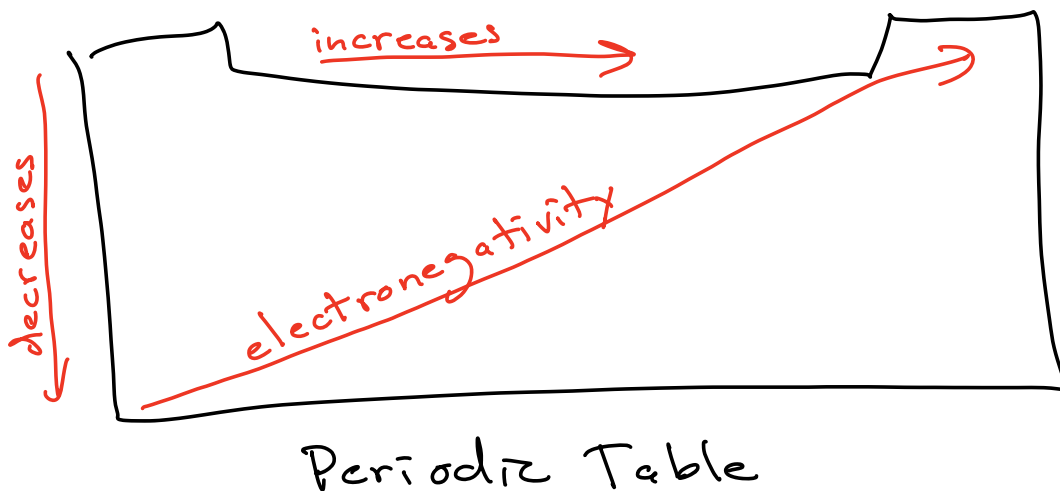


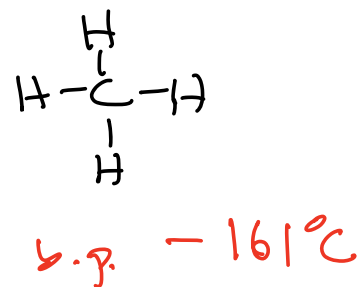
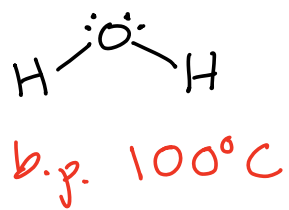
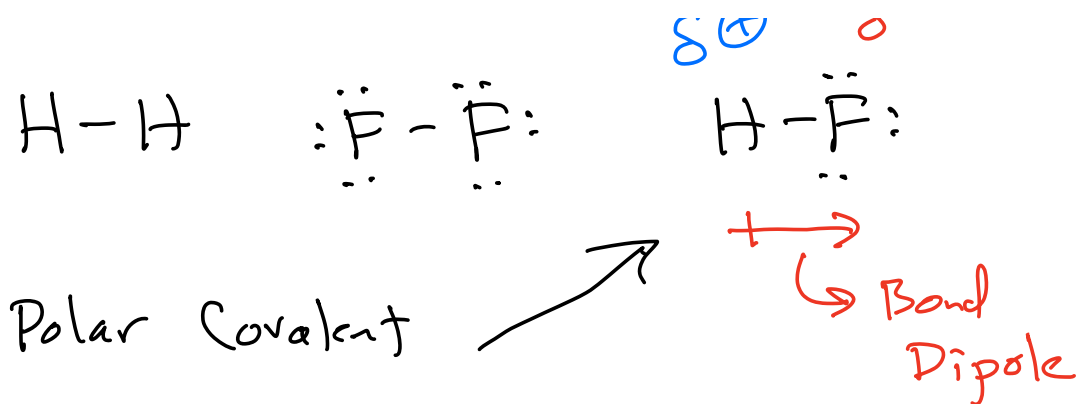
Recall from last lecture:



