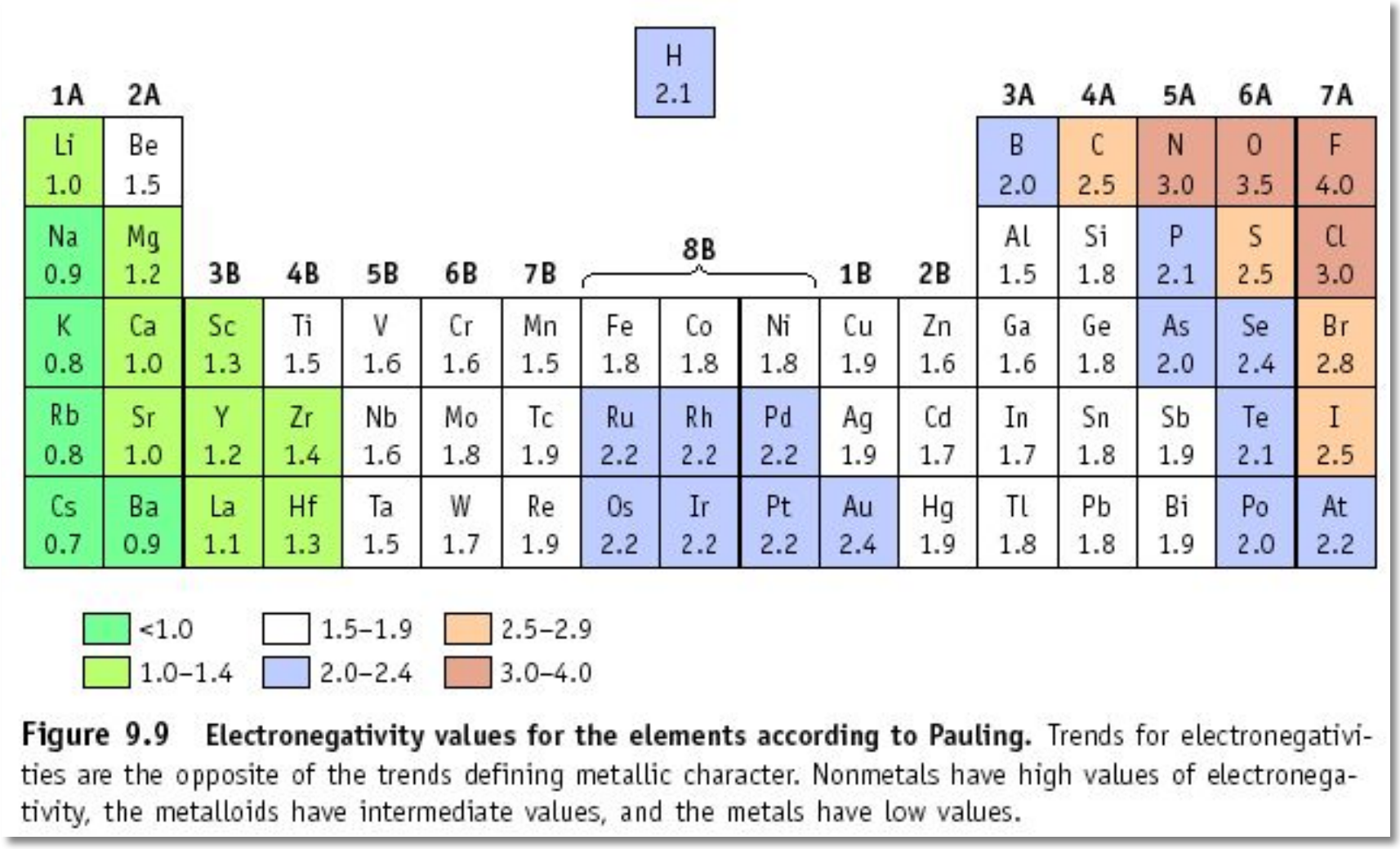


Figure 9.9 Electronegativity values for the elements according to Pauling. Trends for electronegativities are the opposite of the trends defining metallic character. Nonmetals have high values of electronegativity, the metalloids have intermediate values, and the metals have low values.

