

Lab 13 “Molecular Models and Chemical Bond” - Modifications

The “**Lewis structure**” that we are learning in class is similar to what our lab manual calls the “structural formula”, except that the nonbonding pairs (lone pairs) are not shown in the lab manual’s structural formula. A Lewis structure is also nearly equivalent to the lab manual’s “electron dot formula” except that in a Lewis structure, dashes are used for bonds (single, double, or triple) instead of dots. In summary, a Lewis structure has dashes for bonding pairs of electrons and dots for nonbonding electrons.

These lab modifications substitute Lewis structures, as described above, for the structural formulas and electron dot formulas defined in the lab manual. These modifications also turn the procedure around, so that you start with the valence electrons and the Lewis structure before you determine the molecular geometry. This follows the methodology that we’re learning in class.

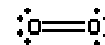
In the pre-lab section, please make the following addition for #4 and the change for #3:

- Skip question #4. Do #6 before you do #5. In #5, draw the Lewis structure, as described above.
- Ignore question #3. We will be using a model set that does not necessarily match the colors mentioned in the lab manual.

In the data table, please make the following changes: Work from *right to left*. That is, start with the valence electron calculation, then draw the Lewis structure, then determine the name of the molecular geometry and draw your 3-dimensional structure.

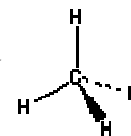
- **Valence electrons column:** Show your calculation for the number of valence electrons. For example, the calculation for H₂O would be (2)(1)+(1)(6)=8.

- **Electron dot formula column:** Draw the Lewis dot structure here (see above, i.e., include the nonbonding pairs in your structure). Use lines for bonds and dots for lone pairs. See examples for O₂ and carbon monoxide.



For many of the molecules, the first element listed in the formula is typically the least electronegative element (most “metallic character”) in the compound and is found in the middle of the structure, with the other elements attached to it. See next page for additional guidance.

- **Structural formula column:** Write the name of the molecular geometry for each atom with two or more other atoms attached to it (each “central atom”). There may be more than one of these ‘central’ atoms, so do both or all of them, and make sure you let me know which atoms are which. (Your choices are “linear”, “bent 109°”, “bent 120°”, “trigonal planar”, “trigonal pyramidal”, or “tetrahedral”.)
- **Molecular model column:** No change, except that I would like you to use wedges and dotted lines, as we do in the lecture class, to show the 3-dimensional structure. An example for CH₄ is shown above.
- For the “unknowns,” we will have some models in the lab.



In the post-lab section, please make the following changes:

- **Electron dot formula column:** Show your calculation for the number of valence electrons and draw a Lewis dot structure for the molecule or ion.
- **Structural formula column:** Write the name of the molecular geometry for the molecule or ion and draw a 3-dimensional model using wedges and dotted lines.

Additional information: A few of the compounds in this lab are a little more complex than this simple (“bicycle wheel with spokes”) type of molecule. Remember a hydrogen atom can only be connected to one other atom, so it never goes in the middle. For clarification, I’ve described these structures here:

HOCl: Connected as shown in the formula.

H₂O₂: Two oxygen atoms connected to each other; with one hydrogen atom on each side.

N₂H₄: Nitrogen atoms are connected to each other, with two H’s on each side.

NH₂OH: Two H’s and O are connected to the nitrogen, with the other H connected to the O.

C₂H₄: Carbons are connected to each other, with two H’s on each side.

HONO: Connected as shown in the formula.

HCOOH: One H and two O’s connected to carbon, with other H connected to one O atom.

C₂H₃Cl: Carbon atoms connected to each other, with two other atoms connected to each C.

C₂H₂: Carbons connected to each other, with one H on each.

HOCN: Connected as shown in the formula.

C₃H₄: Three carbons connected in a row. Two H atoms attached to each end carbon.

That’s it. Have fun making your models.