1A	2A											H					
Li	Be											2.1	3A	4A	5A	6A	7A
1.0	1.5												B	C	N	O	F
Na	Mg	3B	4B	5B	6B	7B	8B			1B	2B	Al	Si	P	S	Cl	
0.9	1.2											1.5	1.8	2.1	2.5	3.0	
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	
0.8	1.0	1.3	1.5	1.6	1.6	1.5	1.8	1.8	1.8	1.9	1.6	1.6	1.8	2.0	2.4	2.8	
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	
0.8	1.0	1.2	1.4	1.6	1.8	1.9	2.2	2.2	2.2	1.9	1.7	1.7	1.8	1.9	2.1	2.5	
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	
0.7	0.9	1.1	1.3	1.5	1.7	1.9	2.2	2.2	2.2	2.4	1.9	1.8	1.8	1.9	2.0	2.2	

	<1.0		1.5 - 1.9		2.5 - 2.9
	1.0 - 1.4		2.0 - 2.4		3.0 - 4.0

- 10 < 20



Formal Charge



Method of counting
of protons vs.
of electrons



Identifies molecules
and atoms with
full charges
protons \neq # electrons



NOT a theory
does not REALLY
always tell you
where electrons
are in molecules

Polar Covalent Bonds



Understanding
properties of
molecules



Identifies partial
charges
associated with
bonds



Based on
a theory \rightarrow
very accurate

Organic Chemistry is the study of carbon-containing molecules.

This class has two points.

The first point of the class is to understand the organic chemistry of living systems. We will teach you how to think about and understand the most amazing things on the planet!!

Water is essential for life, you will learn why water has such special properties. 8/25/2022

You will learn the secret structural reason proteins, the most important molecular machines in our bodies, can support the chemistry of life.

You will learn why when you take Advil for pain, exactly half of what you take works, and the other half does nothing.

You will learn how toothpaste works.

You will learn how a single chlorofluorocarbon refrigerant molecule released into the atmosphere can destroy many, many ozone molecules, leading to an enlargement of the ozone hole.

You will learn how medicines like Benadryl, Seldane, and Lipitor work.

You will learn how Naloxone is an antidote for an opioid overdose.

You will learn why Magic Johnson is still alive, decades after contracting HIV.

You will learn how MRI scans work.

The second point of organic chemistry is the synthesis of complex molecules from simpler ones by making and breaking specific bonds.

You will learn how to understand movies of reaction mechanisms like alkene hydration.

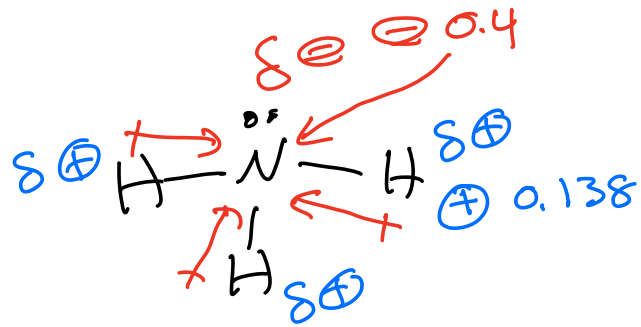
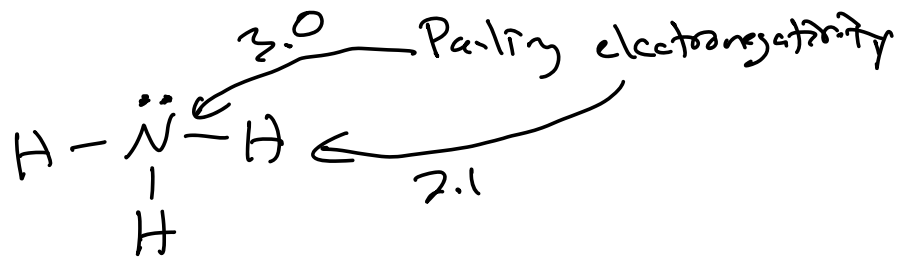
You will learn reactions that once begun, will continue reacting such that each product molecule created starts a new reaction until all the starting material is used up.

You will learn reactions that can make antifreeze from vodka.

You will learn a reaction that can make nail polish remover from rubbing alcohol.

You will learn how to look at a molecule and accurately predict which atoms will react to make new bonds, and which bonds will break during reactions.

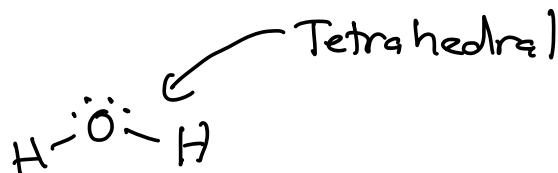
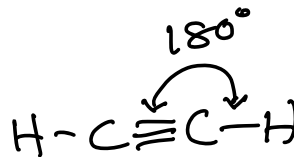
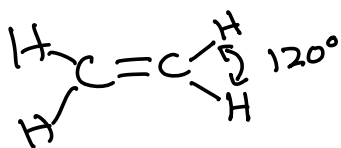
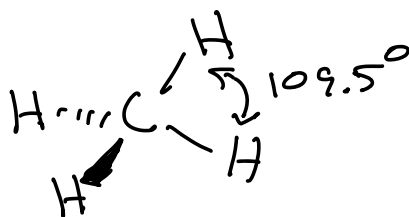
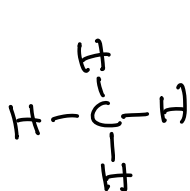
You will learn how to analyze a complex molecule's structure so that you can predict ways to make it via multiple reactions starting with less complex starting molecules.



Shapes \rightarrow VSEPR

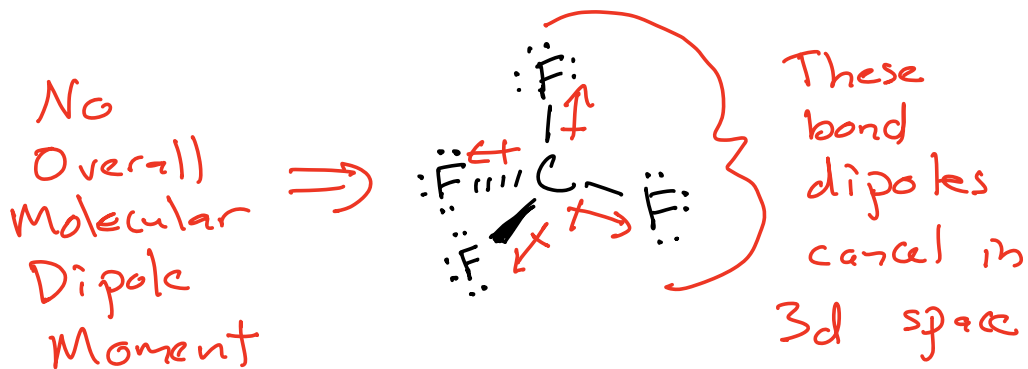
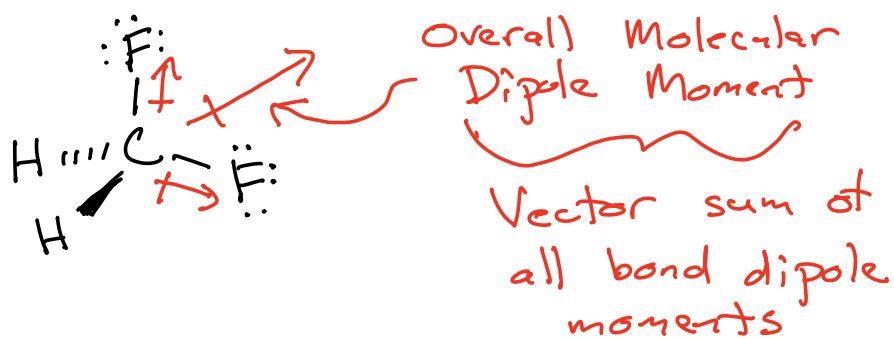
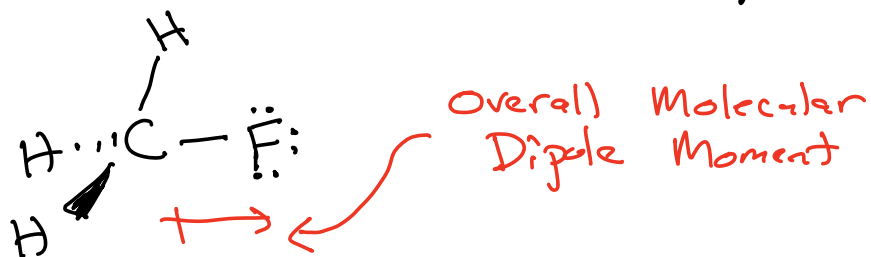
\hookrightarrow 1st approximation \rightarrow areas of electron density