Electronegativity Difference

- If the difference in electronegativities is between:
  - 1.7 to 4.0: Ionic
  - 0.41 to 1.7: Polar Covalent
  - 0.0 to 0.4: Non-Polar Covalent

Example: NaCl
Na = 0.9, Cl = 3.0
Difference is 2.1, so this is an ionic bond!

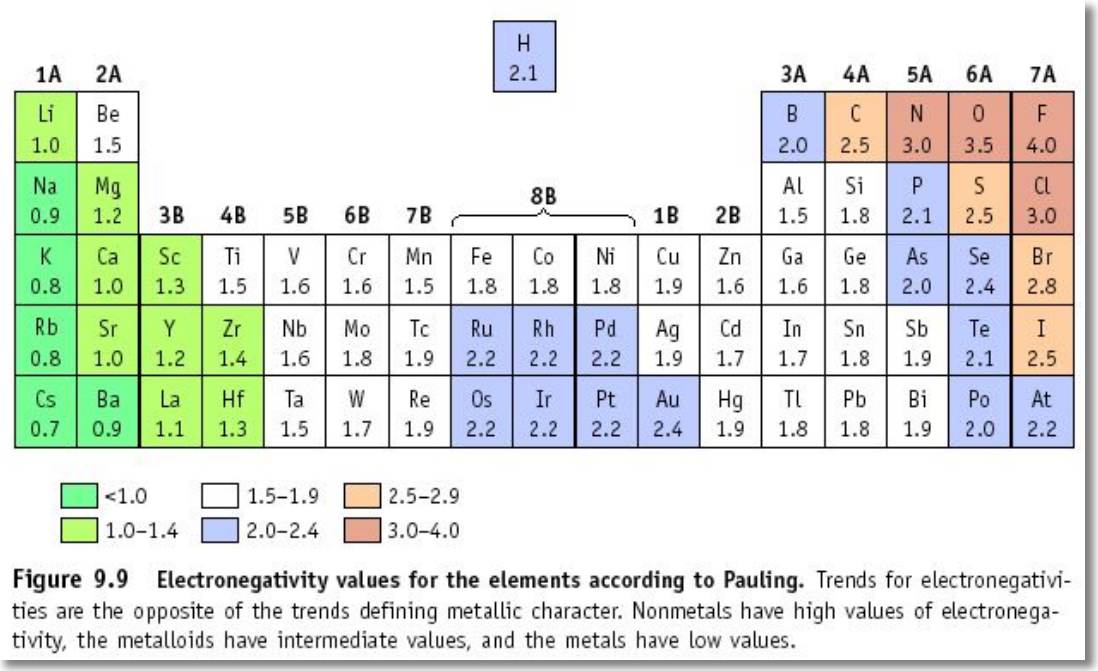
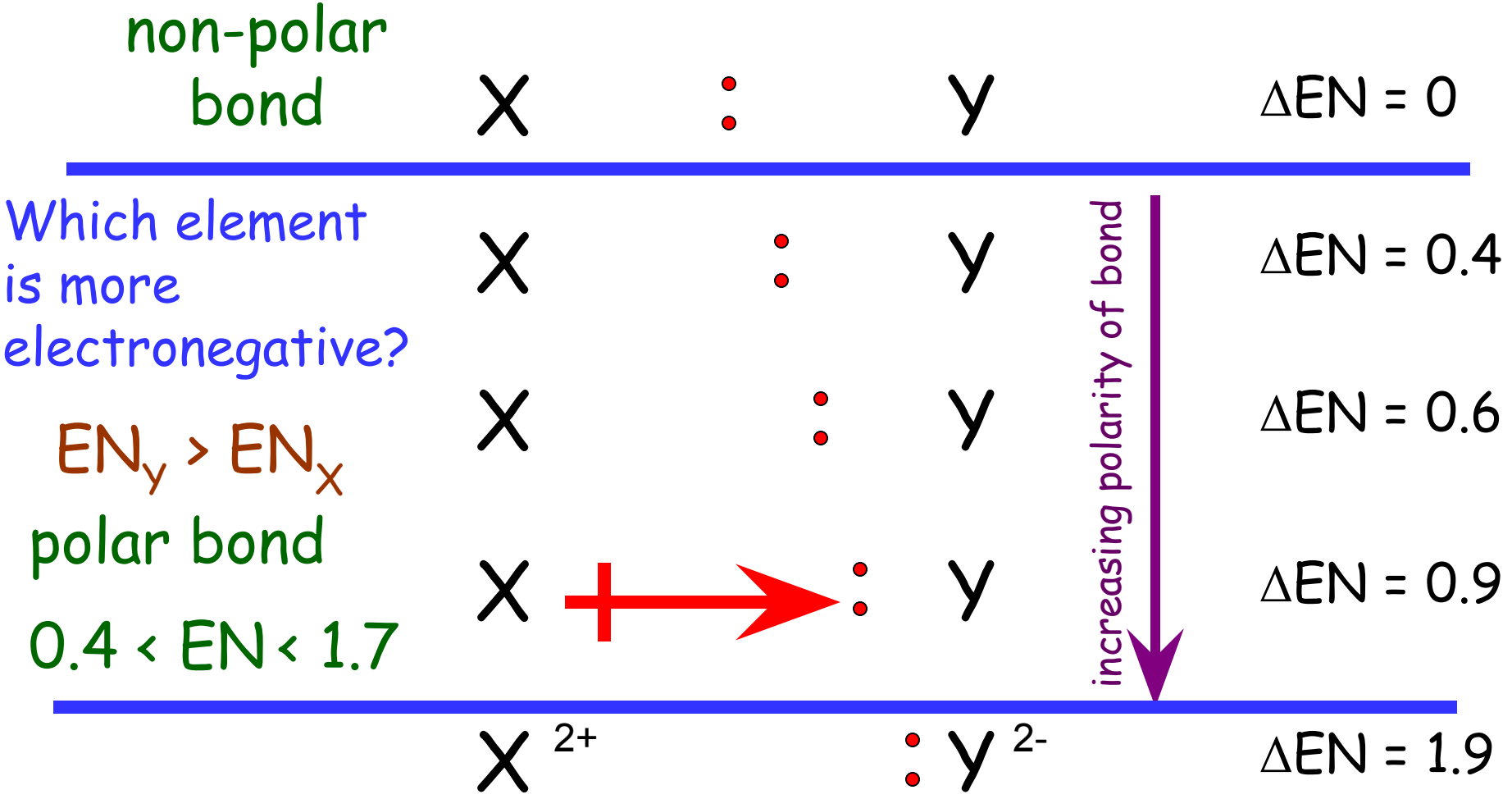


