Covalent Lewis Dot Structures

Covalent Lewis Dot Structures: formulas used to model what atoms look like in a compound that contains atoms that are covalently bonded together.

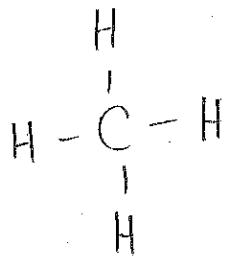
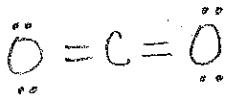
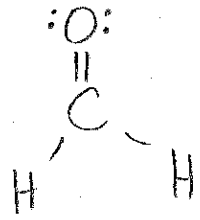
- Non-metals will share electrons to get 8 valence electrons and be stable.

Helpful Hints for Drawing Lewis Dot Structures

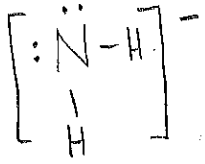
1. H is always a terminal atom → ALWAYS connected to only 1 other atom.
2. Lowest electronegativity is central atom in molecule.
3. If drawing the Lewis structure for a polyatomic ion,
   a. For positive ions, subtract electron(s) from the central atom.
   b. For negative ions, add electron(s) to the central atom.
   c. Enclose the dot structure in square brackets and include the ion's charge outside the brackets.
4. Not all elements can form double or triple bonds: **only C, N, O, P, and S!** (Think CNOP-S)
5. For molecules with more than one central atom, use the formula to help you decide how to draw the structure.
6. The total number of valence electrons in your Lewis structure MUST equal the # of the valence electrons of all of the elements (add or substract electrons as needed for polyatomic ions).
7. For *most* covalent compounds, you can determine how many bonds each atom will form by looking at the number of unpaired electrons in their Lewis dot structure.
   a. Paired electrons do NOT form bonds.
   b. Single electrons do form bonds!

H	**Be**	**B**	**C**	**N**	**O**	**F**
H·	·Be·	·B·	·C·	·N·	·O:	·F:
# bonds? 1	# bonds? 2	# bonds? 3	# bonds? 4	# bonds? 3	# bonds? 2	# bonds? 1

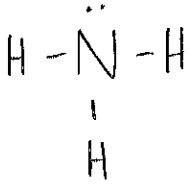
Examples:

CH_4	CO_2	CH_2O
		

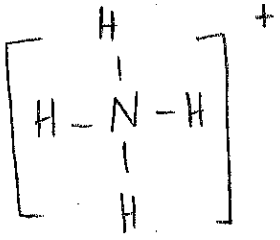
NH_2^-



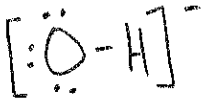
NH_3



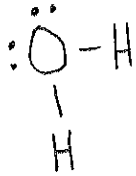
NH_4^+



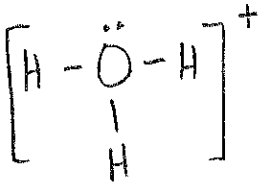
OH^-



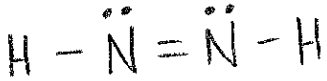
H_2O



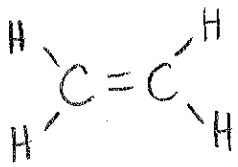
H_3O^+



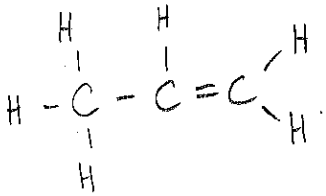
N_2H_2



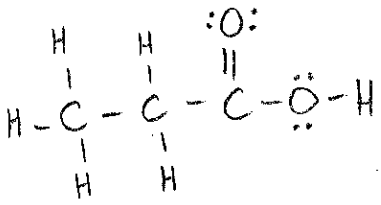
CH_2CH_2



CH_3CHCH_2

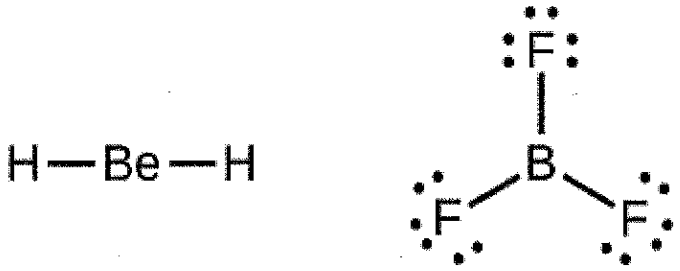


CH_3CH_2COOH

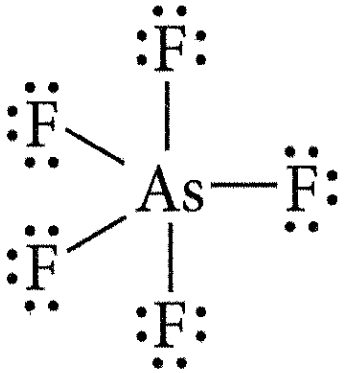


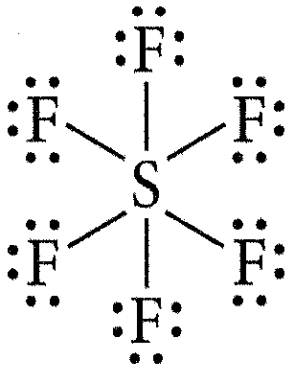
But wait!!! Exceptions to the octet rule

1. Elements that will have less than 8 valence electrons and are stable.
   a. Hydrogen, 2 electrons (1 bond)
   b. Beryllium, 4 electrons (2 bonds)
   c. Boron, 6 electrons (3 bond)



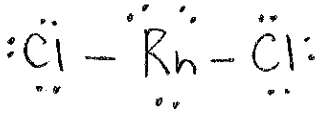
2. Elements that will have more than 8 valence electrons and are stable.
   a. Elements in period (row) 3 through 7 can often expand their octet and can form more than 4 bonds (can have up to 12 electrons, 6 bonds)
      1. This is only possible between periods 3 through 7 because they can hold electrons in their empty d Sublevel.
      2. If you are unsure where to put extra lone pairs, check to see if the central atom can have an expanded octet (check to see if the element is in periods 3 through 7)





Challenge: Lewis Dot Practice, including exceptions to the octet rule. ☺

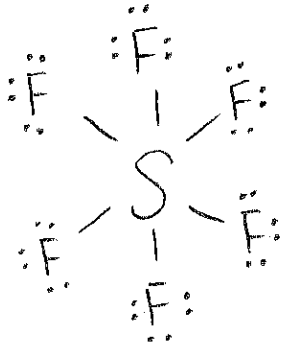
$RnCl_2$



8 - 2 = 6

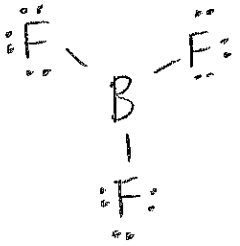
BeH_2

SF_6

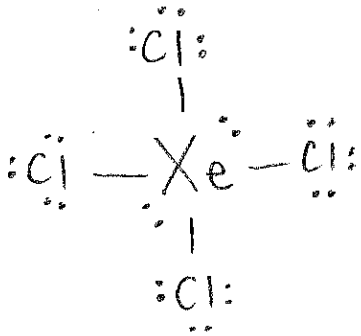


6 - 6 = ∅

BF_3



$XeCl_4$



8 - 4 = 4

IF_7