(bonds or lone pairs) repel each other and stay as far apart as possible around an atom

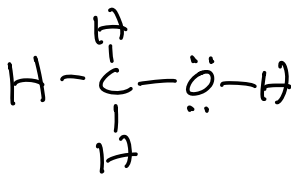
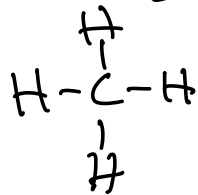


VSEPR \Rightarrow Model \Rightarrow helpful
BUT it's sometimes incorrect!

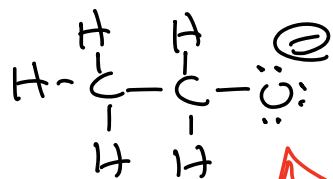
Putting it all together: Molecular Dipoles



The good news: Lewis structures



accurately describe molecules (most of the time)

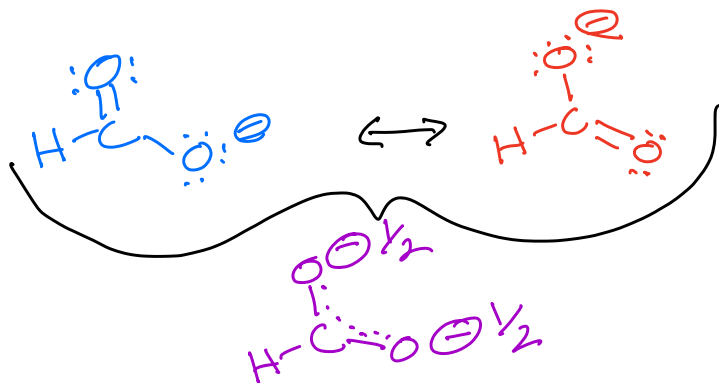


\ominus charge is indeed on O atom

However,

Contributing Structures \Rightarrow cases in which no single Lewis structure describes the true situation (bonding/charges)

\rightarrow Combined to make hybrid structure \Rightarrow NOT equilibrating back and forth \Rightarrow The hybrid describes a SINGLE structure.



Contributing Structures \Rightarrow Generally interconvert double (π) bonds and lone pairs on adjacent atoms (sometimes \oplus charges or unpaired electrons)

\rightarrow Must be reasonable Lewis structures

\rightarrow NEVER move atoms \rightarrow only electrons (lone pairs, bonds) are different

\rightarrow NEVER exceed filled valence shells

\rightarrow NEVER create unpaired electrons that did not previously exist

\rightarrow when deciding which contributing structure represents the major contribution rank according to the following

Priority \uparrow

\rightarrow More atoms with filled valence shells

\rightarrow More total number of covalent bonds

\rightarrow Fewer overall formal charges

\rightarrow \ominus on the more electronegative element and vice versa

Classic Example