Figure 9.9 Electronegativity values for the elements according to Pauling. Trends for electronegativities are the opposite of the trends defining metallic character. Nonmetals have high values of electronegativity, the metalloids have intermediate values, and the metals have low values.

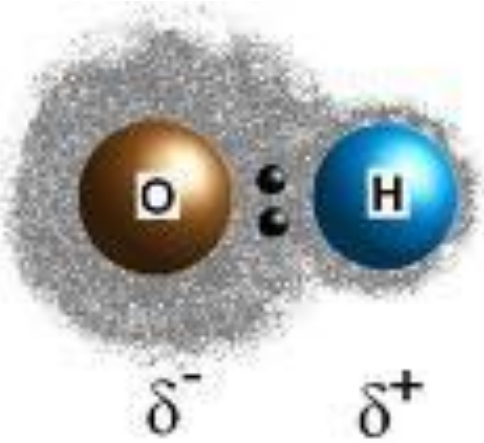
Is the sharing of electrons in molecules always equal?



First, we are going to look at Polar Covalent…

What is polar covalent?
-Polar covalent is a description of a bond that has an uneven distribution of charge due to an unequal sharing of bonding electrons.

The boy is not equally sharing with anyone else but rather taking all the food for himself.



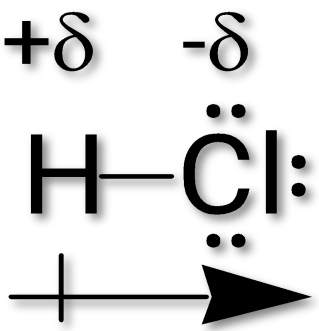
dipole

3.5

2.1

Polar Covalent Bonding

Example: HCl
H = 2.1, Cl = 3.0
Difference is 0.9, so
this is an polar covalent bond!



Cl has a greater electronegativity than H, and therefore, pulls the electrons in the shared bond towards itself.

Cl has slight negative charge (-δ) and H has slight positive charge (+ δ)

Next, we are going to look at Non-Polar Covalent Bonds…

What is non-polar covalent?

-Non polar covalent is a covalent bond that has an even distribution of charge due to an equal sharing of bonding electrons.

This couple is non- polar because they are sharing the drink equally between them.

Examples:

All diatomic molecules (ie: Cl_2, H_2)

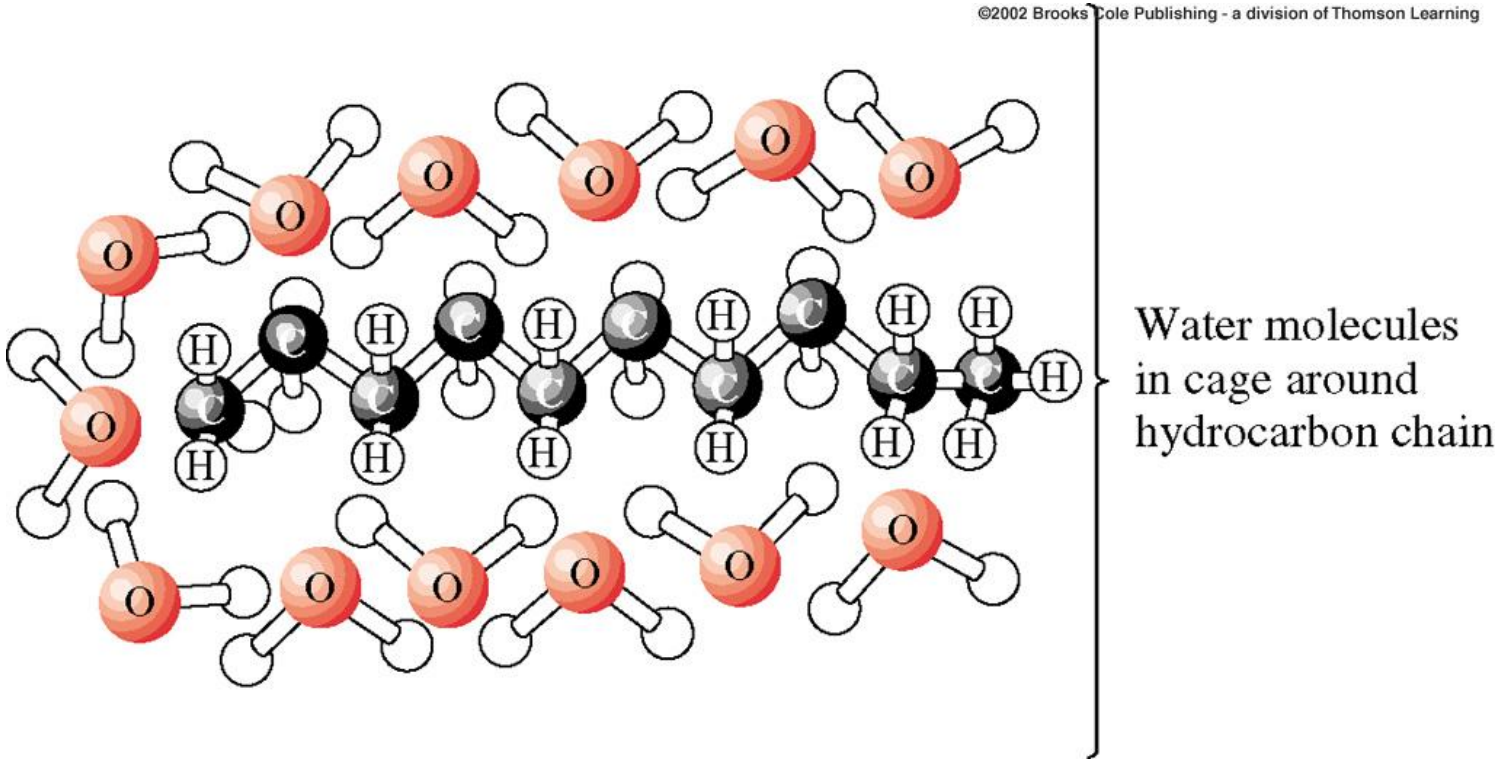
Significance of Molecular Polarity

- Why is polarity of the whole molecule so important?

- Many physical properties of substances (ie: state at SATP, melting and boiling points, solubility) are affected by the polarity of their molecules, not just their intramolecular bonds

Bond Polarity

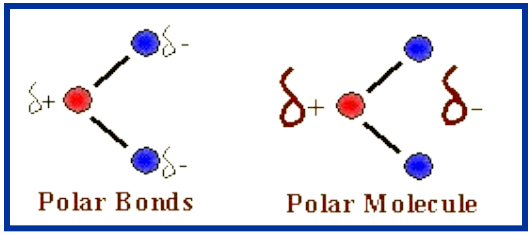
- This is why oil and water will not mix! Oil is nonpolar, and water is polar.
- The two will repel each other, and so you can not dissolve one in the other

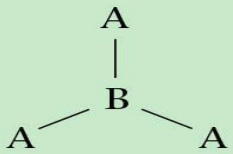
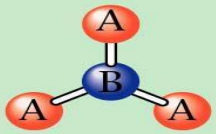
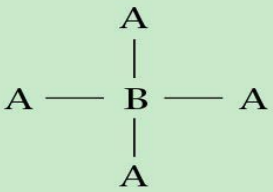
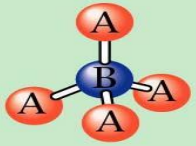
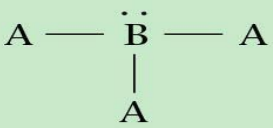
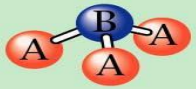
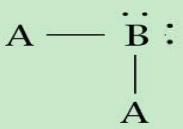
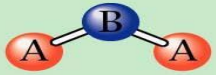


STOP HERE DAY 1

Predicting the Polarity of Molecules

- If a molecule contains only nonpolar bonds than the molecule is **nonpolar**.
- In a molecule that has only one bond, and that bond is polar, the molecule is **polar**.
- If a molecule contains more than one polar bond we have to also look at the shape of the molecule.



Case	Number of Electron Pairs	Bonds	Partial Lewis Structure	Molecular Structure
1	2	2	A — B — A	 Linear
2	3	3		 Trigonal planar (triangular)
3	4	4		 Tetrahedral
4	4	3		 Trigonal pyramid
5	4	2		 Bent or V-shaped

