Student Handout 1 of 3: Chemical Bonding

- To help you determine Lewis structures, you can draw upon two tools: VSEPR and the octet rule.

Octet rule: Most atoms want eight valence electrons -- a full outer octet. This gives you an intuitive idea of what to expect. If you draw a Lewis diagram and one of the atoms in the molecule isn't surrounded by 8 electrons, either as lone pairs or shared in covalent bonds, you'd better make sure you haven't made a mistake. The octect rule doesn't hold 100% of the time, just most of the time.

Electron Bookkeeping:

– a methodical way to draw Lewis structures of molecules whose atoms follow the octet rule.

– It’s also nice because when it breaks down it tips you off to exceptions to the octet rule like the expanded octet.

Step 1: Count the electron pairs needed

- Hydrogen wants 1 pair
- Group II’s want 2 pairs
- Group III’s want 3 pairs
- Everyone else wants 4 pairs

Step 2: Find the total number of covalent bonds possible

- Total # of possible cov. bonds = sum of the valance e^-’s divided by 2

* Remember to add or subtract electrons according to any ionic charge

Step 3: Calculate the actual number of covalent bonds

- Actual C.B.’s = step 1 - step 2

If you don't get enough bonds to draw the molecule then it's an expanded octet

Step 4: Calcluate the number of σ bonds, π bonds, and nonbonding pairs

- # of σ bonds = # of atoms in the molecule -1
- # of π bonds = Actual C.B.’s (step 3) - # of σ bonds
- # of nonbonding pairs = possible C.B.’s (step 2) - Actual C.B.’s (step 3)

Step 5: Draw the molecule (Here are some stereotypical examples)

	CH_4	NH_3	H_2O	CO_2
step 1:	8	7	6	12
step 2:	4	4	4	8
step 3:	4	3	2	4
step 4:				
σ	4	3	2	2
π	0	0	0	2
nbp	0	1	2	4
step 5: