Tutorial 10: Bond Polarity and Polar Vs Nonpolar Molecules

Goals:

- ✓ To determine if a covalent bond is polar or nonpolar.
- ✓ To determine if a molecule is polar or nonpolar by considering it's Lewis structure, molecular geometry and bond polarity.

Bond Polarity

- Electronegativity refers to an atoms ability to pull electrons that are shared in a covalent bond to itself. Electronegativity values are shown in the next slide.

- Bonds are either nonpolar covalent, polar covalent or ionic.

  - **Nonpolar covalent bonds** occur when two atoms share electrons evenly. This occurs when the two atoms have similar (or the same) electronegativity values. So long as the difference in electronegativity is less than 0.5 we will consider the bond to be a nonpolar bond.

  - **Polar covalent bonds** occur when two atoms share electrons unevenly. This occurs when one atom has a much higher electronegativity than the other. We will consider electronegativity differences of 0.5-1.9 to be polar covalent.

  - **Ionic bonds** occur when electrons are transferred from one atom to another to form cations and anions. This occurs when the electronegativity values of the two atoms are drastically different, as is usually the case when metals react with nonmetals. We will consider an electronegativity difference of 2.0 or greater to be ionic.

Electronegativity Values

1	H 2.1																He NA
2	Li 1.0	Be 1.5											B 2.0	C 2.5	N 3.0	O 3.5	F 4.0	Ne NA
3	Na 0.9	Mg 1.2											Al 1.5	Si 1.8	P 2.1	S 2.5	Cl 3.0	Ar NA
4	K 0.8	Ca 1.0	Sc 1.3	Ti 1.5	V 1.6	Cr 1.6	Mn 1.5	Fe 1.8	Co 1.9	Ni 1.9	Cu 1.9	Zn 1.6	Ga 1.6	Ge 1.8	As 2.0	Se 2.4	Br 2.8	Kr NA
5	Rb 0.8	Sr 1.0	Y 1.2	Zr 1.4	Nb 1.6	Mo 1.8	Tc 1.9	Ru 2.2	Rh 2.2	Pd 2.2	Ag 1.9	Cd 1.7	In 1.7	Sn 1.8	Sb 1.9	Te 2.1	I 2.5	Xe NA

Polar and Nonpolar Molecules

- Just because a molecule contains polar bonds does not mean that the overall molecule will be polar. To determine if a molecule is polar we must analyze the bonds for polarity AND analyze the molecular geometry.

  - If a molecule contains only nonpolar bonds then the molecule is nonpolar. Example: CH_4

  - If a molecule contains polar bonds that are equal in magnitude and opposing in direction, than those polar bonds will cancel out and the molecule will be nonpolar. Example: CO_2

  - If a molecule contains polar bonds that are not equal in magnitude and opposing in direction, than those polar bonds do not cancel and the molecule will be polar. Example: H_2O