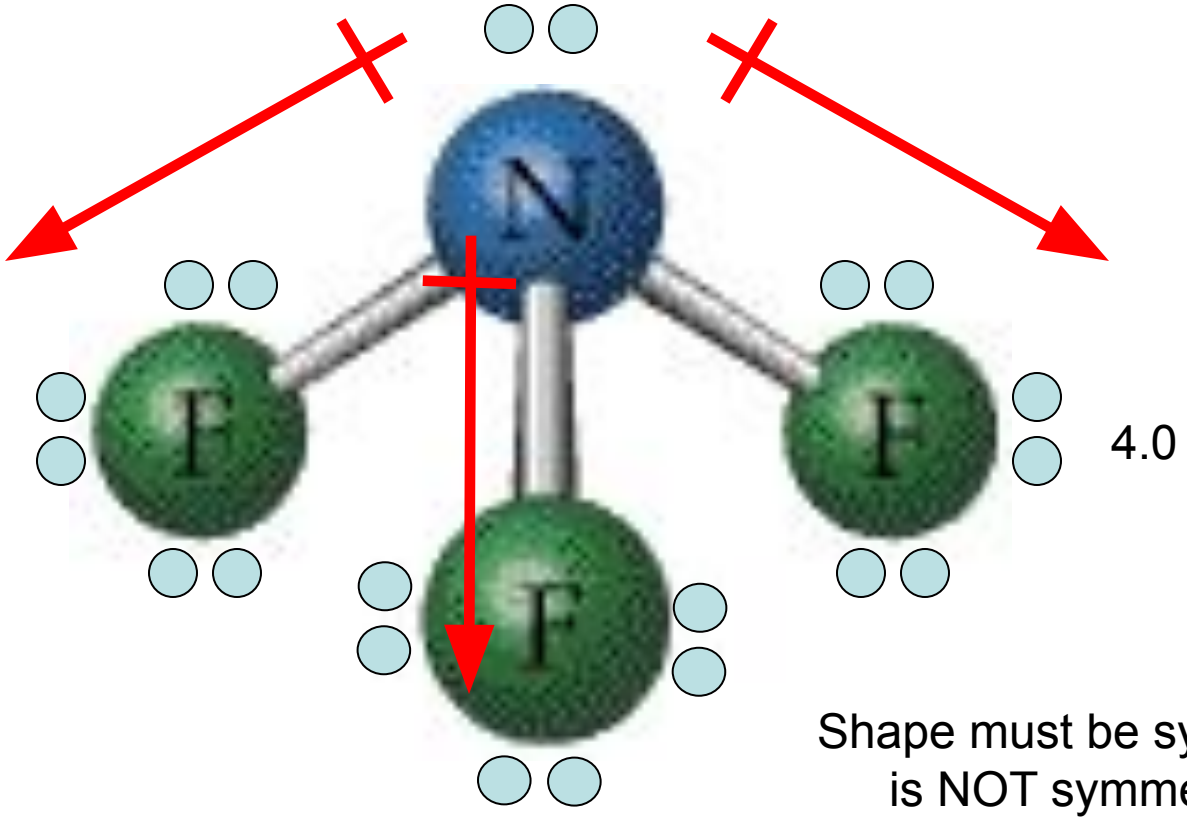
Predicting the Polarity of Molecules

If a molecule contains more than one polar bond look at the shape:

a. Shape must be symmetrical i.e. tetrahedral, linear, trigonal planar
b. All atoms bonded to the central atom must be the same.
c. Both of these statements must be TRUE for the molecule to be nonpolar.

(+δ)

