Chapter 1 - Structure and Bonding

Hybridization (cont)

Double bonds are formed by the side-to-side overlap of unhybridized p orbitals. This is called a pi (\( \pi \)) bond. If a p remains unhybridized, there are only 1 s and 2 p's left to form 3 equal hybrid sp\(^2\) orbitals. This defines a plane and the molecule ethene has a planar geometry with 120° bond angles (each C is trigonal planar).

If there are two pi bonds to a carbon (as in a triple bond), then two p orbitals must remain unhybridized. The resulting two hybrids are sp and adopt a linear geometry with 180° bond angles.
Hybridization also occurs in other atoms such as oxygen, nitrogen, boron, etc. Water (H₂O) is a bent molecule because the two lone pairs reside in hybrid orbitals and defines the sp³ hybridized tetrahedron. BF₃, which has one empty orbital, is trigonal planar due to its sp² hybridization.

Note: Empty orbitals remain unhybridized p orbitals and lone pairs will occupy hybridized orbitals.

Chapter 2 - Polar Covalent Bonds; Acids and Bases

Polar Covalent Bonds

Molecules are polar and bonds are polarized along a continuum from covalent to ionic depending on the difference in electronegativity. A polar covalent bond has some amount of partial + and - charges at either end.

Electronegativity (EN) - the ability of an atom to attract electrons to itself.

Inductive Effect - the polarization of a bond due to differences in EN

Dipole Moment (\(\mu\)) - a measure of net polarity for a molecule - the sum of all individual bond polarities in a molecule. Depends and charge and distance.