3.0



4.0

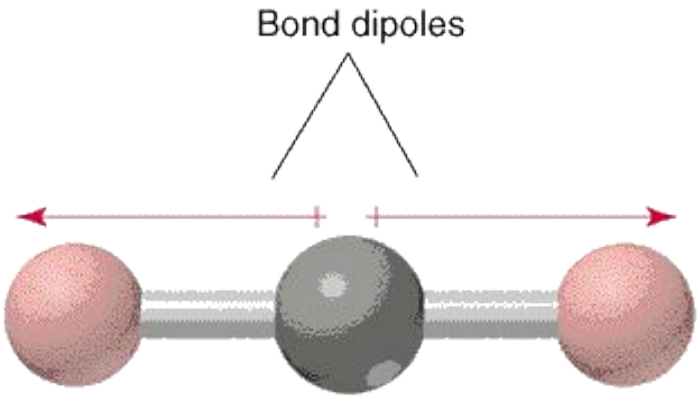
4.0

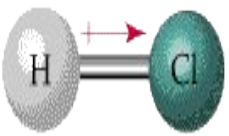
4.0

Shape must be symmetrical pyramidal is NOT symmetrical

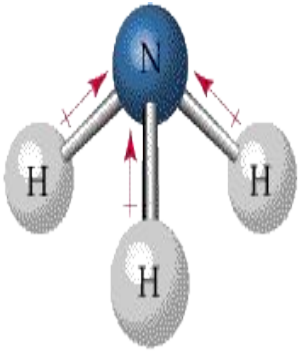
All atoms bonded to the central atom must be the same all Fluorines

Both of these statements are not true for the molecule polar molecule.



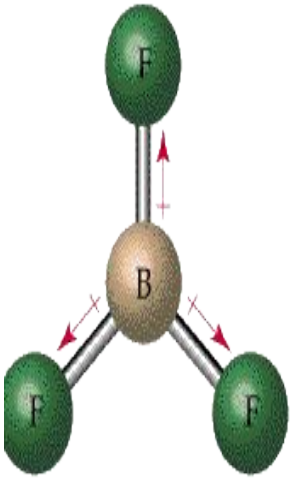


Polar

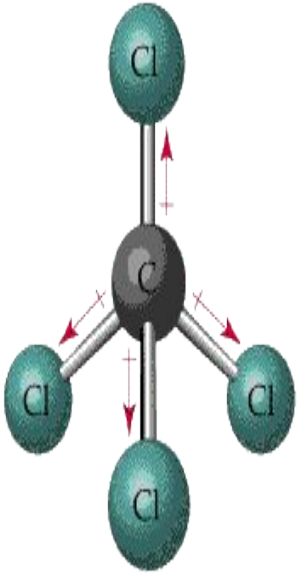


Polar

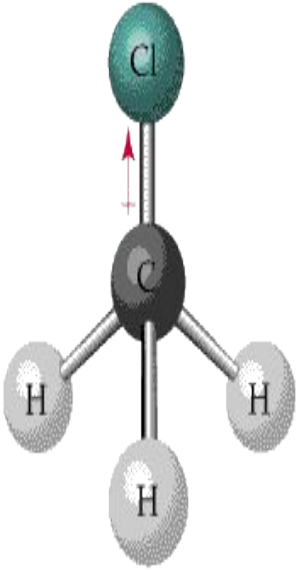
Shape must be symmetrical linear,
All atoms bonded to the central atom must be the same all Oxygen (pink)
Both of these statements are true for the molecule nonpolar molecule.



Nonpolar



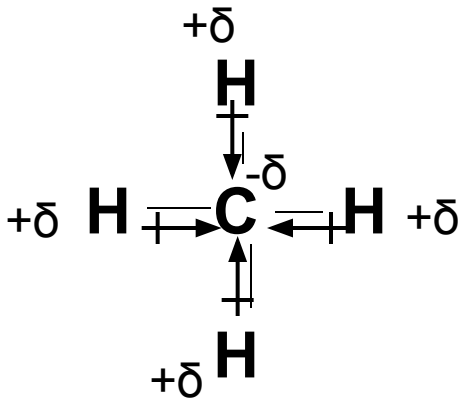
Nonpolar



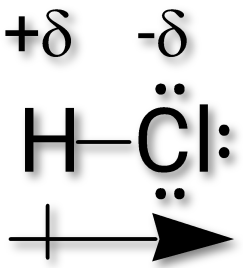
Polar

Practice:
Determining Molecular Polarity

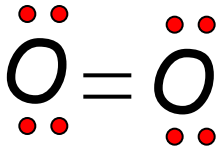
Carbon tetrachloride? _____



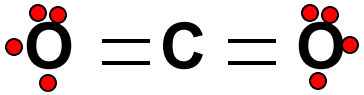
Hydrogen chloride? _____



Oxygen? _____



Carbon dioxide? _____



Nitrogen trihydride? _____